Department for Transport

High Speed Rail: Investing in Britain's Future

Consultation

February 2011

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Foreword

The Government is committed to building a competitive and dynamic economy for the long term. But a 21st century economy needs 21st century infrastructure. That is why we are prioritising the projects that will support economic growth and job creation, while delivering on our climate change targets.

We believe a national high speed rail network from London to Birmingham, and onward to Leeds and Manchester, can transform the way Britain works and competes as profoundly as the coming of the original railways in the 19th century.

High speed rail would bring central London to within 49 minutes of central Birmingham, and within 80 minutes or less of Leeds and Manchester. By slashing journey times and linking to our major international gateways, it has the potential to help bridge the North-South divide that has for too long limited growth outside London and the South East.

A high speed rail network has the potential to generate a massive £44 billion of benefits. It would directly deliver thousands of jobs constructing and operating new lines, development of our world class engineering talent and regeneration of key areas of our inner cities, including in West London and Birmingham's Eastside.

High speed rail is also an important part of our plans for a low carbon economy, helping us meet our climate change targets by encouraging millions out of their cars and off the planes onto the train.

It is a tribute to our Victorian forebears that we are still using their rail networks today. But today's railways face a huge capacity challenge. Rail passengers are familiar with overcrowding, used to long queues and are almost certain to have found themselves standing on a long-distance journey at some point. And demand is set to rise sharply in the years to come. On the West Coast Main Line, in particular, new rail infrastructure will be essential.

By providing a huge increase in capacity for long-distance passengers between our major cities, high speed rail would ensure we are ready for those challenges. And by releasing capacity on existing lines, it would also create space for additional commuter and regional services to run.

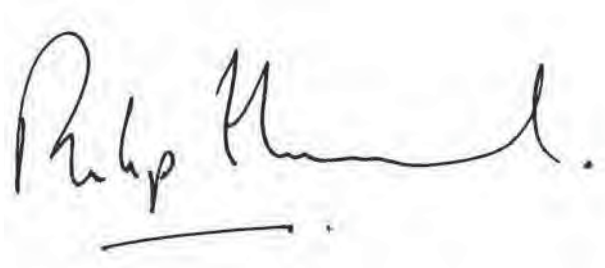
Our competitors already recognise the huge benefits high speed rail can bring and are pressing ahead with ambitious plans. Britain cannot afford to be left behind. Across the globe we have seen how high speed rail can revive and regenerate cities. We must ensure that the UK's principal population centres benefit from this high speed effect.

The Government believes high speed rail is crucial to Britain's future success. Our plans have the support of political and business leaders across the United Kingdom. But this is a massive and complex project, which we acknowledge will have impacts on individuals and communities along the route. We know that we must do everything we reasonably can to mitigate those impacts – so that we strike the right balance between national and local interests.

This consultation – one of the largest and most wide-ranging ever undertaken by Government – is just the first stage in an ongoing process. No final decisions will be taken until everyone has had the opportunity to have their say.

So we are publishing, alongside this consultation document, a full suite of supporting documents, including a detailed economic case and a full Appraisal of Sustainability. And in the coming months, HS2 Ltd will be holding roadshows along the proposed route from London to the West Midlands to make sure local residents are aware of our plans and to listen to your views. We want as many of you as possible to play your part.

That way, we will ensure that the final proposal is the right one – in the long term national interest.



The Rt Hon Philip Hammond MP
Secretary of State for Transport

Executive Summary

The Government believes that a national high speed rail network offers a once-in-a-generation opportunity to transform the way we travel in Britain.

High speed railways were first built in Japan in the 1960s, and now span countries across Europe and Asia. The pace of development shows no sign of slowing, and China, France and Spain, amongst other countries, are all pressing ahead with ambitious plans. Britain cannot afford to be left behind. Our current railway system dates back to the Victorian era and will not be sufficient to keep Britain competitive in the twenty-first century.

A new high speed rail network would transform the country's economic geography. It would bring our key cities closer together, enable businesses to operate more productively, support employment growth and regeneration, provide a genuine alternative to domestic aviation, and create a platform for delivering long-term and sustainable economic growth and prosperity.

A Y-shaped national high speed rail network linking London to Birmingham, Manchester and Leeds, and including stops in the East Midlands and South Yorkshire, as well as direct links to the HS1 line and into Heathrow Airport, would cost £32 billion to construct, and would generate benefits of around £44 billion, as well as revenues totalling a further £27 billion.

It would deliver a huge increase in rail capacity to meet rising demand for long-distance rail travel, and ease overcrowding on existing railways.

It would slash journey times between cities, bringing London within 49 minutes of Birmingham, and to within 80 minutes or less of both Manchester and Leeds. Travel times between regional centres would be cut equally sharply, so that Birmingham would be only around 50 minutes from Manchester and just over an hour from Leeds.

By linking the high speed network to the existing East Coast and West Coast Main Lines, London would be brought within around three and a half hours of both Glasgow and Edinburgh – significantly reducing the demand for internal UK flights. Short-haul aviation could be reduced further by international high speed rail services from cities across the country using a direct link via the High Speed 1 line to the Channel Tunnel.

The Government's proposed network also includes a direct link to Heathrow, which would bring Manchester and Leeds city centres within around 70 and 75 minutes of the country's main hub airport respectively.

High speed rail also has the potential to play a central role in promoting long-term and sustainable economic growth. The first phase alone of a national network would support the creation of around 40,000 jobs and contribute to major regeneration programmes in Britain's inner cities.

New high speed links would enable the UK's key urban economies to improve their productivity, attract new businesses, and access more directly the economic strength of London and the South East.

Figure 1 – **The Government's proposed national high speed rail network**

The Government believes that a high speed rail network would be a transformational investment in Britain's future and help to bridge the north-south divide. This consultation document sets out the basis on which the Government has reached that view, and seeks your views on its proposed way forward.

Part 1 of this document sets out the Government's proposed high speed rail strategy, and describes:

- the wider context in which high speed rail has been considered;
- why additional rail capacity is needed;
- the options for providing additional capacity and the case for high speed rail; and
- the Government's strategy for delivering a national high speed rail network, including links to Heathrow and to the Channel Tunnel.

Part 2 explains how the Government's recommended route for an initial high speed line from London to the West Midlands has been identified. It describes the core principles underpinning this work, and sets out the proposed route in detail, including its sustainability impacts. The main alternatives considered are set out in Annex B, together with the reasons why these were rejected.

Part 3 sets out the questions on which the Government is seeking views through this consultation process, and explains how to respond.

PART 1 – THE CASE FOR HIGH SPEED RAIL

The Fast Track to Prosperity

The Government is committed to providing a strong basis for long-term and sustainable economic growth by creating the right environment for private enterprise to flourish and by re-balancing our economy.

High speed rail can play a key strategic role in delivering these objectives.

For Britain and its major cities to compete effectively in the 21st century, it is vital that the right infrastructure is in place. Infrastructure helps promote competitiveness – by boosting productivity, reducing costs and increasing efficiency, and expanding business and labour markets.

The National Infrastructure Plan sets out the Government's strategy to deliver the infrastructure our economy needs to compete in the modern world. Investment in transport is a core element.

The UK's transport networks provide the crucial links that enable firms to operate efficiently. The business sector consistently underlines the importance of reliable transport systems, with an October 2010 survey finding that 95 per cent of companies agree that the UK's road and rail network is important to their business and its productivity.

The central role played by the country's rail links cannot be overstated. Rail commuter networks support the deep labour markets that underpin the productivity of the UK's cities. Inter-city lines have an unrivalled capacity to enable rapid and direct journeys between central business districts – avoiding traffic jams and the difficulties of finding parking space. And the rail freight industry

is playing an ever stronger role in ensuring goods and raw materials get to the right place at the right time.

The Capacity Challenge

Britain's rail network is seeing a continuing pattern of steeply rising demand. As a result, rail capacity is under increasing strain and services are growing more crowded.

Between 1994/95 and 2009/10, total passenger miles travelled rose from 18 billion to almost 32 billion. The fastest growth of all has been in demand for long distance travel, which continued to rise even through the recent recession. The total number of long distance journeys made more than doubled in the period from 1994/95 to 2009/10.

Standing Room Only

As capacity on the network becomes ever more intensively used, the scope to meet rising demand by running additional services and longer trains is becoming increasingly limited. This means that some of the country's key rail routes are forecast to be completely full in peak hours in the next 20 years.

High levels of crowding are already being seen, particularly in the peak, across a growing proportion of the network. Many services on the West Coast, East Coast and Midland Main Lines are already extremely full. Despite the capacity increases provided by the West Coast Route Modernisation programme, long distance services on this route are regularly overcrowded. Almost half of all long distance Midland Main Line trains arriving into St Pancras International in the peak have passengers standing.

This picture of rising demand is underpinned not only by growth in inter-city travel but also very significant increases in long-distance commuting from places such as Milton Keynes, Northampton, Peterborough and Kettering.

If demand carries on rising in this way, it is clear a substantial long term expansion in capacity will be needed to enable the rail network to respond.

The Long-Term Challenge

Industry and government forecasts show that these patterns of growing demand for rail travel are set to continue.

Some of the highest levels of future demand growth are anticipated on the West Coast Main Line. Network Rail forecast that demand on the London-Manchester route will grow by around 60 per cent by 2024.

High levels of demand growth are also expected on the East Coast and Midland Main Lines, on both of which Network Rail predicts overall long-distance growth of more than 70 per cent in the period from 2007 to 2036. Even higher levels are forecast over the same period on specific routes including from London to Nottingham, Sheffield and Leeds.

The Government is currently investing heavily in projects to enhance the capacity of the network, for instance through the Thameslink project and the electrification of key intercity and suburban lines.

In the longer-term, however, the scope to increase capacity on the main routes out of London will be increasingly constrained and eventually exhausted, with Network Rail recently concluding that by 2024 "the West Coast Main Line, particularly at the southern end of the route, is effectively full and subsequent additional capacity could only be provided by exceptionally expensive infrastructure solutions."[1]

Whilst the capacity challenge is most severe on the West Coast Main Line, forecasts of demand growth carried out for HS2 Ltd indicate that over the coming decades all three main north-south routes out of London will become very highly congested, particularly in peak hours.

This would lead to unprecedented levels of crowding, worsening reliability and a deteriorating travel experience.

The Government's view is that significant investment will be needed to tackle the capacity challenges set out above. Because major rail infrastructure projects take many years to develop and implement, decisions on how such investment should be taken forward cannot be postponed or delayed.

The Government believes the priority should be the main north-south inter-city routes out of London – beginning with the West Coast Main Line corridor.

Enhancing Network Performance

Rising demand for travel and increasing overcrowding are not the only challenges facing Britain's rail networks.

Experience on the West Coast Main Line following the completion of the route modernisation programme indicates the value placed by travellers on reducing journey times and improving reliability.

But maintaining current levels of reliability is likely to become increasingly challenging as more services are accommodated on the network, and enhancements to transport and communications networks are leading to ever rising public expectations about the speed and convenience of travel – particularly as other countries are seen to invest in improving connectivity.

High Speed Rail

High speed rail has provided a highly effective answer to these challenges in countries across Europe and Asia. It has improved the capacity, speed and reliability of rail journeys, with demand rising sharply as a result. Significant shifts away from aviation have been achieved.

International experience also shows that high speed rail can be a powerful tool for supporting city economies and drawing in new investment.

1 Network Rail, *Draft West Coast Main Line Route Utilisation Study*, December 2010; available at www.networkrail.co.uk

Lille has seen increasing demand for office space and growth in urban tourism as a result of its location at the centre of the European high speed rail network. And in Zaragoza high speed rail links have supported a major programme of regeneration and contributed to the city's success in hosting Expo 2008.

The Government believes that Britain cannot afford to be left behind; cannot afford to ignore the benefits offered by high speed rail.

Britain needs a rail network which matches its growing ambitions:

- enabling rising numbers of journeys to be comfortably accommodated;
- improving the speed, convenience and reliability of links between our big cities and international gateways;
- supporting sustainable growth – given the UK's Climate Change commitments; and
- keeping pace with developments in other countries.

The following sections set out the basis on which the Government has reached this view.

The Case for a National High Speed Rail Network

Britain's road network cannot offer an effective solution to the rail capacity issues described above. The unreliability and delay caused by congestion in cities, and particularly in central London, make road travel an unattractive option for the journeys into city centres which are seeing the highest levels of demand growth on the rail network.

Therefore the Government has focused on reviewing the costs and benefits of the key strategic rail options for meeting the capacity challenge. These include new lines – both high speed and conventional – and upgrades to existing infrastructure.

Its assessment is that a new high speed rail network would generate significantly greater benefits for travellers in terms of capacity, connectivity and reliability than any of the other options considered, as well as offering valuable potential to support the Government's wider strategy to promote long-term and balanced economic growth.

The strategic case for high speed rail

The Government believes that high speed rail can play an important role in promoting valuable strategic change in the economic geography of Britain, supporting sustainable long-term growth and reducing regional disparities.

By bringing the major cities of the Midlands and the North closer to the capital, and by ensuring that capacity is available to handle high levels of demand growth, high speed rail could benefit thousands of businesses by improving access to the huge and internationally-competitive markets of London and the South East – just as service sector firms in Lyon have benefited from enhanced access to Paris. And by bringing the major regional conurbations closer together, boosting productivity and enabling greater economic specialisation, high speed rail could put them in a strong position to compete effectively in those markets.

High speed rail would also act as a catalyst for regeneration, as has been seen in cities across Europe, such as Lille, where the arrival of high speed rail drove the development of the major Euralille complex. A British high speed rail network could contribute strongly to regeneration in our major cities, for example at Old Oak Common in West London and in the Eastside district of Birmingham. A London – West Midlands line alone could support the creation of around 40,000 jobs.

Successive governments have sought to bridge the north-south divide – a national high speed rail network could provide a unique opportunity to finally ensure it happens.

Assessing costs and benefits – high speed rail

The Government favours a Y-shaped high speed rail network, comprising a line from London to the West Midlands and onward legs to Manchester and Leeds. This network would cost around £32 billion to construct, and would deliver very significant benefits for rail travellers, including unprecedented increases in capacity and reductions in journey times, as well as making a major contribution to economic growth, job creation and regeneration. These benefits are set out in more detail below:

- **Increased capacity:** A national high speed network would transform rail capacity between London and the major cities of the Midlands and the North. New high speed lines would enable 14 or more additional train services per hour and be designed to accommodate larger and longer trains able to carry up to 1,100 passengers.

- Transferring long-distance services to this network would also enable capacity to be released on the West Coast, East Coast and Midland Main Lines, which could be used to increase the number of services to other important destinations. HS2 Ltd's modelling suggests, for example, that enough capacity could be released to increase service levels to Milton Keynes to as many as 12 trains per hour.

- **Faster journeys:** Speeds of 225 miles per hour (and potentially faster in future) would transform journey times, bringing Birmingham within 49 minutes of London, and Manchester and Leeds within 80 minutes. Travelling from Birmingham to Manchester would take around 50 minutes and to Leeds just over an hour.

- Stops in the East Midlands and South Yorkshire would provide reductions in travel times for cities in these regions. And links back onto the West Coast and East Coast main lines would enable through running services to reach Liverpool, Newcastle, Glasgow and Edinburgh – cutting journey times from London to Scotland's major cities to around 3 hours 30 minutes.

- **Enhanced integration:** Links to urban transport networks (such as Crossrail at Old Oak Common) would further reduce end-to-end journey times – bringing Leeds and Manchester within 1 hour and 40 minutes of Canary Wharf.

- **Modal shift:** This enhanced capacity and connectivity could see as many as 6 million air trips and 9 million road trips a year shift onto rail.

- **Improved reliability:** High speed rail can deliver high levels of reliability. The High Speed 1 line to the Channel Tunnel has an annual average of just 6.8 seconds delay per train due to infrastructure incidents.

- **Wider economic benefits:** The additional capacity and connectivity created by new high speed links would generate valuable wider economic benefits, for instance by contributing to increased business productivity. A London – West Midlands line alone would deliver benefits of this kind worth approximately £4 billion.

The construction of a Y-shaped network linking London, Birmingham, Manchester and Leeds, as well as the Channel Tunnel and Heathrow, would cost £32 billion. In total, and on conservative assumptions, it would generate

estimated benefits with a net present value of around £44 billion, plus fares revenues with a net present value of approximately £27 billion.

A national high speed rail network could deliver these very significant benefits whilst remaining broadly carbon neutral, despite a significant increase in passenger miles. At best, high speed rail has the potential ultimately to deliver valuable carbon reductions, depending in particular on the level of modal shift achieved from aviation.

Over a 60-year period, which is the standard approach to appraising major transport infrastructure schemes, its net present cost to the public purse (calculated as capital and operating costs with a net present value of £44.3 billion less fare revenues with a net present value of £27.2 billion) would be £17.1 billion. The net present value of benefits generated over the same timescale would total £43.7 billion. This results in a benefit:cost ratio (BCR) of 2.6.

This BCR is important, but it is not, by any means, the whole story. The Government believes that high speed rail would deliver significant non-monetised benefits, such as its contribution to job creation and regeneration and its potential to promote sustainable and balanced economic growth. It is these non-monetised benefits which underpin the strategic case for high speed rail.

There are also, however, important non-monetised costs which must be considered,

particularly in relation to high speed rail's potential impacts on the local environment and communities.

HS2 Ltd's proposed London – West Midlands route, for example, would generate noticeable noise increases in a number of areas, as well as having an impact on the landscape, including in the Chilterns Area of Outstanding Natural Beauty (AONB). The redevelopment of Euston Station would require the demolition and replacement of a significant number of homes in four local authority blocks. A more detailed summary of these impacts and the Government's planned approach to mitigating them is provided in Part 2 of this document.

Although such impacts cannot be eliminated entirely, HS2 Ltd's recent work to review and improve its proposed alignment demonstrates that sensitive route design and refinement can substantially reduce them. Work on assessing the opportunities for noise mitigation, for example, has seen the number of homes potentially affected by 'High Noise' levels fall from 350 to around 10.

Taking account of these non-monetised costs and also the significant non-monetised benefits that have been identified, the Government considers that the overall case for high speed rail is strong.

Assessing costs and benefits – alternatives to high speed rail

New conventional speed lines would not be able to offer the same value for money as high speed rail. They would not be significantly cheaper to construct and operate than high speed lines, and any reduction in environmental impacts would be relatively small, but they would generate far fewer benefits and revenues. In respect of a London – West Midlands line, HS2 Ltd estimate that reducing line speed would deliver only a 9 per cent cost reduction, whereas fare revenues would drop by 24 per cent and overall benefits by 33 per cent.

With regard to enhancements to existing infrastructure, the Government has commissioned a strategic analysis of three enhancement scenarios on the key north-south inter-city routes out of London.[2] These aim to deliver longer trains, high frequency services and reduced journey times respectively.

The capacity and journey time benefits which these scenarios would be able to deliver are in all cases much smaller than those from high speed rail, and the works required to deliver them would be very substantial, affecting all three main north-south routes out of London. As a result, only the higher frequency scenario would generate benefits in excess of its costs.

The net present cost to the public purse of this scenario, calculated over 60 years, would be £7.7 billion (£18.7 billion capital and operating costs less £11.0 billion fares revenues). The transport benefits from this scenario have a net present value of £10.9 billion – less than a quarter of those potentially delivered by a new high speed rail network. This results in a BCR of 1.4.

In addition, whilst they would have lower impacts than new infrastructure in respect of factors such as visual impact, land take and noise, the level of disruption caused to travellers as a result of enhancements on this scale to existing lines would be extremely high. Although the works on any individual line would not be as substantial as those carried out under the

2 *High Speed Rail Strategic Alternatives Study: Strategic Alternatives to the Proposed Y Network*.

recent West Coast Main Line route modernisation, the network is now being used much more intensively, which would increase the level of disruption caused.

The Government's view therefore is that such enhancements cannot provide a strategic value for money alternative to high speed rail.

A National High Speed Rail Strategy

Delivering a national high speed rail network

The previous section set out why the Government supports a Y-shaped core high speed rail network, which would link the UK's largest conurbations, enhancing capacity, transforming journey times and promoting growth.

The Government proposes that this network should be delivered in phases, beginning with an initial London – West Midlands line. This is for four reasons:

- First, phasing the project would help to ensure rapid and early progress in developing high speed rail in the UK. Under the previous Government, initial work was commenced on the London – West Midlands line, which could now be taken forward.
- Second, the parliamentary process for securing powers is likely to be complex and lengthy. Seeking powers at a later stage for the subsequent legs of the network would help to reduce the scale of the task and speed up the commencement of construction.
- Third, as developing a major piece of new infrastructure on this scale involves significant cost, the impact on the public finances would best be managed by a phased approach to construction.
- Fourth, the task of constructing the network would also be best managed through a phased construction programme.

The initial London – West Midlands phase could be operational by 2026, with the second phase to Manchester and Leeds opening in around 2032-33.

Whilst work was underway on designing and constructing the two phases of the Y, the Government would expect to work with the Scottish Government and others to identify and evaluate options for developing the network further.

Connecting to international gateways

The Government considers that there is a strong strategic case for linking a UK high speed rail network to the country's major international gateways. Future patterns of economic activity are likely to depend increasingly on international connectivity. The Government also believes that we should be seeking alternatives to flying, which high speed rail is well-suited to deliver.

For this reason, the Government commissioned HS2 Ltd in June 2010 to provide advice on the options for direct links to Heathrow and to the High Speed 1 line to the Channel Tunnel. This section sets out its preferred way forward.

Heathrow

The Government considers that a direct link between the high speed rail network and Heathrow would have important strategic advantages:

- Releasing capacity at the airport through mode shift from short-haul aviation to rail would provide an opportunity to boost its resilience and potentially to develop its route network.

- A direct link would transform the accessibility of Heathrow from the Midlands and the North. This could generate valuable economic opportunities for these regions, making them more attractive locations for investment.

- It would also contribute to Heathrow's future development as a multi-modal transport hub, further boosting demand for high speed rail access to and from the airport.

The Government favours serving Heathrow by a spur from a main London – West Midlands high speed line. Such a spur would retain the flexibility to be extended to form a loop back onto the main line in future, enabling through services via the airport to London. The Government proposes to work with BAA and others to determine the optimal location for a station at the airport, and HS2 Ltd has been commissioned to develop route proposals for a spur by the end of 2011.

As with the main network, the Government prefers a staged approach to connecting Heathrow to a high speed rail network. Whilst only the London – West Midlands line was operating, the station at Old Oak Common would be the most appropriate option for serving Heathrow, given likely passenger demand. Passengers could change here for frequent and fast Heathrow Express services into the airport.

A full Y-shaped network would be likely to generate additional mode-shift from aviation. Demand to access Heathrow would be expected to grow accordingly, and so it is at this stage that the Government favours the construction of the direct link to Heathrow. To anticipate this development and reduce potential disruption to a new London – West Midlands line, the junctions for the spur from the main line would be constructed as part of the first phase.

High Speed One

At present, services on HS1 and the Channel Tunnel are relatively inaccessible for those outside London and the South East. By providing direct access to the wider European rail network for services from Manchester, Birmingham and other cities, a link between a national high speed rail network and the current HS1 line could address this.

The Government favours a direct rail link between HS2 and HS1, which would run in tunnel from Old Oak Common to the North London Line and then use existing infrastructure to reach the HS1 line north of St Pancras International.

This would enable direct high speed services from across Britain to European destinations via the Channel Tunnel. An indirect link – such as improving the interchange connectivity between the respective London termini of the two lines – would come at a lower cost than a direct link

but would not deliver the same strategic benefits, particularly in terms of reduced dependency on aviation.

It is not possible to adopt a staged approach to linking HS2 to HS1. For technical reasons, it would be necessary to complete construction of a tunnel linking Old Oak Common to the North London Line before services became operational. Therefore, any link between HS2 and HS1 would be constructed as part of Phase 1, the line between London and the West Midlands.

Other international connections

The Government will also explore the case for high speed rail links to other international gateways. The Birmingham Interchange station would bring Birmingham International Airport within 40 minutes of central London, and HS2 Ltd is considering the case for stations serving Manchester and East Midlands Airports as part of its current work on route proposals for the legs to Manchester and Leeds.

Next steps

The Secretary of State for Transport will announce the outcome of this consultation process and the Government's final decisions on its strategy for high speed rail before the end of 2011.

The Government proposes to seek the necessary powers and consents for constructing any new high speed lines via the hybrid Bill process. This was the approach adopted for both the HS1 line to the Channel Tunnel and for Crossrail, and allows those affected by the proposals to petition Parliament directly to seek amendments to the proposals or assurances and undertakings.

Subject to the outcome of this consultation, the Government's intention is that the necessary preparations, including a full Environmental Impact Assessment, should be carried out in time to introduce a hybrid Bill for the initial London – West Midlands phase of the proposed network in October 2013, with a view to achieving Royal Assent at the beginning of 2015. On this basis, construction of a new line could begin early in the next Parliament. The construction process would be expected to last in total approximately seven to eight years (although on most parts of the line, construction would only be underway for a period of two years or so), and would be followed by a period of testing and commissioning, with the proposed line opening by 2026.

In respect of the proposed second phase to Manchester and Leeds, following receipt of detailed advice from HS2 Ltd later this year, which will include assessments of route and station options, the Government's intention is to consult on its preferred way forward and subsequently to introduce a second hybrid Bill in the next Parliament. The Government expects that construction could commence on this basis in the mid-2020s, allowing the lines to open by 2032-33.

Property impacts

The Government and HS2 Ltd would ensure that timely and full information is made available to those affected by proposals for any new high speed line. Minimising uncertainty and protecting the legitimate interests of private property owners would be of paramount importance.

If the Government decides, following consultation, to go ahead with any new high speed line, it would aim to safeguard land from future development. Annex A gives details of the statutory provisions on blight and compensation that would apply for any new speed line.

The Government is also considering what additional measures may be appropriate to help those whose properties would be unlikely to need to be compulsorily purchased in order to build a new line, but who may still experience a significant loss in the value of their property as a result of its proximity. For the purposes of this consultation, the Government has identified a range of approaches that it is considering applying to any additional discretionary arrangements and these are also set out in Annex A, along with some options for how such arrangements might operate.

Conclusion

A national high speed rail network would deliver unprecedented improvements in rail capacity and connectivity, as well as supporting job creation, urban regeneration and business productivity. Such a network could also promote longer-term strategic changes to Britain's economic geography – with potential to enhance economic growth and help to bridge the north-south divide.

The network would be delivered in two phases, with the first phase being a high speed line from London to the West Midlands, including links to Crossrail and HS1, and connecting back to the West Coast Main Line in order to provide improved journey times to a wide range of cities on that corridor.

Part two of this document explains the work that HS2 Ltd has undertaken to identify and consider route options for that initial line, and then sets out the Government's proposed route and its potential impacts in detail.

PART 2 – HS2: LONDON TO THE WEST MIDLANDS

Developing a new high speed line

The Government's proposed route for a new high speed line from London to the West Midlands, and the first phase of a national high speed rail network, is based on work carried out by HS2 Ltd over the past two years.

The focus has been on developing proposals for a safe and reliable railway, using proven European standards, technology and practice. Key aspects include:

- **Speed:** A line capable of up to 250 miles per hour but with a maximum train speed of 225 mph assumed at opening.
- **Capacity:** Up to 400 metre long trains with as many as 1,100 seats, and up to 14 trains per hour in each direction; developments in train control technology are expected to see that increase to 18 trains per hour on a wider network.
- **Minimising impacts on the environment:** For instance, by following existing rail or road transport corridors, using deep cuttings and tunnels, and avoiding sensitive sites wherever possible.
- **Controlling cost:** Balancing cost and the other design aims.

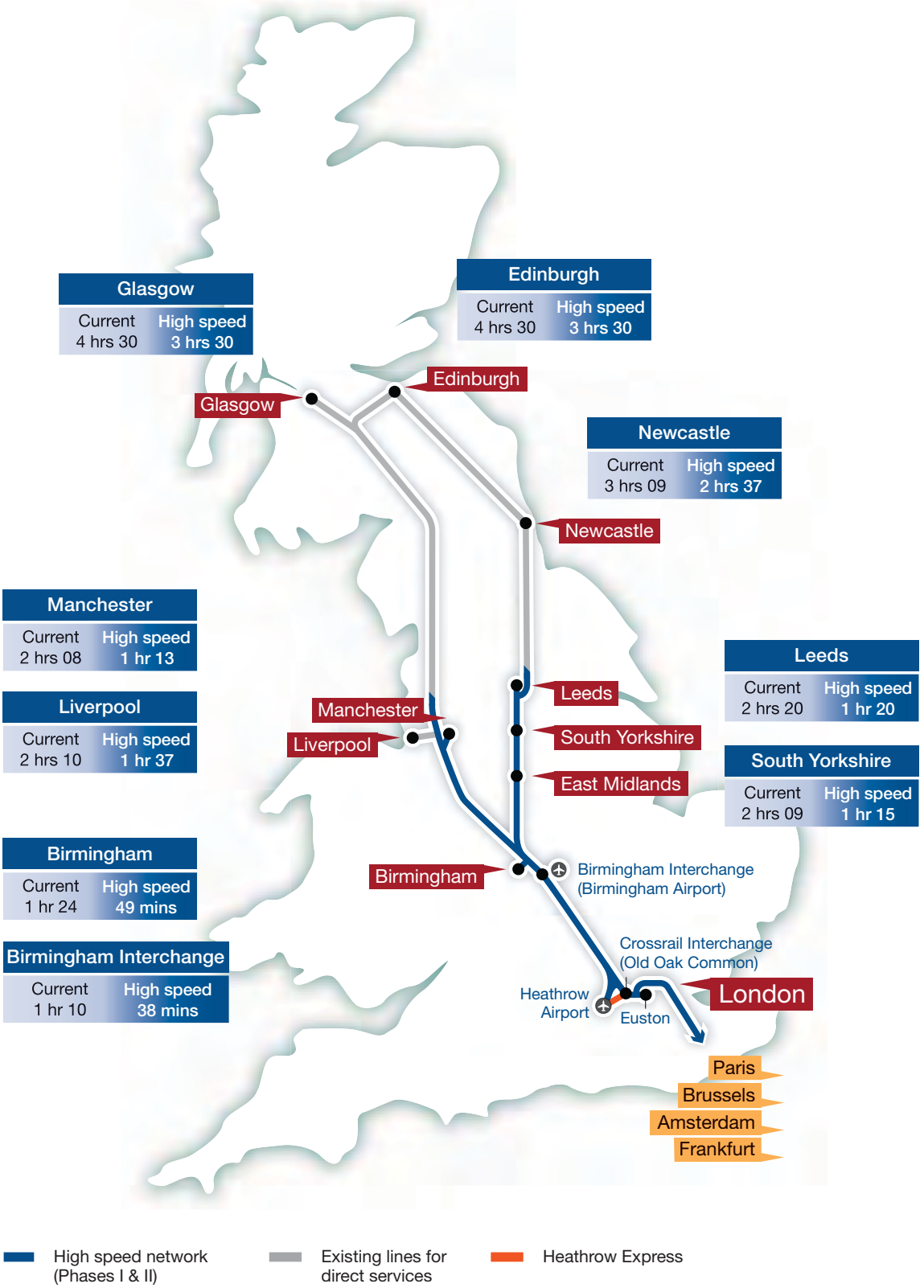


Figure 2 – **Journey time savings to and from London by train**

Designing HS2

The economic case for HS2 relies heavily on ensuring that decisions are informed by the journeys that people want to make. Route design focused mainly on city centre station locations with high quality onward transport links.

Sustainability issues have been addressed in detail through an Appraisal of Sustainability (AoS) covering the four principles of sustainable development:

- reducing greenhouse gas emissions and combating climate change;
- protecting natural and cultural resources and enhancing the environment;
- creating sustainable communities (including noise); and
- achieving sustainable consumption and production.

The full AoS, together with a non-technical summary, has been published to inform this consultation.

In sifting route and station options, HS2 Ltd considered cost and engineering feasibility, demand (i.e. how well they would serve the journeys people want to make), and environmental impacts. More than 90 options were considered for stations and line of route sections during the selection process.

Recommended and alternative routes were submitted to Government by HS2 Ltd in December 2009, and were published in March 2010.

Additional advice was provided between September and December 2010, including on options for environmental mitigation, and the Government has now identified its preferred route for consultation.

The Government's Preferred Route for HS2 (London – West Midlands)

HS2's London terminus would be a redeveloped Euston station serving both high-speed and conventional lines. The station would need to be extended to the south and the west and the platforms would be built two metres below the current level, allowing new development above them and the opening up of east-west routes across the site, which is largely occupied currently by a Royal Mail shed.

Leaving Euston, the route would descend into tunnel for about four and a half miles, surfacing at a new interchange station at Old Oak Common in west London. Passengers would be able to interchange here with Crossrail, the Heathrow Express, the Great Western Main Line and other local public transport. A direct link to HS1 would also run from the main high speed line at Old Oak Common.

From Old Oak Common towards the M25, the route would run along the Chiltern Line corridor to West Ruislip and then cross the Colne Valley on a two-mile long viaduct. Junctions for a future connection to Heathrow would be provided in this section.

Immediately before the M25, the line would enter a six-mile long tunnel, emerging just north of Amersham. It would continue towards Aylesbury, largely in tunnel or cutting, along the A413 corridor. Beyond Aylesbury it would broadly follow the disused Great Central Line corridor to Calvert, and pass to the east of Brackley.

The line would head north-west towards the gap between Kenilworth and Coventry, before curving north to Coleshill. A new interchange station would be constructed where the line of route passes the National Exhibition Centre (NEC) and Birmingham Airport.

North of the interchange station the route would pass west of Tamworth to Lichfield, where it would join the West Coast Main Line for services to Manchester, Liverpool and Scotland. A junction at Water Orton would provide a link into Birmingham city centre, which would follow the existing rail corridor and terminate at a new high speed station at Curzon Street.

Protecting the Environment and Promoting Growth

Mitigating the impacts of HS2 (London – West Midlands)

Since recommending the route to Government in December 2009, HS2 Ltd has identified refinements to around half its recommended route, including more than a mile and a half of "green-tunnels" to maintain local access and minimise noise and visual impacts, lowering large sections of the proposed line and reducing the number of viaducts, while some changes to the alignment have moved it further away from settlements and important heritage sites. HS2 Ltd's analysis of the sustainability impacts of its refined route is set out below.

Sustainable communities

HS2 stations could act as a catalyst for major regeneration in London and the West Midlands. The proposed station at Old Oak Common in West London would contribute to the regeneration of the surrounding area and would support planned employment growth of up to 20,000 jobs. HS2 could also support growth in employment of more than 8,000 jobs in the West Midlands around the proposed Curzon Street terminus and the interchange station near to Birmingham International Airport; and it could support a further 2,000 jobs around Euston.

Released capacity on the West Coast Main Line could provide additional fast commuter services in and out of London and Birmingham, supporting major growth areas, such as Northampton, Rugby and Milton Keynes.

HS2 would, however, require a number of property demolitions, particularly around Euston where around 200 mainly local authority owned homes would need to be demolished and replaced with new, high quality, social housing. HS2 Ltd intends to work closely with the London Borough of Camden and the GLA with the intention of agreeing a joint strategy for the Euston area, including through engagement with local people, businesses and community representatives.

Around 30 dwellings would need to be demolished to make way for the proposed rolling stock maintenance depot at Washwood Heath in Birmingham. Elsewhere, property demolitions, although significant to those people directly affected, would be relatively low in number.

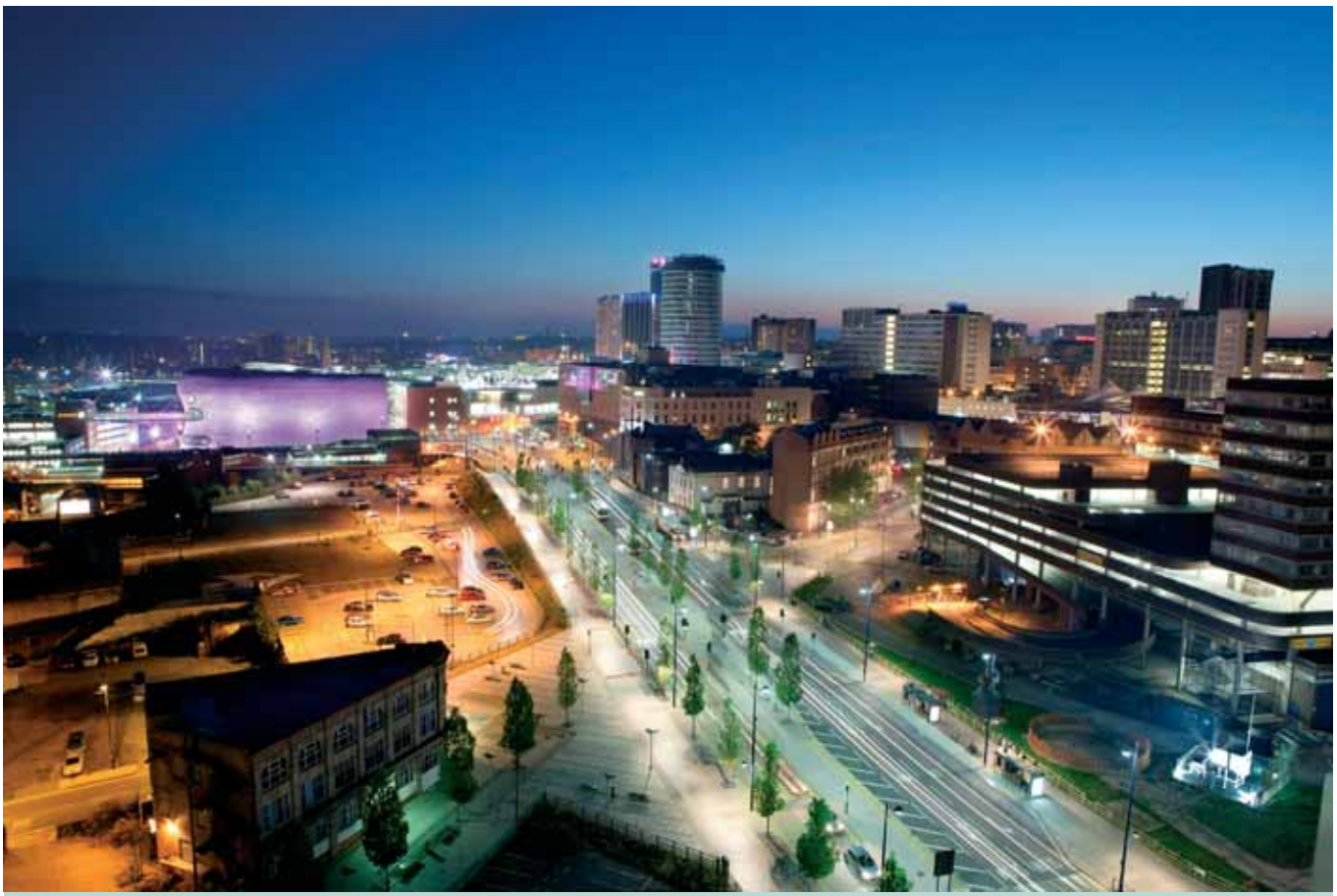
HS2 Ltd's work on mitigation has substantially reduced potential noise impacts. Around 10 dwellings would be likely to be affected by high noise levels, with around 150 additional properties likely to experience levels of noise which would qualify for noise insulation under Noise Insulation Regulations, and around 4,700 properties potentially experiencing some noticeable increase in noise levels.

Experience from HS1 and other high speed railways shows that significant effects from vibration and ground-borne noise in properties over tunnels can be avoided. The engineering design of HS2 will build on this experience and it is not expected that there will be significant effects on properties above tunnels.

For the construction phase, HS2 Ltd would develop and implement a code of practice for its contractors to reduce impacts to a practicable minimum and protect the environment and the amenity of people along the proposed route.

Landscape, townscape and cultural heritage

The Chiltern Hills would be crossed predominantly in tunnel and deep cutting with short elevated sections on embankment or viaduct to the south of Wendover where the proposed route is in close proximity to the A413 and Chiltern Railway. Extensive tree planting, as well as the creation of planted earth mounds or 'bunds', carefully blended into the natural contours of the land, would help to reduce noise, screen views and integrate the railway into the landscape. Overall HS2 Ltd expect to plant more than two million trees along the proposed line from London to the West Midlands.



Birmingham's Eastside: the location of the proposed Birmingham terminus for HS2

No Grade I or Grade II* buildings would be demolished, although a number of Grade II buildings would need to be demolished or relocated. The route would pass through three Registered Parks and Gardens, and two scheduled monuments would be directly affected. HS2 Ltd would work with relevant partners to ensure these effects were minimised. Although no internationally protected sites of ecological interest would be adversely affected, partial landtake would be required from one site of special scientific interest (SSSI).

Sustainable consumption and production
The proposed new railway would make good use of land that has had a previous industrial or railway use, although some productive agricultural land would be lost. Construction of the proposed scheme would generate and consume large quantities of excavated materials and opportunities would be taken to re-use spoil as part of embankments and landscaping.

If the scheme is taken forward, further detailed consideration would be given to mitigation and how this is best developed, refined and incorporated into the design and into the way that HS2 would be built and operated, with tailored solutions for the specific characteristics and challenges of each section of the route. Appropriate local mitigation would be discussed and agreed with local authorities and communities through additional targeted consultation processes.

Alternative Routes and Stations

HS2 Ltd considered a number of alternatives to the key elements of its recommended scheme. Two main alternatives were considered to the recommended option for a single-deck extended station at Euston: a double-deck solution on a smaller footprint at Euston was found to cost more to construct, would be very intrusive in the local area and would impose unacceptable disruption to existing services during construction, while an alternative location on the Kings Cross Lands would have serious impacts on developments currently underway.

HS2 Ltd identified two main alternative lines of route, plus a later consideration of a further route via Heathrow.

- The Government considers that there is a compelling strategic case for being able to link the high speed network to Heathrow. HS2 Ltd's Route 4, which follows the West Coast Main Line corridor more closely through the Chilterns, would make this impractical. It would also cost more and mean longer journey times, and therefore lower benefits.

- The alternative route through the Chilterns, Route 2.5, would create an entirely new transport corridor through the Chilterns Area of Outstanding Natural Beauty and would be very intrusive in the Hughenden Valley. It would cost more and lengthen journey times, reducing overall benefits.

- The alternative route via Heathrow would be substantially more expensive and its longer journey times would lead to reduced benefits. Although it would have less direct impact on the Chilterns AONB, it would adversely affect other sensitive areas.

In Birmingham, HS2 Ltd considered a new station at Warwick Wharf, but the Curzon Street site was found to have less effect on local conservation areas and would require fewer demolitions. HS2 Ltd also considered an approach along the Coventry (West Coast Main Line) corridor, but the Water Orton corridor performed better in terms of sustainability.

In addition to the above options, HS2 Ltd and the Government reviewed the proposed site put forward independently by Arup for an interchange near Iver in Buckinghamshire, with a light rail link to Heathrow. Routing the line via this site shared many of the disadvantages of a direct Heathrow route without offering the benefits of an on-airport station.

Conclusion

The Government's view is that the route recommended by HS2 Ltd, following its additional work on mitigating environmental impacts, appropriately balances the benefits and impacts of such a line, and provides a better solution than any of the alternatives considered.

For this reason, the Government believes that this route for an initial London – West Midlands high speed line should be taken forward, as the first phase in the development of a national high speed rail network.

Part 3 explains the questions on which the Government is seeking views on both its high speed rail strategy and on the proposed route described above, and sets out how to respond to this consultation.

PART 3: RESPONDING TO THE CONSULTATION

This consultation seeks views on the proposed national high speed rail strategy described in Part 1 and on the recommended line of route for an initial London – West Midlands line set out in Part 2.

The questions on which the Government is seeking views are set out below. In each case, the Government is interested in whether or not you agree with its proposals and why, as well as in any additional evidence that you feel it should consider in reaching its final decisions.

1. This question is about the strategy and wider context:
Do you agree that there is a strong case for enhancing the capacity and performance of Britain's inter-city rail network to support economic growth over the coming decades?

2. This question is about the case for high speed rail:
Do you agree that a national high speed rail network from London to Birmingham, Leeds and Manchester (the Y network) would provide the best value for money solution (best balance of costs and benefits) for enhancing rail capacity and performance?

3. This question is about how to deliver the Government's proposed network:
Do you agree with the Government's proposals for the phased roll-out of a national high speed rail network, and for links to Heathrow Airport and to the High Speed 1 line to the Channel Tunnel?

4. This question is about the specification for the line between London and the West Midlands:
Do you agree with the principles and specification used by HS2 Ltd to underpin its proposals for new high speed rail lines and the route selection process HS2 Ltd undertook?

5. This question is about the route for the line between London and the West Midlands:
Do you agree that the Government's proposed route, including the approach proposed for mitigating its impacts, is the best option for a new high speed rail line between London and the West Midlands?

6. This question is about the Appraisal of Sustainability:
Do you wish to comment on the Appraisal of Sustainability of the Government's proposed route between London and the West Midlands that has been published to inform this consultation?

7. This question is about blight and compensation:
Do you agree with the options set out to assist those whose properties lose a significant amount of value as a result of any new high speed line?

You can provide your answers online via the consultation website at:

http://highspeedrail.dft.gov.uk

or you can send written responses to:

Freepost RSLX-UCGZ-UKSS
High Speed Rail Consultation
PO Box 59528
LONDON
SE21 9AX

Responses must be received by:

Friday 29 July 2011.

PART 1

1. The Fast Track to Prosperity

Introduction

1.1 The Government believes that a national high speed rail network offers a once-in-a-generation opportunity to transform the way we travel in Britain.

1.2 High speed railways were first built in Japan in the 1960s, and have now been developed in countries across Europe and Asia. This progress shows no sign of stopping, and China, France and Spain, amongst other countries, are all pressing ahead with ambitious plans. Britain cannot afford to be left behind. Our current railway system dates back to the Victorian era and will not be sufficient to keep Britain competitive in the twenty-first century.

1.3 A new high speed rail network would transform the country's economic geography. It would bring our key cities closer together, enable businesses to operate more productively, support employment growth and regeneration, provide a genuine alternative to domestic aviation, and create a platform for delivering long-term and sustainable economic growth and prosperity.

1.4 A Y-shaped national high speed rail network linking London to Birmingham, Manchester and Leeds, and including stops in the East Midlands and South Yorkshire, as well as direct links to the HS1 line and into Heathrow Airport, would cost £32 billion to construct, and would generate benefits with a net present value of around £44 billion, as well as fares revenues with a net present value of around £27 billion.

1.5 It would deliver a huge increase in rail capacity to meet rising demand for long-distance rail travel, and ease overcrowding on existing railways.

1.6 It would slash journey times between cities, bringing London within 49 minutes of Birmingham, and to within 80 minutes or less of both Manchester and Leeds. Travel times between regional centres would be cut equally sharply, so that Birmingham would be only around 50 minutes from Manchester and just over an hour from Leeds.

1.7 By linking the high speed network to the existing East Coast and West Coast Main Lines, London would be brought within around three and a half hours of both Glasgow and Edinburgh – significantly reducing the demand for internal UK flights. Short-haul aviation could be reduced further by international high speed rail services from cities across the country using a direct link via the High Speed 1 line to the Channel Tunnel.

1.8 The Government's strategy also includes a direct link to Heathrow, which would bring Manchester and Leeds city centres within around 70 and 75 minutes of the country's main hub airport respectively.

1.9 High speed rail has the potential to play a central role in promoting long-term and sustainable economic growth. The first phase alone of a national network would support the creation of around 40,000 jobs and contribute to major regeneration programmes in Britain's inner cities. New

high speed links would enable the UK's key urban economies to improve their productivity, attract new businesses, and access more directly the economic strength of London and the South East.

1.10 The Government believes that a high speed rail network would be a transformational investment in Britain's future and help to bridge the north-south divide. This consultation document sets out the basis on which the Government has reached that view, and seeks your views on its proposed way forward.

Background to the consultation

1.11 The Government's support for high speed rail was set out clearly in its *Programme for Government*, published on 20 May 2010, which states that:

"We will establish a high speed rail network as part of our programme of measures to fulfil our joint ambitions for creating a low carbon economy. Our vision is of a truly national high speed rail network for the whole of Britain."

1.12 Since then it has looked to build on and develop the work begun by the Conservative Party in Opposition and by the previous Government, which set up HS2 Ltd to consider the case for high speed rail in the UK and develop detailed proposals for an initial route from London to the West Midlands. Last October's Spending Review settlement reaffirmed the Government's support and provided over £750 million to fund the development of plans for a national network over the next four years.

1.13 In addition, the Government has commissioned and received additional advice from HS2 Ltd on options for a national high speed rail network and on direct links to Heathrow and to the High Speed 1 (HS1) line to the Channel Tunnel. And following a programme of visits to the proposed London – West Midlands route by the Secretary of State for Transport, a range of improvements to the detailed alignment have been identified, which would significantly reduce its local environmental impacts. These mitigations have resulted in around half of the original route proposal published in March 2010 being altered in some respect.

1.14 In December 2010, the Secretary of State announced the Government's proposed high speed rail strategy – including its preferred route for an initial London-West Midlands line and its approach to delivering a wider high speed rail network.

1.15 The Government recognises that no final decision should be taken on a major infrastructure project of this scale, however, until all those with an interest have had the opportunity to make their views known.

1.16 The purpose of this consultation is to give people the chance to have their say. Part 3 of this document sets out the questions on which the Government is seeking your views, and explains how you can reply. The last date for submitting a response to the consultation is Friday 29 July 2011.

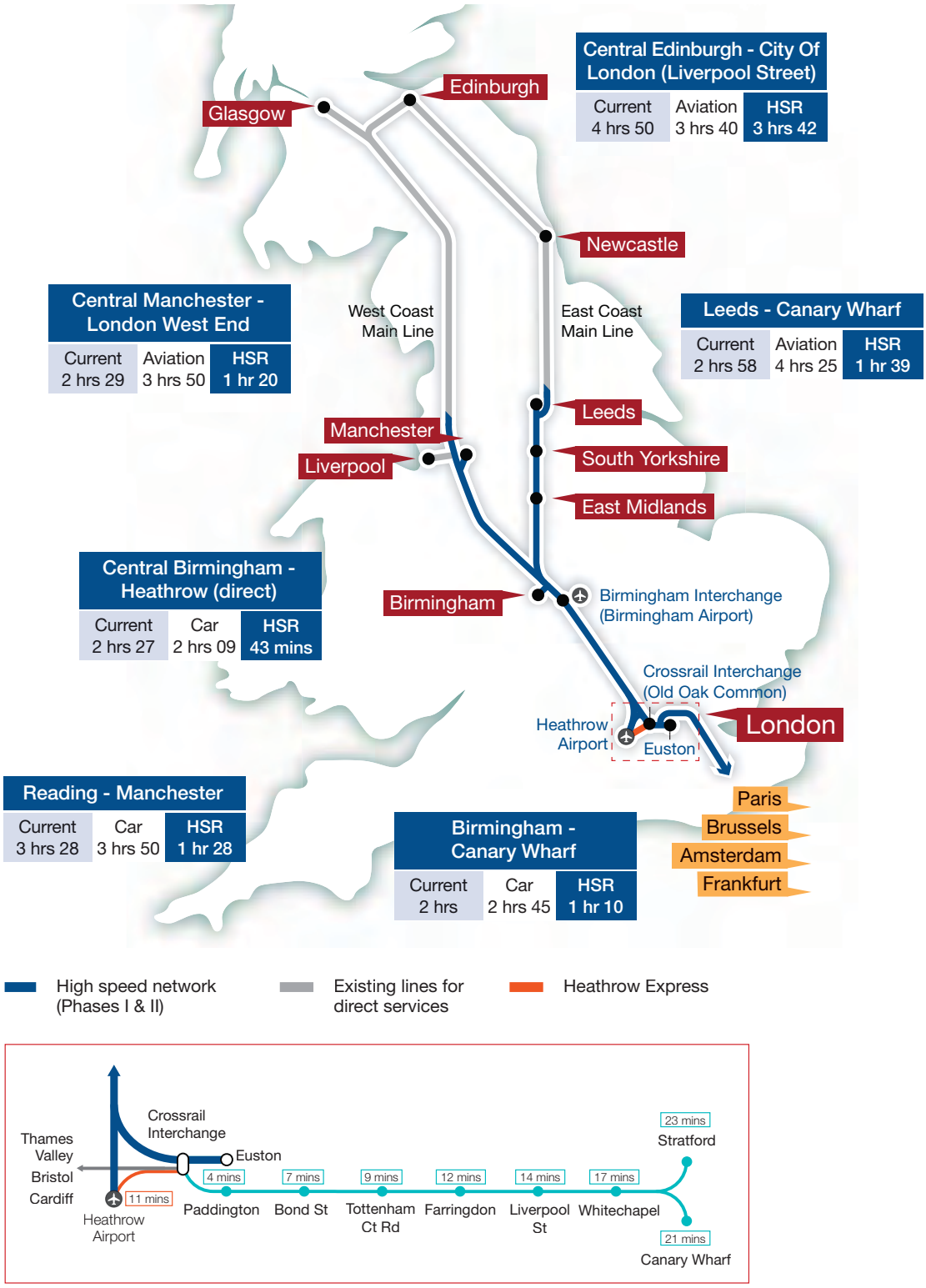


Figure 1.1 – **Journey time savings via Crossrail Interchange**

Preparing for growth

1.17 The Government's proposed high speed rail strategy must be seen within the context of its broader plans for creating a more balanced economy and restoring sustainable growth.

1.18 As the UK emerged from the longest and deepest recession in peacetime history, the Government's first priority was to cut the record budget deficit – the largest in the G20.

1.19 In June 2010, the Emergency Budget outlined the Government's plan to eliminate entirely the UK's structural deficit and reduce the level of debt as a proportion of GDP. Subsequently, in October 2010, the Spending Review provided each Government department with a fixed spending total for the next four years, as well as setting out far-reaching reforms to public services and the welfare state. The result has been the confirmation of Britain's AAA credit rating and the restoration of confidence in the UK economy.

1.20 The second critical task for the Government is to create the conditions that will put Britain back on the path to economic prosperity. It is committed to providing a strong basis for long-term growth by creating the right environment for private enterprise to flourish and by re-balancing the economy.

1.21 Britain's major cities have a vitally important role to play in delivering sustainable economic growth. London's economy is diverse, innovative and internationally competitive. Britain's regional cities are also of huge economic importance and contain key clusters of innovation and growth: green technologies in the North East; creative industries in Manchester and Glasgow; financial services in Edinburgh and Leeds. 60 per cent of the UK's Gross Value Added and 75 per cent of its jobs can be found in its cities.

1.22 But the economic performance of Britain's cities and regions varies significantly. Over the past decade, around half the UK's economic growth has been concentrated in London and the surrounding regions. If other regions of the country had been able to match this rate of growth, the UK would have been £38 billion better off.

1.23 The Government is determined to take steps to promote sustainable growth and to overcome these geographical and sectoral imbalances – tackling the historic north-south gap in economic growth.

The National Infrastructure Plan

1.24 In order to achieve these objectives, Britain must have the right infrastructure in place to help boost productivity, reduce costs, increase efficiency, and expand business and labour markets.

1.25 Other countries understand the importance of modern infrastructure to economic growth. China is building tens of thousands of miles of roads, a network of intercity railway lines and several new nuclear power stations. In contrast, UK governments have previously neglected infrastructure investment as a way of avoiding taking difficult decisions in other areas, such as welfare spending.

1.26 As a result, according to *The World Economic Forum*, the UK was ranked just 33rd for the quality of its infrastructure and 12th for overall competitiveness in 2010, compared to ninth in 2005.

1.27 This Government is determined not to repeat those mistakes. Alongside the tough choices that it has made on welfare and in other areas, it has taken steps in the Spending Review to protect infrastructure investment because it understands that it provides a vital platform for growth.

1.28 In October 2010, the Coalition published its National Infrastructure Plan setting out its strategy for delivering world-class infrastructure. This clearly identified the scale of the infrastructure challenge and the major economic investment needed to underpin sustainable growth in the UK over the coming decades.

Investing in transport infrastructure

1.29 Investment in transport is a key part of the Government's approach, enabling faster and more convenient journeys between major cities and other key destinations; improving productivity; and promoting economic growth and prosperity.

1.30 An October 2010 survey of UK businesses, carried out for the Association for Consultancy and Engineering and the Civil Engineering Contractors Association,[3] found that 95 per cent of companies agree that the UK's road and rail network is important to their business and its productivity. This view is supported by the Confederation of British Industry (CBI) which has said transport infrastructure investment "offers high returns and will play a crucial role in boosting domestic and international trade."[4]

1.31 The Government demonstrated its commitment to transport in last year's Spending Review when it earmarked £18 billion for rail investments, £4 billion for the Highways Agency, and £6 billion for local transport.

1.32 Britain's rail infrastructure has a vital role to play in the Government's plans to promote sustainable economic growth. Efficient commuter networks support the deep labour markets that underpin the productivity of the UK's cities. Inter-city rail links have an unrivalled capacity to enable rapid and direct journeys between central business districts – avoiding traffic jams and the difficulty of finding parking space. Around 1 billion of the 1.3 billion rail journeys made each year are by commuters or business travellers.

1.33 The rail freight industry is also playing an ever stronger role in ensuring goods and raw materials get to the right place at the right time and providing valuable reductions in carbon emissions as increasing amounts of freight switch from the roads.

3 ACE & CECA, *Transport – UK's infrastructure priorities*, October 2010; available at: http://www.acenet.co.uk/Documents/Files/Policy%20and%20Operations%20Guides/UK%20Transport%20infrastructure%20survey%20FINAL.pdf

4 CBI News Release, 20 September 2010, available on www.cbi.org.uk

1.34 The British Chambers of Commerce share the Government's view of the importance of a modern and efficient rail network, stating that: "The railways are a key element of our transport infrastructure, impacting hugely on the development of the regions by increasing connectivity and driving long term economic growth."[5]

The capacity challenge

1.35 Britain's rail network, however, is under increasing strain as economic growth and rising prosperity lead to growing demand for travel and ever higher passenger expectations. It cannot be assumed that today's network, which still reflects decisions taken in the Victorian era, will be able to respond to those pressures and continue to support economic growth indefinitely.

5 British Chambers of Commerce, High Speed, High Time: The Business Case for High Speed Rail (2009); at: www.britishchambers.org.uk/67982192457292881 78/High%20Speed%20Rail%20Report%202009.pdf

1.36 Over recent years, the rail system has seen a continuing pattern of rising passenger demand. Total passenger miles have risen from 18 billion across the network in 1994/95 to almost 32 billion in 2009/10. The increase in passenger journeys has been similarly rapid, increasing by 71 per cent from 735 million in 1994/95 to 1,258 million in 2009/10.

1.37 The fastest growing sector is long-distance travel, which saw the total number of journeys with franchised long distance operators more than double between 1994/95 and 2009/10. Demand for long-distance rail travel has also weathered the economic storm well, with 2 million additional passenger journeys being made in 2009/10 compared to 2008/09.

1.38 It is not only the long-distance market, however, which has seen increasing demand. The number of journeys on franchised London and South East operators' services rose by 68 per cent between 1994/95 and 2009/10, and franchised regional operators saw a 70 per cent growth in demand. Despite a fall following the recent recession, current industry data suggests that the pattern is reasserting itself, with the number of journeys rising in the first 9 months of 2010 for both regional and London and South East operators.

1.39 In addition, levels of rail freight carried have risen since their low in the mid-1990s, growing by 45 per cent in the ten years to 2006/07. Since the recession, there has been an overall decrease, though certain types of rail freight have continued to experience substantial rises, such as domestic intermodal containers which rose by 17 per cent between 2006/07 and 2009/10.

Standing room only

1.40 The result of this ongoing growth in demand, particularly for long distance services, is increasing levels of crowding on passenger services.

1.41 High levels of crowding are already being seen across a growing proportion of the network. Despite the capacity increases provided by the West Coast Route Modernisation programme, long distance services on this route regularly see passengers standing for a significant portion of their journey, particularly in peak hours and at other popular times.

1.42 Crowding is not only a feature of services to and from London on this route – more than a quarter of trains between Birmingham and Scotland, for example, carry standing passengers for part of their journey.

1.43 Long-distance services on the East Coast Main Line also suffer from significant overcrowding, with passengers often having to stand in peak hours. The numbers of standing passengers is particularly high between London and Peterborough, but the busiest services regularly carry standing passengers as far as York or Leeds. On the Midland Main Line, almost half of all long distance trains arriving into St Pancras International in the peak have passengers standing.

1.44 This pattern of rising demand and increasing crowding on long distance services is underpinned not only by growth in inter-city travel, but also by significant increases in usage of these services by commuters from towns such as Milton Keynes, Northampton, Peterborough, Rugby and Kettering. Improvements in rail capacity and journey times have enabled

many London-based workers to take advantage of lower housing costs in these locations, but this is placing increasing strain on the rail network. In the last ten years, for example, there has been an 88 per cent increase in demand from Rugby.

The long-term capacity challenge

1.45 Unprecedented numbers of services are already being run on the rail network to accommodate these high levels of demand, but it is clear that further capacity increases will still be needed. The Government and the rail industry have identified a range of nearer-term measures to address existing capacity concerns, including:

- investment in Crossrail and in the Thameslink project;
- the addition of extra carriages to Pendolino rolling stock sets on the West Coast Main Line;
- major upgrades to Birmingham New Street, Reading and London Kings Cross stations;
- the electrification programme on the Great Western Main Line and on key routes in the North West;
- the introduction of new trains to replace the ageing Intercity fleet;
- the lengthening of longer-distance suburban commuter trains to 10 or 12 carriages on routes to London; and
- significant works on the East Coast and Midland Main Lines, and on the Chiltern Line, to improve line speed, reliability and capacity.

1.46 In the long-term, however, it is unlikely that these enhancements will be sufficient. Government and industry forecasts indicate that strong demand growth is likely to continue, which will place an increasing strain on the network, particularly as the scope to accommodate additional services on the current infrastructure is gradually exhausted.

1.47 Some of the most significant challenges are predicted on the West Coast Main Line. Network Rail's recent draft Route Utilisation Strategy (RUS)[6] forecasts that demand on the London-Manchester route will grow by around 60 per cent over the period to 2024, with high levels of growth also forecast to other destinations including Birmingham, Liverpool and Glasgow. Substantial increases in passenger journeys are also forecast in the RUS between regional cities, and on services from Birmingham and Manchester to Scotland.

1.48 In addition, the West Coast Main Line is also a key strategic corridor for rail freight, carrying more freight services than any other major line. Capacity for rail freight is already under pressure, particularly on the sections north of Birmingham, and further growth is forecast such that large stretches of the line between London and Manchester would be expected by 2030 to see freight usage rise to more than 80 paths a day.

6 Network Rail, *West Coast Main Line Route Utilisation Strategy: Draft for Consultation* (2010).

1.49 The potential to increase capacity on the West Coast Main Line is limited, as a major route modernisation programme has already been carried out, leaving relatively little scope for additional upgrades. As a result, Network Rail's RUS states that after 2024 "the West Coast Main Line … is effectively full and subsequent additional capacity could only be provided by exceptionally expensive infrastructure solutions."

1.50 For this reason, the RUS therefore concludes that Network Rail supports "the development and implementation of a high speed line … as the best intervention to free up capacity on the WCML."

1.52 High levels of demand growth are also expected on the East Coast and Midland Main Lines, on both of which Network Rail's long-distance forecasts[7] indicate potential overall long-distance growth of over 70 per cent in the period from 2007 to 2036. Even higher levels of potential growth are forecast over the same period on specific routes including from London to Nottingham, Sheffield and Leeds.

1.53 In order to inform the Government's assessment of the case for high speed rail, long-term forecasts have been developed of demand growth on these three main north-south lines out of London, which connect the majority of Britain's major cities. These forecasts look forward to the early 2040s and show that, even allowing for a range of enhancements to these lines, crowding levels on long-distance services will continue to rise.

1.54 These forecasts indicate very high average daily load factors (i.e. the number of passengers across the entire day expressed as a percentage of the number of available seats) on the West Coast, East Coast and Midland Main Lines.

1.55 HS2 Ltd's analysis of future demand on the West Coast Main Line predicts that between 2008 and 2043 demand for long distance services will roughly double. Even allowing for planned enhancements, this would see the average daily load factor on the southern section of the line rise from around 57 per cent to more than 70 per cent. The consequence would be that in peak hours the vast majority of trains would be carrying large numbers of standing passengers for most, if not all,

7 Network Rail, *Network RUS: Scenarios and Long Distance Forecasts* (2009).

of their journey, and some passengers would have to stand on many other services throughout the day.

1.56 High load factors are also predicted on the East Coast and Midland Main Lines by modelling carried out to inform the assessment of strategic alternatives to high speed rail. On the Midland Main Line, long distance demand is expected to double over the period to 2043, seeing daily load factors of almost 70 per cent, and on the East Coast Main Line even higher demand growth of around 115 per cent is forecast, with an average daily load factor of over 60 per cent on large sections of the line by 2043.

1.57 These load factors are well in excess of the level at which government and the industry would normally seek to identify options for providing additional capacity since they imply substantial and prolonged overcrowding will occur during peak times. Given that major infrastructure enhancement projects can take many years to plan and implement, there is clearly an urgent need, therefore, to consider how capacity can be enhanced on these key strategic routes.

Enhancing network performance

1.58 But rising demand for travel and increasing overcrowding are not the only long-term challenges facing Britain's rail networks.

1.59 Experience on the West Coast Main Line following the completion of the route modernisation programme indicates the value placed by passengers on reducing journey times and improving reliability, with usage of the line increasing rapidly and rail's overall share of the market on this key inter-urban route growing substantially.

1.60 Reliability is a key concern. The predictability of rail travel is one of its most important advantages, and delays, particularly when they are unexpected, cause frustration and disrupt plans. Poor reliability can have a serious impact on business travellers, causing productive time to be wasted.

1.61 The rail industry has been very successful in improving reliability over recent years, achieving performance levels of over 90% since 2007-08. Maintaining this level of reliability, however, is likely to become increasingly challenging as more services are accommodated on the network in response to growing demand.

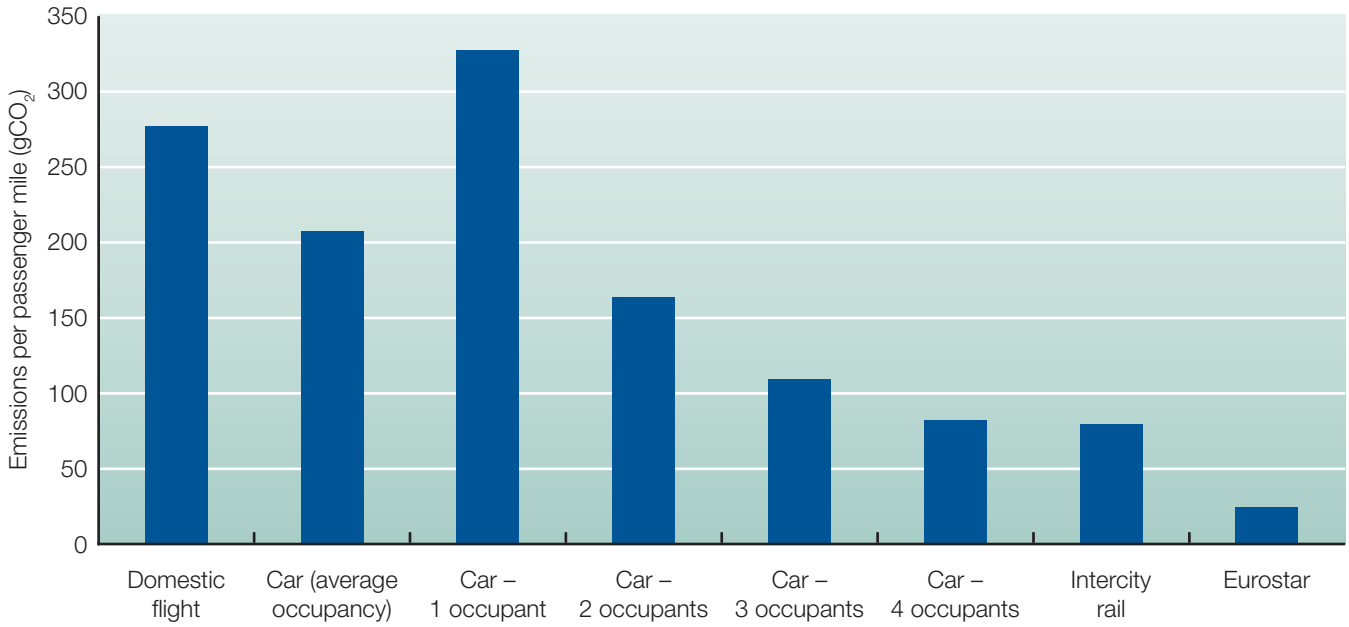
1.62 In addition, as the UK's economy returns to a long-term pattern of growth, improving journey times and connectivity will also be important. Enhancements to transport and communication networks across the globe are leading to ever rising public expectations about the speed and convenience of travel – particularly as other countries are seen to invest in improving connectivity. If Britain's major cities are to remain competitive and to continue to attract skilled workers and inward investment, it will be important to ensure that they do not fall behind.

Reducing carbon emissions

1.63 The Climate Change Act 2008 commits the UK Government to setting five-yearly carbon budgets consistent with achieving a reduction of greenhouse gas emissions of at least 80% by 2050. Reaching this long term target is likely to require almost complete decarbonisation of surface transport. High speed rail, drawing on a decarbonised electricity supply, can play a key part in providing attractive carbon-efficient domestic transport options by 2050.

1.64 Rail is a comparatively carbon efficient form of transport, generally creating significantly fewer carbon emissions per passenger mile than either car travel or aviation. Even allowing for the fact that power usage increases with speed, the high levels of passenger usage that high speed services tend to attract mean that per passenger carbon emissions remain comparatively low. The graph below shows average emissions per passenger mile by mode.

Figure 1.2 – **Carbon emissions per passenger mile by mode of transport**



1.65 For this reason, high speed rail could play an important role in supporting economic growth consistently with the UK's commitments to reduce greenhouse gas emissions, particularly as the improvements to capacity and connectivity that it creates attract journeys that would otherwise be made by car or short-haul aviation to the rail network.

1.66 A further advantage to high speed rail in carbon terms is that, in contrast to aviation and to the vast majority of road transport, it derives its power from the National Grid. The Government is committed to reducing the carbon intensity of electricity generation, and as these improvements take place, the carbon efficiency of electrified rail travel will automatically improve over time. In contrast, it is widely accepted that there will ultimately be a limit to the improvements that can be made to the environmental performance of conventional engines. This is why, for example, the Government is investing in the development of a next-generation of ultra-low emission vehicle technologies, such as electric cars.

1.67 Over 90% of domestic transport emissions are currently generated by road transport, and so improving the carbon efficiency of road vehicles, as described above, will inevitably form the central element of the Government's low carbon transport strategy. On key inter-city routes, however, where rail transport plays an important role in supporting economic growth, high speed rail would provide an effective option for sustainably accommodating rising demand.

High speed rail

1.68 Over recent decades, countries across Europe and Asia have developed high speed rail links as a means of enhancing their transport networks, beginning with the opening of the first Shinkansen line between Tokyo and Osaka in 1964.

1.69 In Europe, France took the lead in developing high speed rail, and now has 1,185 miles of high speed track in operation. Other European countries are also building extensive networks: Spain now has 1,285 miles of high speed line, and Germany and Italy have more than 800 and 500 miles respectively.

1.70 China has even more ambitious plans for its high speed rail network. Although its first high speed line from Beijing to Tianjin did not come into operation until 2008, it now has 2,609 miles of high speed lines in operation and has plans to develop the world's largest network with almost 4,000 miles currently under construction and a further 1,800 miles in development.

1.71 High speed rail links have increased capacity and slashed rail journey times across the globe – reducing the time taken to travel between Paris and Lyon by half; cutting the Tokyo-Osaka journey from 7 hours to 2 hours 25 minutes; and enabling passengers to travel by rail from Madrid to Barcelona in around 2 hours 40 minutes. In many cases, this has seen a significant transfer of passengers away from aviation onto the railways, with aviation's share of the market between Madrid and Barcelona dropping from 88% to just 41% since the opening of the high speed rail connection. Between Paris and Brussels, and between Frankfurt and Cologne, flights have almost ceased since the opening of high speed rail connections.

1.73 Over and above these conventional transport benefits, however, new high speed rail links have also been shown to be a powerful tool for supporting economic growth and drawing in new investment. High speed rail can both support growth in cities which already have a strong competitive position, and enhance the economic potential of previously underperforming urban centres.

1.74 In Lyon, for example, high speed rail has helped service sector firms to thrive by providing enhanced access to the Paris market, where their experience working with small- and medium-sized businesses has given them a valuable competitive advantage. Lille's position at the centre of the north European high speed rail network has also made an important contribution to the transformation of its economy and the development of its service industry sector, as well as promoting significant urban regeneration around the new high speed rail station.

1.75 The connection of Ciudad Real to the Spanish high speed network, bringing it within an hour of Madrid, has seen the town develop into an important regional business centre and enabled its university to expand its student population, faculty and staff. In Zaragoza, high speed rail links have made a major contribution to urban regeneration – transforming the Delicias area, creating new open areas and green spaces, and supporting new initiatives to promote innovation and growth.

1.76 In Germany, the arrival of high speed rail in Cologne has supported a major programme of redevelopment, including office, hotel, retail and leisure developments, as well as new housing and the redevelopment of the city's main exhibition and conference venues. And in Japan, research undertaken in the 1980s on the effects of the development of the Shinkansen network suggested that land values in commercial areas with a Shinkansen station rose by as much as 67 per cent.

1.77 In England, the opening of the High Speed 1 line from London through Kent to the Channel Tunnel has also brought real economic benefits. With journey times to central London being cut from well over an hour to just 37 minutes (around 45 minutes faster than on the conventional speed line), the town of Ashford has seen valuable new investment and development. Similarly, the area around Ebbsfleet is the focus of significant regeneration plans, expected to deliver 9,500 new homes and up to 25,000 jobs, and the redevelopment of St Pancras station has contributed to major changes to this area of London, with a range of new business, cultural and leisure developments underway.

1.78 Britain still lags far behind its European neighbours, however, in the development of a high speed rail network. The HS1 line is only around 70 miles long and no high speed links are in place between the country's major cities. In contrast, France has plans to expand its high speed rail network to 2,951 miles and Spain plans to grow its network to more than 3,000 miles. Germany and Italy too have plans for further expansion.

1.79 As countries around the globe increasingly reap the substantial benefits that high speed rail can offer, Britain cannot afford to be left behind. The next chapter sets out in more detail the basis on which the Government has reached that view.

Conclusion

1.80 The Government believes that if Britain's railways are to continue to play their full part in supporting the economy, there is a strong case for enhancing the capacity and performance of the country's key north-south inter-city links.

1.81 Only in this way can Britain ensure that it has an inter-city rail network which matches its growing ambitions:

- promoting long-term, sustainable and rebalanced economic growth;
- enabling rising numbers of journeys to be comfortably accommodated;
- improving the speed, convenience and reliability of links to our big cities and international gateways; and
- keeping pace with developments in other countries.

1.82 The next chapter describes why the Government believes that high speed rail is the best option to achieve these objectives, and has the potential to transform rail travel in Britain – supporting economic growth and regeneration, helping to bridge the north-south divide, and sending a powerful signal that the whole country is open for business.

Consultation Question:
Do you agree that there is a strong case for enhancing the capacity and performance of Britain's inter-city rail network to support economic growth over the coming decades?

2. The Case for a National High Speed Rail Network

2.1 The previous chapter described the vital role that transport infrastructure investment can play in securing sustainable and rebalanced economic growth, and outlined the case for adding capacity on and boosting the performance of the key inter-city rail corridors between London and the major conurbations of the Midlands and the North.

2.2 This chapter sets out the basis on which the Government has formed its view that high speed rail is the best option for delivering additional capacity and enhancing the performance of Britain's inter-city rail links, bringing them into line with rail networks now operating in other countries in Europe and Asia.

2.3 The Government considers that the transformation in the country's connectivity that high speed rail would provide offers unique potential to redraw the economic geography of the UK. As part of a wider integrated strategy, it would help to promote long-term growth and address imbalances in productivity and prosperity between the South East of England and the economies of the Midlands and the North.

2.4 In addition to these wider strategic opportunities, a national high speed rail network would also deliver very substantial benefits for rail travellers – increasing capacity, reducing journey times and enhancing reliability. Released capacity on existing lines would enable growth in commuter, regional and rail freight markets to be accommodated.

2.5 As the analysis set out in this chapter shows, the benefits of a new high speed rail network would be significantly greater than those offered by either major enhancements to the existing network or the construction of new conventional speed lines. Taking account of monetised and non-monetised costs and benefits, the Government's assessment is that the case for such a network is strong.

2.6 For these reasons, the Government believes that a national high speed rail network should form the basis of its long-term strategy for enhancing inter-urban rail capacity and connectivity.

The strategic case for high speed rail

2.7 Chapter 1 set out the Government's broader objectives for sustainable and balanced economic growth and the role of transport and wider infrastructure improvements in delivering them. The Government's view is that the enhanced connectivity offered by a new high speed rail network would help to promote longer-term growth and rebalancing through its potentially transformational impacts on economic geography.

Increasing regional prosperity

2.8 By boosting rail capacity and reliability, and transforming journey times between the country's largest conurbations, a high speed rail network would help the major cities in the Midlands, the North and Scotland to benefit more directly from the economic strength of London and the South East, to attract new businesses, and to increase productivity by merging labour markets and customer bases.

2.9 Improving accessibility to London markets can contribute to improving urban productivity, helping to attract more and more productive businesses to a city or region, as well as increasing productivity in existing firms by providing access to major new markets and enabling them to more easily attract the most highly skilled workers.

2.10 International experience supports this view. In Lyon, the high speed rail link to Paris has enabled firms from the city to benefit from improved access to the French capital. The area around Lyon's Part Dieu high speed rail station now hosts 5.3 million square feet of office space and around 20,000 jobs. Similar patterns have been observed in Japan, where high speed rail has seen a dispersal of investment and economic activity from the main 'developed region' towards the periphery. And in Spain, a number of towns and cities have benefited from improved links to the capital – for example, Lleida, whose high speed rail links have helped to attract investment from Microsoft and other high-tech companies.

2.11 Experience in Ashford following the introduction of domestic high speed services on the HS1 line at the end of 2009 also bears this out. A reduction of journey times to central London to 37 minutes (around 45 minutes faster than on the conventional speed line), combined with a clear strategy to promote the town's economy, has delivered new inward investment and business interest. Major new developments are taking place at Eureka Park, County Square and Elwick Place, and Ashford's economy is predicted to be one of the fastest growing in Kent in 2011.[8]

2.12 The Government believes that high speed rail could play a similar role elsewhere in Britain. The major cities of the Midlands and the North have significant advantages that they can bring to bear in attracting firms and skilled workers, including major educational and cultural sectors, lower costs of living than in London and the South East, access to key regional markets, and large pools of graduates. By bringing all these cities closer to London, and by ensuring that sufficient capacity is available to handle high levels of demand, high speed rail would enable them to benefit more directly from the capital's large, diverse and internationally-competitive economy, helping to bridge the north-south divide.

8 SEEDA, Kent and Medway Economy Update (2010); available at: http://www.seeda.co.uk/_publications/492-SEEDA_Kent_Economy_Update_September_2010.pdf

2.13 Similarly, access to Heathrow is often an important factor in business location decisions, particularly for international firms. A high speed rail network directly linked to the airport would transform access to Heathrow from many of Britain's major cities and increase their attractiveness to inward investors.

2.14 London's economy too would benefit from improved links of this kind. To maintain its international competitive position it needs continuing access to new skills, markets and ideas. A new high speed rail network could help provide this – improving access, for example, to the financial services centres of Leeds and Edinburgh, Manchester's creative industries, or Newcastle's burgeoning green technology sector. By freeing up capacity on existing main lines, and enabling growth in commuter demand to be accommodated, a high speed rail network could also help to support the deep labour markets which are vital to London's economic success.

Improved connectivity between regional centres

2.15 It is not only through enhanced access to London that a national high speed rail network could contribute to promoting and rebalancing growth. By enabling improved connectivity between the major conurbations in the Midlands and the North, high speed rail could also enable those cities to work more effectively together, bringing benefits from increased competition and specialisation, and putting them in a strong position to benefit from access to wider markets.

2.16 Despite the comparatively short distances between them, rail journeys between these cities can be relatively long – particularly where they involve crossing from one major north-south route to another, such as on the corridor between Birmingham and Leeds, with journeys between these two cities currently taking two hours or more. Similarly, the fastest services between Sheffield and Leeds currently take around 40 minutes for a journey of little more than 30 miles, and the majority of services take longer even than this. The direct journey time from Leeds to Nottingham is two hours for a 70-mile journey.

2.17 This lack of connectivity between cities in the Midlands and the North is an important reason why their economies continue to function more as isolated units than as a coherent whole. The long journey times between them discourage firms from entering new markets and so the service sectors in these cities largely replicate each other. This reduces their potential to act together as a counterweight to the economic strength of London and the wider South East.

2.18 Enhanced rail links through a national high speed rail network, particularly if combined with other improvements, such as the forthcoming electrification programme and the proposed Northern Hub scheme, stand to play an important role in tackling this.

2.19 A high speed rail network would significantly reduce journey times between major cities in the Midlands and the North. The time needed to travel from Birmingham to Manchester would be reduced to around 50 minutes and to Leeds to little more than an hour. The Sheffield to Leeds journey time would be as low as 20 minutes. This would enable

workers to access a wider range of job opportunities and would help firms to tap into new markets and increase their customer and client bases. It could also reduce costs where firms were able to service more than one city from a single office as a result.

2.20 Over a longer period, it could contribute to more significant changes: promoting greater specialisation – such as building on Leeds' reputation as a financial centre – and encouraging businesses to locate and invest in these regions.

Employment and industry

2.21 The construction and operation of a national high speed rail network would create thousands of new jobs. HS2 Ltd estimate that around 9,000 jobs would be created to construct a new London-Birmingham high speed line alone, with a further 1,500 permanent jobs created in operations and maintenance, with these figures rising significantly once the network reaches Manchester and Leeds.

2.22 New high speed rail lines could also provide business opportunities for firms involved in design, engineering, training and development and operations throughout the UK's rail industry supply chain.

2.23 The delivery of a new high speed rail network would provide a long-term programme of investment in rail infrastructure, building on and helping to strengthen the skills base currently employed on major rail projects including Crossrail and Thameslink, as well as the planned programmes of rail electrification. UK expertise in delivering high speed rail projects would be highly marketable internationally, given the large number and scale of projects of this kind in planning across the globe, including in Europe, Asia and the Americas.

Regeneration

2.24 International experience also shows that high speed rail links have the potential to make a major contribution to urban regeneration programmes.

2.25 In France, the strategic choice of Lille as the location for a major high speed rail hub at the centre of the Paris/London/Brussels/Cologne network has supported a significant programme of regeneration. A new TGV station (Lille Europe) was built on a former barracks site near to the original station and the city centre, with the remainder of the site being used for a major commercial centre, including offices, hotels and retail developments, as well as a new public park. Euralille is now the third largest office complex in France, after La Defense in Paris and the Part Dieu complex around Lyon's high speed station.

2.26 HS2 Ltd's proposed London – West Midlands high speed line offers similar important opportunities for regeneration. The proposed site for an interchange with Crossrail and the Great Western Main Line at Old Oak Common is situated within one of the major growth corridors identified in the Mayor's London Plan and in an area for which Hammersmith and Fulham Borough Council has developed detailed regeneration plans. Similarly, the Eastside area of Birmingham city centre, which is the location identified by HS2 Ltd for the Birmingham terminus of the proposed line, is also undergoing significant redevelopment and regeneration.

2.27 Further regeneration opportunities could be opened at Euston, where the proposed station redevelopment could support the London Borough of Camden's aspirations for the Euston area as a whole. The significant changes that have been seen over recent years around St Pancras indicate the potential for improved transport links and station redevelopments to contribute to growth.

2.28 In total, HS2 Ltd estimate that the station developments associated with the proposed London – West Midlands line could potentially support planned employment growth of as many as 30,000 jobs. A wider network would be likely to offer further important opportunities to support regeneration as potential station and interchange sites are identified in other major conurbations.

The Government's preferred high speed rail network

2.29 In order to identify the best approach to delivering a national high speed rail network, the Government commissioned HS2 Ltd to carry out an analysis of the key strategic options. Its report was published by the Government in October 2010.[9]

2.30 On the basis of HS2 Ltd's analysis, the Government announced in October 2010 that it favours a Y-shaped core high speed rail network, linking London to Birmingham, Manchester and Leeds, with additional stations serving South Yorkshire and the East Midlands. This network would also include links to HS1 and Heathrow, and connections to the West Coast and East Coast Main Lines would enable through-running high speed rail services to continue to other destinations including Liverpool, Newcastle, Glasgow and Edinburgh via the conventional network.

2.31 HS2 Ltd is currently developing proposals for the legs from the West Midlands to Leeds and Manchester, and will provide

9 www.dft.gov.uk/pgr/rail/pi/highspeedrail/hs2ltd/networkoptions/

its advice to Government, including assessments of route and station options, by the end of this year.

2.32 The alternative option considered by HS2, which comprised a line from London to the West Midlands and Manchester, together with a link across the Pennines between Manchester and Leeds, offered slower journey times to destinations on the East Coast corridor and would not provide any connectivity improvements to the East Midlands or South Yorkshire or released capacity on the Midland Main Line. The high cost of constructing a line across the Pennines means that the cost differential between the two options would be comparatively small (less than £1 billion), despite the shorter length of the transpennine route.

2.33 As well as the strategic benefits described above, the Y-shaped high speed rail network favoured by the Government would deliver very substantial benefits for rail travellers, including unprecedented increases in capacity and reductions in journey times, as well as improvements to rail reliability. It would also have the potential to deliver valuable reductions in carbon emissions. These benefits are set out in more detail below.

Capacity

2.34 The Government's proposed high speed rail network would deliver a transformational capacity increase on the key north-south routes out of London and between major cities in the Midlands and the North. This would be achieved in four key ways:

- The proposed new line to the West Midlands would initially provide 14 new train paths every hour for long-distance services, with developments in train control technology expected to see that rise to 18 trains per hour on a wider network;
- The infrastructure would be designed to accommodate larger and longer trains of up to 400 metres and carrying up to 1100 passengers;
- As a result of transferring long-distance services to new high speed lines, significant amounts of capacity would be released on the conventional network enabling the provision of additional commuter, regional and freight services;
- Increased levels of segregation between fast and slow services would allow more efficient use to be made of available capacity on all lines.

2.35 It is particularly important to note that such a network would not only deliver capacity improvements for those people travelling on the new lines themselves. For example, on the London – West Midlands corridor, a new high speed line would release capacity on the West Coast Main Line for additional passenger services to towns and cities such as Northampton, Coventry, Rugby, and Milton Keynes, or for the increased use of the West Coast Main Line for Cross-Country services or for services on other east-west routes.

2.36 The Government's favoured Y-shaped network would also release substantial capacity on the East Coast and Midland Main Lines, permitting an increase in commuter and regional traffic on these routes – especially on the crowded southern sections, where significant growth in commuter demand has been forecast. Furthermore, released capacity

on the West Coast Main Line between Birmingham and Manchester would be particularly valuable in enabling growth in rail freight, for which capacity on this section of line is already very constrained.

Faster journeys

2.37 By directly linking the UK's four largest conurbations, as well as enhancing wider connectivity, the proposed Y-shaped high speed rail network would transform journey times between the country's major cities.

2.38 The standard journey time from London Euston to central Birmingham would be cut to just 49 minutes, compared to 1 hour 24 minutes currently, and current journey times to Manchester and Leeds from London of more than two hours would be reduced to just 73 and 80 minutes respectively.

2.39 The journey time benefits delivered by this network would not be restricted to services to and from London. The deficiencies of the existing Victorian rail network are particularly apparent for journeys between cities in the Midlands and the North. The proposed direct high speed link between Birmingham and Leeds could address this, cutting the journey time on this route from over 2 hours at present to just 1 hour 5 minutes.

2.40 The journey time from London to Scotland's major cities would also be reduced to around 3 hours 30 minutes. On the basis of an analysis of international experience carried out by HS2 Ltd, this reduction in journey time would be likely to see rail capturing around half of the overall market on these routes from aviation, compared to around 20 per cent in 2009.

2.41 Still greater reductions in end-to-end journey times would be generated through effective integration with other transport networks. The Government's proposed network includes a direct link to Crossrail, for example, which would provide improved access to Canary Wharf and parts of the West End and City of London. Manchester would be within 87 minutes of the West End, Leeds within 99 minutes of Canary Wharf and Birmingham within an hour of the City of London.

2.42 A high speed link to Heathrow Airport would bring Manchester and Leeds within around 70 and 75 minutes respectively of the UK's major international hub. And a link to HS1 would make it possible to travel non-stop from the Birmingham Interchange station to Paris in under three hours.

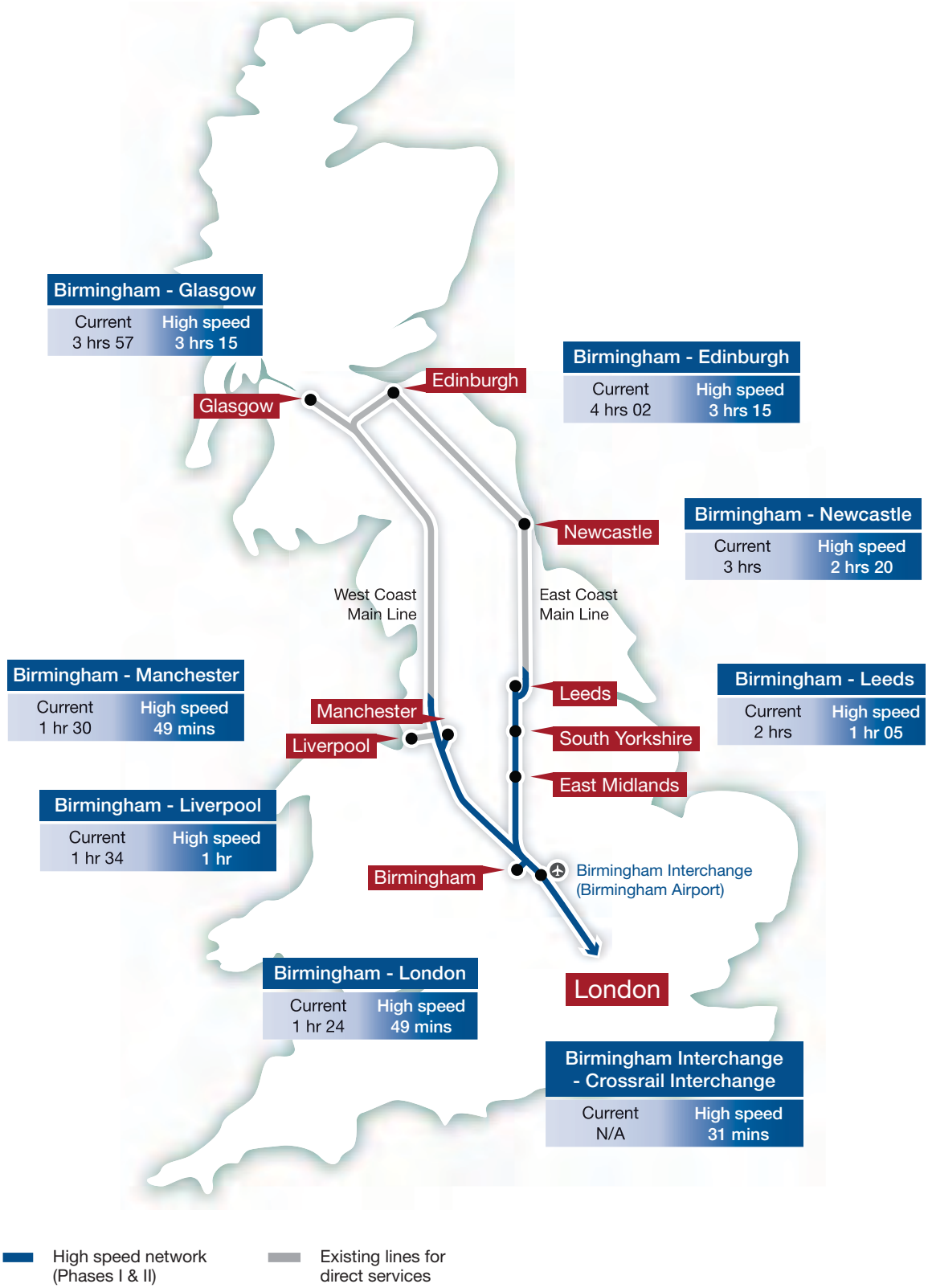


Figure 2.1 – **Journey time savings to and from Birmingham by train**

Valuing productivity for rail business travellers

Being able to work on the train is an important advantage of rail travel for business passengers. In particular, as information and communications technologies develop, time spent travelling by rail can be used increasingly productively, for instance to prepare for meetings or deal with correspondence. The opportunities to work productively in this way are significantly smaller on other modes – and virtually non-existent for car drivers. But the ability to work on a train depends on the right conditions. Someone standing on a crowded train is unlikely to be able to be productive, and on a full train even someone with a seat may be prevented from working on any material for which a degree of privacy is required.

The fact that business travellers can work productively potentially presents some challenges for how the Government's standard approach to transport appraisal values factors such as time savings for business travellers and reductions in crowding. For example, the Government's approach assumes that reducing a rail journey by 30 minutes would generate 30 minutes additional productivity; whereas if a business passenger is able to spend half of their time on the train working, then in practice the half an hour's journey time reduction might only save 15 minutes of 'lost' productive time.

On the other hand, if crowding on trains is reduced so that more business passengers can have a seat and are able to spend time working, then that additional productivity should be taken into account, whereas the approach used by HS2 Ltd assumes that the only disbenefit for business travellers in relation to crowding is discomfort and not lost productive time. Also, modal shift from road travel for business passengers becomes particularly valuable if the ability to work productively on the train is taken into account.

There is little robust evidence on which to base adjustments to business values of time. Therefore, in its analysis of the economic case for the proposed London – West Midlands high speed line, HS2 Ltd has followed the standard Government approach, but has also carried out sensitivity testing to consider the potential impacts of assessing business time and crowding values differently. This shows that if the business value of time was halved and crowding impacts also adjusted to reflect the loss of value to business passengers from travelling in crowded conditions, the benefit:cost ratio of the proposed line would not be significantly affected (the analysis shows a small uplift).

So while this is a complex issue, the Government believes that a change in the approach to valuing time would not significantly alter the case for a new high speed rail network.

Modal shift

2.43 These faster journey times would prompt significant modal shift away from more polluting modes. A national network could see as many as 6 million air trips and 9 million road trips switching to high speed rail each year. The carbon benefits from modal shift, as well as the potential to reduce congestion on roads and at airports, would be valuable – with even a

London to West Midlands line on its own potentially reducing carbon emissions by more than 23 million tonnes as a result of modal shift.

2.44 In addition, by releasing capacity on existing main lines, a new high speed rail network could enable growing demand for rail freight to be accommodated, particularly in the intermodal market, reducing the number of lorry movements on the motorway network, and cutting both congestion and carbon emissions as a result.

Reliability

2.45 International experience shows that high speed rail lines can deliver improved reliability, which is valued very highly by rail travellers. The segregation of different types of services onto different lines helps to simplify operations, enables more efficient use of capacity and reduces the risk of delays caused by fast services being trapped behind slower moving trains.

2.46 Any new high speed lines would also be based on proven European standards, technology and practices, reducing the risk of unanticipated technical problems. The High Speed 1 line to the Channel Tunnel has delivered very high levels of reliability since opening, with a current moving annual average of just 6.8 seconds delay per train from infrastructure incidents.

Wider economic benefits

2.47 Over and above these conventional transport benefits, the Government's proposed high speed rail network would also deliver valuable wider economic benefits – enabling firms to work more efficiently together (known as agglomeration benefits) and to access deeper labour markets, and supporting growth and profitability.

2.48 In respect of its proposed London – West Midlands high speed line, HS2 Ltd has calculated, on the basis of draft guidance published by the Department for Transport, that the net present value of wider economic benefits would total approximately £4 billion.

2.49 The largest part of these relate to agglomeration benefits in London and Birmingham which would arise mainly from the reuse of released capacity for commuter and local services and improved integration with urban transport networks. The figure also includes benefits valued at around £1 billion related to imperfect competition. More detail on how these wider economic benefits have been calculated is provided in the Economic Case for HS2, which has been published to inform this consultation.

2.50 HS2 Ltd will make a detailed assessment of the potential scale of such benefits from a wider high speed rail network as part of its work on route proposals for the legs to Manchester and Leeds. It is clear, however, that these would be in excess of those provided by the London – West Midlands line alone, not least given the scope for further benefits from released capacity on the East Coast and Midland Main Lines into London and into Manchester, Leeds and potentially other major cities. In addition, the very short journey times between conurbations on the Birmingham-Leeds route with a high speed rail link in place could be expected to generate further agglomeration effects.

2.51 In order to inform a strategic assessment of the benefits of the proposed Y-shaped network, HS2 Ltd has made a conservative estimate of these potential additional benefits of £2.3 billion in net present value terms over 60 years.

Carbon benefits

2.52 The Government's assessment is that high speed rail could address capacity constraints on key inter-urban routes and deliver very substantial economic benefits without any overall increase in carbon emissions, and with the potential to deliver valuable reductions, particularly if the network is expanded beyond the West Midlands.

2.53 Although the construction and operation of any major new transport links would generate carbon emissions, rail is a comparatively carbon efficient mode of transport compared with road and air travel. Many of the emissions from the construction and operation of the line would also be offset by corresponding emissions reductions from elsewhere under the EU's Emissions Trading System. Furthermore, even though power requirements rise with speed, the emissions per passenger mile associated with high speed rail would not necessarily be higher than those from conventional speed routes, due to its ability to attract high levels of usage and thus highly efficient load factors.

2.54 Therefore, because high speed rail could attract significant numbers of passengers from other modes, due to the improved journey times, reliability and convenience that it would offer, it could generate reductions in carbon emissions to offset any increases created from the construction and operation of new high speed lines.

2.55 An assessment of the potential carbon effects of the proposed London – West Midlands line is set out in the Appraisal of Sustainability published to inform this consultation. This shows that the overall carbon impacts of its proposed London – West Midlands line would be likely to be broadly neutral, even allowing for the significant forecast increases in passenger journeys that it could deliver, with potential under the best case scenario to deliver a reduction in overall UK carbon dioxide emissions of around 28 million tonnes over 60 years. The largest part of these would be due to reductions in aviation emissions resulting from modal shift from aviation generated by improved journey times to the North and Scotland.

2.56 HS2 Ltd has also analysed a pessimistic scenario, in which no modal shift is achieved from either road or aviation and the carbon intensity of electricity generation remains unchanged. In this scenario, the additional carbon generated as a result of the proposed line would still average no more than around 0.4 million tonnes per year, compared to current annual domestic greenhouse gas emissions from transport of around 122 million tonnes per year.

2.57 This pessimistic scenario ignores, however, both the international evidence of high speed rail's ability to attract passengers from other modes and the Government's clear commitments to progressively decarbonise power generation. As set out in Chapter One, high speed rail's use of electric power is an important advantage in carbon terms, given the significant scope for reducing the carbon intensity of the National Grid.

2.58 There would be some carbon emissions associated with the construction of the proposed new line totalling around 1.2 million tonnes over the entire construction period of seven to eight years. As noted above, many of these construction emissions would be offset by reduction elsewhere under the EU Emissions Trading System.

2.59 The Government's view is that a wider high speed rail network offers the potential to deliver more substantial carbon benefits. This is because, although there would be increases in operational and construction emissions as any network was expanded, much higher levels of modal shift from aviation would be anticipated, which could result in further emissions reductions.

Appraising the costs and benefits of high speed rail

2.60 The cost of constructing a Y-shaped network linking London, Birmingham, Manchester and Leeds, as well as the Channel Tunnel and Heathrow, is estimated to be £32 billion (in 2009 prices). This includes allowances for risk and optimism bias of more than 60 per cent. In addition, there would also be capital costs for rolling stock procurement and replacement of £5.3 billion and annual operating and maintenance costs of around £1.1 billion (again in 2009 prices).

2.61 In order to enable comparison on a consistent basis, the Government's approach to appraisal expresses costs and benefits occurring at different points in time on a net present value basis. This requires future year values to be discounted on the basis that benefits and costs today are valued more highly than those in future.

2.62 The net present value of the total capital and operating costs, calculated over a 60-year period from opening, in line with Department for Transport guidance on appraising major transport infrastructure schemes, is estimated to be £44.3 billion.[10] HS2 Ltd also estimates that the proposed network would generate fares revenues over the same period with a net present value of £27.2 billion, resulting in an overall net present cost to Government of £17.1 billion.

2.63 As set out in the previous sections, however, the proposed network would also generate benefits which would be of significant value to rail passengers and to the economy as a whole. In total, and on conservative assumptions, HS2 Ltd's analysis estimates that a national high speed rail network would generate benefits with a net present value of £43.7 billion. This results in a benefit:cost ratio (BCR) of 2.6.

2.64 The basis on which this BCR has been calculated is explained in more detail in the Economic Case for HS2, which has been published to inform this consultation.

2.65 This BCR does not include the significant strategic benefits set out earlier in this chapter which relate to the potential for new high speed rail links to support job creation, regeneration and economic growth. There are also, however, important non-monetised costs which must be considered, particularly in relation to high speed rail's potential impacts on the local environment and communities, which are described below.

Local and environmental impacts

2.66 Any new transport infrastructure of this kind would have consequences for communities near by and for the landscapes through which it would pass.

2.67 HS2 Ltd's proposed London – West Midlands route, for example, would see around 10 dwellings experiencing high noise levels[11], and noticeable noise increases for much larger numbers of properties along its route. It would also have an impact on the landscape, including in the Chilterns Area of Outstanding Natural Beauty (AONB).

2.68 In addition, the proposed line would affect townscapes and cultural heritage, particularly as a result of the major redevelopment project necessary at Euston Station, lasting between seven and eight years. This would require the demolition and replacement of around 200 homes, mainly in four local authority owned blocks.

10 All net present value figures are expressed in 2009 prices.

11 Defined as an average noise level equal to or greater than 73dB(A) over an 18-hour day.

2.69 The potential impacts of HS2 Ltd's proposed new line on the local environment and communities are described in more detail in Part 2 and set out in full in the separate Appraisal of Sustainability published to inform this consultation.

2.70 The Government is clear that, although it is impossible to eliminate such impacts entirely for projects of this scale, if a high speed line is to be taken forward, then it must be designed sensitively and include mitigation measures to ensure that they are reduced to the minimum wherever practical.

2.71 The Appraisal of Sustainability prepared for the proposed London – West Midlands line shows that the improvements delivered through sensitive design and mitigation can be significant. For example, work to assess opportunities for noise mitigation, along with work on refinements to the route following the Secretary of State's programme of visits in autumn 2010, has contributed to the number of properties which would be expected to experience high noise levels reducing from 350 to around 10, since the publication of HS2 Ltd's original report to Government.

Managing the Impacts of HS1

Experience of building and operating the HS1 line indicates the degree to which local and environmental impacts can be successfully managed.

The use of mitigated track design for the tunnel out of St Pancras means that HS1 services have been able to operate beneath highly populated areas of London without people living above it being affected by noise or vibration.

Considerable effort went into the early planning and evaluation of the impacts of the route of HS1, allowing measures to be taken to protect many sensitive features. Where possible, archaeological sites were avoided or preserved in situ. If this proved impossible, excavations were undertaken in advance of construction to achieve a detailed record of the site. Along the way this included excavating Roman farmsteads, uncovering Anglo-Saxon jewellery at Saltwood, and moving and rebuilding the fifteenth century Grade II listed Talbot House.

In addition, significant opportunities were identified to avoid adverse impacts on landscape and biodiversity through careful design, tree planting and the creation of new habitats away from the line of route. Ecological mitigation on HS1 included the creation of some 230ha of woodland, 25ha of new woodland or trans-located ancient woodland soils, 370ha of grassland, 80ha of wildflower meadow, 40km of hedges, seven ponds and two wetlands. Strict controls were also imposed so that 200 hectares of high-grade agricultural land was restored to its previous quality.

Noise barriers and earth mounds were used extensively to prevent the spread of noise, as well as visual impacts.

2.72 Similarly, by following existing and former transport corridors, as well as using tunnels and deep cuttings to reduce or eliminate the visibility of high speed lines, impacts on landscapes can be significantly reduced. For example, in the Chilterns Area of Outstanding Natural Beauty (AONB), all but 1.2 miles would be either in tunnel, in cutting and/or in the corridor of the A413 main road.

2.73 The Government's view, therefore, is that although every effort should continue to be made as any new high speed line is taken forward to ensure that mitigation opportunities are identified, the Appraisal of Sustainability process indicates that with careful design and ongoing refinement the impacts of new high speed rail infrastructure can be kept to an acceptable level.

2.74 If, subject to the outcome of this consultation, the proposed line is taken forward, then an Environmental Impact Assessment would be carried out as part of the preparations for the process of seeking powers.

2.75 In addition, should any high speed route proposals for subsequent lines from the West Midlands to Manchester or Leeds be brought forward for public consultation, Appraisals of Sustainability would be prepared and published to inform those processes.

Conclusion

2.76 Whilst the potential impacts of new high speed rail lines on the local environment and communities are important, they must be considered alongside both the strong quantified benefit:cost ratio for a national high speed rail network, and also the significant non-monetised benefits discussed earlier in this chapter.

2.77 On this basis, the Government's view is that the overall case for a national high speed rail network is strong.

Alternatives to High Speed Rail

2.78 This chapter has set out the strategic case for a national high speed rail network and considered its costs and benefits. In undertaking this analysis, the Government has also reviewed a number of alternative options for improving the capacity and performance of Britain's key inter-city links, including major enhancements to the current rail network. This section sets out the Government's assessment and explains why it does not favour them.

Aviation and road transport

2.79 The Government's view is that neither domestic aviation nor road transport would offer an acceptable or effective solution to inter-city rail capacity constraints.

- **Aviation** is a comparatively carbon-intensive mode of travel and offers less competitive journey times for many trips of less than 200 miles between major conurbations, not least because airports tend to be located well outside city centres.
- **Road transport** has equivalent disadvantages for travel between city centres, as urban congestion results in unreliability and delay.

New conventional speed lines

2.80 The Government does not consider that new conventional speed rail lines could offer either the same strategic benefits or value for money as high speed lines. In addition, they would generate much lower benefits and revenues whilst not being significantly cheaper to construct and operate. In respect of a London – West Midlands line, HS2 Ltd estimate that reducing line speed to the current maximum of 125 miles per hour would deliver only a 9 per cent cost reduction, whereas fare revenues would drop by 24 per cent and overall benefits by 33 per cent.

2.81 HS2 Ltd's analysis indicates that the sustainability benefits of a new conventional speed line over high speed rail would be likely to be small. Slower speeds allowing tighter curves could offer the potential to avoid some sensitive features, and lower operational speeds could mean lower noise impacts. HS2 Ltd has, however, been mindful of these issues in the design of its proposals. It has carefully designed its route to avoid sensitive sites wherever possible, and, in respect of noise it has reduced speeds in built-up areas and lowered or covered the line as it passes close to settlements, as well as identifying opportunities for noise mitigation.

2.82 Similarly, the overall carbon impact of a new conventional speed line would not necessarily be significantly more positive that that of the high speed alternative. Although the lower energy demands of slower speed trains would mean that they would be likely to generate fewer carbon emissions, a conventional speed line would be likely to see lower load factors and would not attract as many travellers from other modes as high speed rail.

2.83 The Government's view therefore is that, although there may be some individual route sections where the sustainability impacts of a new conventional line would be lower than those of the high speed alternative, any such benefits would in total be very unlikely to outweigh the weaker economic case for new

conventional lines. This view is reinforced by HS2 Ltd's recent work to refine and improve its proposed London – West Midlands route, which has shown that sensitive route design and careful consideration of mitigation options can significantly reduce the local impacts of new high speed lines.

Enhancements to existing networks

2.84 In respect of enhancements to existing networks, the Government commissioned an analysis of strategic options for enhancing the three key north-south inter-city rail lines out of London.[12] This focused on three major packages of enhancements aimed respectively at lengthening trains, enabling a high frequency of services, and combining increased capacity with reduced journey times. Of these, only the second was found to have benefits in excess of its costs.

2.85 Therefore, the Government's assessment focuses on this scenario (referred to in the supporting report as Scenario B), which aims to increase the number of services that can be accommodated on these lines, but without increasing the number of tracks from four to six, which would be likely to be prohibitively expensive and disruptive and have significant sustainability and community impacts.

2.86 Even so, this enhancement scenario would require major works on all three main north-south lines, as set out in Table 1.

2.87 This enhancement scenario, which would have a capital cost of approximately £13 billion, would not be able to match the increases in capacity delivered by new high speed rail lines, although it would see crowding reduce on long-distance services. Furthermore, because it assumes that any new capacity generated is allocated to long-distance services, it would provide little additional capacity for growth in commuter, regional or freight markets.

2.88 The improvements in journey times delivered by enhancements of this kind would be relatively small. The time saving to Manchester would be just three minutes, and this scenario would deliver no reduction in journey time at all between London and Leeds. Time savings greater than ten minutes would only be achieved to London from the East Midlands and Sheffield. More significant time savings could only be achieved at disproportionate cost or unacceptable risk to reliability and they would still be significantly lower than those offered by high speed rail.

2.89 The net present value cost to the public purse of this scenario, calculated over 60 years, would be £7.7 billion (£18.7 billion capital and operating costs less £11.0 billion fares revenues). The benefits from this scenario have a net present value of £10.9 billion – less than a quarter of those potentially delivered by a new high speed rail network. This results in a BCR of 1.4, substantially lower than that offered by the proposed high speed rail network.

12 *High Speed Rail Strategic Alternatives Study: Strategic Alternatives to the Proposed Y Network*.

Table 1 – **The works necessary to enable higher train frequencies on the West Coast, East Coast and Midland Main Lines**

West Coast Main Line	Midland Main Line	East Coast Main Line
Major works to add new platforms at Euston Station and Manchester Piccadilly	Electrification between Bedford and Sheffield via Derby, and to Corby and Nottingham	Major works at Kings Cross to remodel station throat, reinstate tunnel and create 6-track approach
Grade-separation works south of Leighton Buzzard	Additional freight loops between London and Bedford.	4-tracking between Welwyn and Stevenage; Huntingdon and Peterborough; and Grantham and Doncaster
4-tracking between Rugby and Nuneaton and on the Coventry corridor into Birmingham	4-tracking between Bedford and Kettering, and in the Leicester area. 2-tracking between Kettering and Corby.	Construction of flyovers close to Peterborough, Newark and York.
New by-pass route in the Stafford area	Electrification and other modifications to depots.	Electrification and route upgrade from Retford to Sheffield, and electrification of alternative route into Leeds. Reinstatement and electrification of additional route into Newcastle
Speed improvements in the Northampton area		Track remodelling and/or platform works at Doncaster, York and Leeds
		Power supply works; and modifications to depots.

2.90 This BCR does not include any assessment of the type of wider economic benefits discussed in paragraphs 2.47 to 2.51. However, because enhancement packages of this kind would deliver comparatively few improvements to commuter services – in contrast to the significant released capacity generated by new high speed lines – it is likely that any such benefits would be small.

2.91 Enhancements to existing networks would also offer reduced strategic benefits in terms of supporting job creation, regeneration and economic growth. They would have little potential to enhance connectivity through reduced journey times and improved interchanges with urban transport networks and international gateways, as they would rely on the same links and stations as are currently in place.

2.92 In contrast, the sustainability impacts of enhancing existing networks would be more favourable than those of new high speed lines – particularly in respect of factors such as visual impact, land take and noise. Nonetheless, these impacts would not be entirely negligible. The proposed works near Stafford, for example, would affect the Cannock Chase Area of Outstanding Natural Beauty, and some of the four-tracking works would require land take outside the current railway boundary.

2.93 The disruption caused to travellers on the existing network as a result of enhancements on this scale, however, would be very significant – potentially lasting more than ten years in total across all three main lines. And although the works on any individual line would not be as large in scale as the recent West Coast Main Line route modernisation, the network is now being used much more intensively than when those works were carried out. In order to manage the challenges that this would pose, it is likely that the costs and duration of the works would increase, and efficiency reduce, as a result of the need to carry out works in short possessions to minimise disruption.

The Bullring, Birmingham

2.94 Overall, this analysis indicates that major enhancements to existing lines can offer neither as strong an economic case as a new high speed rail network, nor the same broader strategic benefits for economic growth, employment or regeneration. The extremely significant disruption caused as works to existing operating railways are carried out further reinforces the case against an approach of this kind.

2.95 The Government's view therefore is that such enhancements would not provide a strategic value for money alternative to high speed rail.

Conclusion

2.96 The Government believes that the benefits delivered by a Y-shaped national high speed rail network, connecting London to Birmingham, Manchester and Leeds, would be significantly higher than those of any other option for enhancing the capacity and performance of Britain's key inter-city rail links, and well in excess of twice its costs.

2.97 Such a network would not only provide a huge increase in capacity and transform journey times between Britain's largest cities, but it would also deliver substantial wider economic benefits and make a significant contribution to major regeneration programmes in the cities that it serves. The Government considers that sensitive route design and effective use of mitigation measures can reduce any local environmental impacts to an acceptable level.

2.98 The enhanced capacity and connectivity provided by a new high speed rail network could also help the major cities of the Midlands and the North to prosper. In this way, it could play a key role in enabling long-term sustainable economic growth and in bridging the north-south divide.

2.99 In contrast, enhancements to the existing network could neither deliver against these wider strategic priorities nor match the benefits to transport users of new high speed lines. The implementation of any such programme of enhancements would also entail unacceptable levels of delay and disruption for travellers on the lines affected. Therefore, although the costs and local impacts of enhancement packages would be lower than those of high speed rail, the overall value for money that they offer would be less strong.

2.100 Similarly, new conventional speed lines also would not match the value for money of a national high speed rail network, with any cost savings delivered outweighed by the reductions in benefits and revenues that would result.

2.101 For these reasons, the Government considers that the delivery of a new high speed rail network would be the most effective option to address the capacity and performance challenges described in Chapter 1 and promote sustainable and balanced economic growth.

2.102 The next chapter sets out the Government's preferred approach to developing its proposed national high speed rail network.

Consultation Question:
Do you agree that a national high speed rail network from London to Birmingham, Leeds and Manchester (the Y network) would provide the best value for money solution (best balance of costs and benefits) for enhancing rail capacity and performance?

3. A National High Speed Rail Strategy

Introduction

3.1 The previous chapter set out why the Government supports a Y-shaped core high speed rail network linking the UK's four largest urban areas. This network would radically enhance capacity and performance on Britain's key inter-city rail corridors. It would transform journey times and promote growth across the country by drawing cities closer together and providing better access to the markets and opportunities of London.

3.2 This chapter sets out the Government's proposed high speed rail strategy. It explains:

- the Government's proposed approach to the phasing of the development and construction of the project;
- the case for linking the network to the UK's major international gateways – principally Heathrow and the Channel Tunnel; and
- the next steps in taking forward this strategy.

Phasing the network

3.3 The Government proposes that the Y-shaped network should be delivered in two phases. The first phase would comprise an initial line from London to the West Midlands, including a link to the existing West Coast Main Line to enable high speed trains to serve destinations further north including Liverpool, Manchester and Glasgow. It would also incorporate a connection onto the High Speed 1 line to the Channel Tunnel.

3.4 The second phase would comprise the lines from the West Midlands to Manchester and Leeds, including stations in South Yorkshire and the East Midlands and a direct link to Heathrow airport.

3.5 Phasing the project in this way has a number of important advantages:

- First, it would help to ensure rapid and early progress in developing high speed rail in the UK. Under the previous Government initial work was commenced on the London – West Midlands line which could now be taken forward rapidly.
- Second, the parliamentary processes for securing powers for the construction of new rail lines is likely to be complex and lengthy. Seeking powers at a later stage for the second phase of the network would help to reduce the scale of the task and speed up the commencement of construction.
- Third, developing a major piece of new infrastructure on this scale involves significant cost, so the impact on the public finances is best managed by a phased approach to construction.

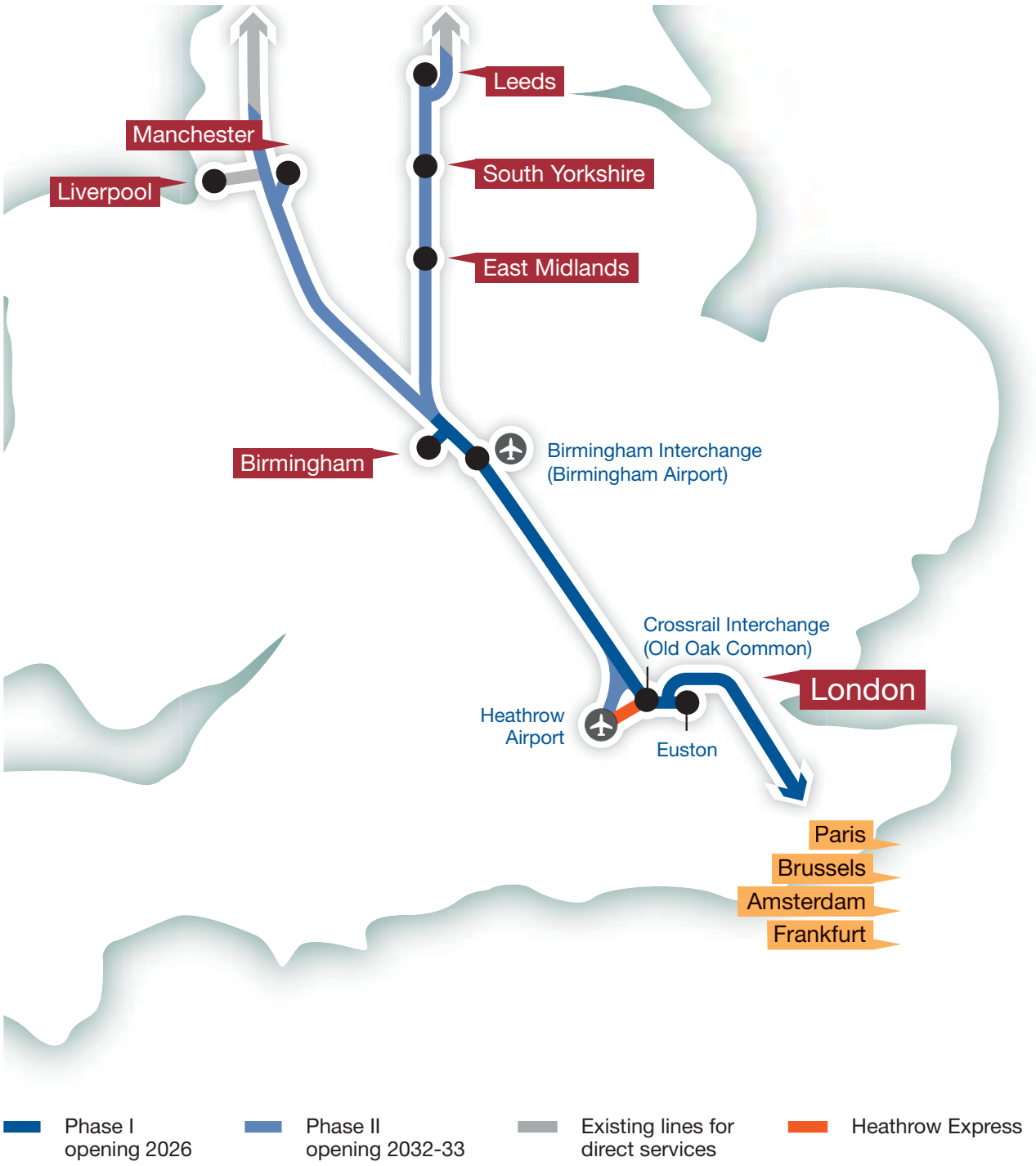


Figure 3.1 – **Constructing the Y network in two phases**

- Fourth, constructing a national high speed rail network would represent a very major undertaking for the construction industry in the UK. By phasing the delivery of the proposed network, construction of the first phase could begin as Crossrail is completed. In this way, a clear pipeline of major rail-related civil engineering projects over two or more decades would be mapped out for the industry.

3.6 Subject to the outcome of this consultation, the Government expects that the initial London to West Midlands phase could be operational by 2026. Bringing forward the first phase of the Y to this timetable would address the significant capacity issues forecast on this corridor by the mid-2020s and highlighted in Network Rail's West Coast Main Line Route Utilisation Strategy.[13]

3.7 The strategic case for this initial phase as the foundation for the full Y network is clearly strong. However, even considered in isolation, it would still offer a benefit:cost ratio (BCR) of approximately 2.0[14] including wider economic benefits. This is lower than the BCR for the overall network, reflecting the fact that this initial phase includes some of its most expensive elements, including the redevelopment of a major London terminus and the tunnelling required to create a route out of the capital, but still demonstrates that a London-Birmingham line would offer value for money, even on a stand-alone basis.

3.8 Following an initial commission by the previous Government, which was extended by the present Secretary of State for Transport in October 2010, route proposals for the second phase – the legs to Leeds and Manchester – are currently being developed by HS2 Ltd. These would be subject to a separate consultation process beginning in 2012.

3.9 While work was underway on designing and constructing the two phases of the Y network, the Government would expect to work with the Scottish Government and others to identify and evaluate options for developing the network and reducing journey times further, as set out in the National Infrastructure Plan.[15]

International connections

3.10 The Government considers that there is a strong strategic case for linking a UK high speed rail network to the country's major international gateways.

3.11 Future patterns of economic activity are likely to depend increasingly on international connectivity. International travel is forecast to experience significant demand growth over the coming decades. Deepening globalisation and ever diversifying trading patterns and cross-border business activity mean that it will become increasingly prominent for many businesses and sectors.

13 West Coast Main Line RUS: Draft for Consultation; available at www.networkrail.co.uk

14 The basis on which this BCR has been calculated is set out in detail in the supporting Economic Case document.

15 National Infrastructure Plan 2010; available at www.hm-treasury.gov.uk/ppp_national_infrastructure_plan.htm

3.12 Direct high speed rail links to our key international gateways would enhance access to international markets for companies across Britain and would also be a key opportunity to enable modal shift. High speed rail can provide a very effective alternative for short-haul and domestic aviation, as shown by the high market share of Eurostar services to Brussels and Paris. Reducing reliance on domestic and short-haul aviation for some journeys, however, would require rail to offer a genuinely attractive alternative – for instance, by providing connections which operate as seamlessly as possible to key airports and other international gateways.

Heathrow

3.13 Heathrow is a huge national asset, with a range and density of route network unmatched by any other UK airport. The Government considers that a direct link between the high speed rail network and Heathrow would have important strategic advantages:

- Releasing capacity at the airport through mode shift from short-haul aviation to rail would enable Heathrow to boost its resilience and could provide opportunities for enhancing its route network.

- A direct link would transform the accessibility of Heathrow from the Midlands and the North. Those travelling to the airport by rail from Leeds, could be at the airport within 75 minutes – far faster than the equivalent journey by road – and those travelling from Manchester within around 70 minutes. The journey from central Birmingham would be faster still – taking less than 45 minutes. This would generate valuable economic opportunities for these regions – making them more attractive locations for investment – and creating new opportunities for those who currently live and work in these cities.

- A direct link would also contribute to Heathrow's future development as a multi-modal transport hub, further boosting demand for high speed rail access to and from the airport. Heathrow is strategically located between London and the significant economic and population centres of the Thames Valley. In combination with other measures to enhance transport connections to the airport, a direct link could provide improved access for businesses in this area to high speed services across the country and to Europe.

3.14 The Government also believes that the UK should be seeking alternatives to flying, which high speed rail is well-suited to deliver. In parallel with its potential ability to release capacity at Heathrow, high speed rail could also provide opportunities for modal shift. Chapter 2 has already examined the environmental benefits, particularly in relation to carbon dioxide emissions, that could be achieved through shifting journeys from more polluting modes onto high speed rail.

3.15 There were around two million passenger trips by air between Heathrow and Manchester and Glasgow in 2008. The wider market from other regions potentially served by the high speed rail network is around double this. If an attractive alternative to flying were available, and especially if services were integrated into flight schedules and through-ticketing and baggage check-in were provided, a significant proportion of passengers could switch to high speed rail.

3.16 For these reasons the Government believes that the strategic case for a direct high speed rail line to Heathrow is compelling.

Options for serving Heathrow

3.17 Given its view of the case for a direct link between Heathrow and a high speed rail network, and its decision not to support the provision of further runway capacity at Heathrow, Gatwick and Stansted, the Government commissioned HS2 Ltd in June 2010 to provide detailed advice on the available options for serving Heathrow. A summary of its analysis is provided below.

Conclusions on route options for a Heathrow connection

Through route: HS2 Ltd found that redirecting its preferred route for the London to West Midlands line via Heathrow airport, or a nearby station able to serve the airport, would involve additional costs of between £2.9 billion and £4.2 billion, depending on the route configuration and station option selected. The additional route length would entail a longer journey time between London and the West Midlands of 3 minutes for non-stopping services, and 8 minutes for services stopping at the airport. It would also require a tunnel of some 18 miles – given the built-up character of the area through which the route would have to pass – and it would limit the station options at the airport itself. The additional cost and journey time penalty incurred for the majority of the passengers using HS2 who wanted to access central London make a through route via Heathrow unattractive.

Loop: A loop option – where trains would divert off the main route and stop at a Heathrow station before rejoining the main route – would involve additional costs of between £4.1 billion and £5.4 billion. The journey time penalties for passengers travelling on through services to the West Midlands and beyond via a Heathrow loop would be greater than those resulting from a through route, although there would be no journey time penalty for passengers travelling on services to and from London which stay on the main line (i.e. not using the loop). There could also be some impact on line capacity as a result of interaction between services where the loop leaves and joins the main line.

Spur: A spur solution could offer a lower cost option for linking to Heathrow. HS2 Ltd considered a number of options for a spur, including routes which would be largely in tunnel and routes incorporating surface sections running along the M25 corridor. Depending on the route and station option chosen, a spur link to Heathrow would entail additional costs of between £2.5 billion and £3.9 billion. A spur would also mean that a train path into central London would be lost for every train serving and terminating at Heathrow, but it would be possible to split trains on-route to provide a reasonable service frequency to a range of destinations further north while minimising the capacity impacts on the main London – West Midlands line.

3.18 The Government considers that the option that best balances the costs of a direct link to Heathrow with its important strategic benefits would be a spur following HS2 Ltd's proposed surface route from the main London – West Midlands line into the airport. This would enable the provision of services from the airport to the major cities of the Midlands, the North and

Scotland at the lowest overall cost. Furthermore, as HS2 Ltd's report makes clear, the proposed configuration for the spur line would also create the opportunity for subsequent extension into a loop if required.

3.19 The optimal location for an at-airport station would need to be identified through discussions with the airport operator and others, building on work that BAA Ltd has already undertaken. These discussions will also be informed by ongoing work on a surface access strategy for the airport.

Phasing

3.20 Given likely levels of passenger demand following the opening of the proposed London to West Midlands line, the Government considers that as part of the initial phase a link to the airport via an inter-connection with the Heathrow Express at Old Oak Common would be the most appropriate solution. The journey time from Old Oak Common would be around 11 minutes and services would run regularly to Terminal 5 and the Central Terminal Area.

3.21 The demand for a direct high speed link to the airport would be stronger, however, once the second phase of the proposed network – extending to Leeds and Manchester – was in place and demand for high speed services was beginning to mature. Such a network would provide a strong alternative to aviation on routes from London to Manchester, Glasgow and Edinburgh, particularly as journey times to Scotland would drop to around 3 hours 30 minutes. It would also address the current lack of connectivity to the airport for major cities in Yorkshire and the East Midlands, reducing the journey time to within 75 minutes or less. Therefore, the Government proposes that a high speed rail link to the airport should be constructed as part of this second phase, following the spur configuration outlined above.

3.22 In order to avoid disruption to services on the London to West Midlands line while a spur was constructed, the provision of junctions for the spur would be included in the construction of Phase 1. The construction of the spur itself could then be completed as part of the Phase 2 construction programme with little, if any, adverse impact on services already operating.

3.23 In December 2010, as part of his announcement on the Government's proposed high speed rail strategy for consultation, the Secretary of State for Transport commissioned HS2 Ltd to develop route proposals for a Heathrow spur. The Government will consider its advice alongside the company's proposals for routes to Leeds and Manchester.

HS1 and the Channel Tunnel

3.24 The Channel Tunnel and the HS1 line serving it have revolutionised the market for travel between the UK and mainland Europe. Since opening, Eurostar has carried more than 100 million passengers, and air passengers numbers from London to Paris and Brussels have fallen by more than half. Eurostar now holds 80% of the combined rail/air market to these destinations.

3.25 International rail connectivity has also grown significantly across mainland Europe. The networks of high speed rail lines being developed by France, Germany,

Spain, the Netherlands, Belgium and Italy have all been designed to enable international travel. Connecting any UK high speed line to this rapidly growing network will be vital if the UK is not to become isolated from what is already a key mode of travel between major European cities.

3.26 However, at present, services on HS1 and the Channel Tunnel are relatively inaccessible for those outside London and the South East. By providing direct access to the wider European network for services from Manchester, Birmingham and other cities, a link between a national high speed rail network and the current HS1 line could address this.

3.27 The Government favours a direct rail link between HS2 and HS1, which would run in tunnel from Old Oak Common to the North London Line and then use upgraded existing infrastructure to reach the HS1 line north of St Pancras International.

3.28 This would enable direct high speed services from across Britain to European destinations via the Channel Tunnel. Birmingham would be a little over three hours from Paris, and Manchester and Leeds around 3 hours 40 minutes. An indirect link – such as improving the interchange connectivity between the respective London termini of the two lines – would deliver neither these journey times nor the same strategic benefits, particularly in terms of reduced dependency on aviation.

3.29 The Government's view is that the strategic case for a direct link between the proposed high speed rail network and the HS1 line to the Channel Tunnel is strong. The following section discusses the options for such a link and the views that the Government has reached.

Options

3.30 On the basis of the advice commissioned from HS2 Ltd in June 2010, the Government considers that the most appropriate option would be a single-track conventional speed connection between the HS2 and HS1 lines.

3.31 This would comprise a tunnel from Old Oak Common to the North London Line close to Chalk Farm, followed by a link along existing rail infrastructure to the tunnel portal north of St Pancras. This proposal, whose cost HS2 Ltd estimate to be around £0.9 billion including risk and optimism bias, is set out in more detail in Chapter 5.

3.32 HS2 Ltd considered a dual-track link along roughly the alignment proposed above but concluded that any additional benefits were substantially outweighed by its high costs, particularly as the proposed single track link could provide capacity for up to three trains an hour.

3.33 HS2 Ltd also considered improving pedestrian links between Euston and St Pancras, by providing a rapid transport system (similar to those used between airport terminals). Although this option would cost less than a direct rail link, the Government does not support such an approach because it would have significant negative impacts for local communities, because it would cause disruption to the development of the recently approved UK Centre for Medical Research and Innovation and because, compared to a direct link, it would reduce the attractiveness of international high speed rail services and hence their ability to compete with aviation.

Phasing and operations

3.34 It would not be possible to construct a link to HS1 as part of the second phase of the proposed network. The tunnel would need to be dug from Old Oak Common, and due to the technical limitations of the site, it would be necessary to complete this work before services became operational. The only alternative would be to significantly disrupt Crossrail operations, which the Government does not consider acceptable.

3.35 Therefore the Government considers that a direct single-track link between HS2 and HS1 should be constructed as part of Phase 1 – the initial line between London and the West Midlands. This would enable through-services to run from Birmingham and other destinations to the Continent from the opening of the line.

Other international connections

3.36 Links to Heathrow Airport and HS1 are not the only potential opportunities for providing direct international connectivity through a national high speed rail network.

3.37 An interchange station serving Birmingham Airport, as well as being readily accessible from the National Exhibition Centre and the dense motorway network of the West Midlands, would provide potentially important new international connectivity options. It would bring Birmingham Airport within 40 minutes of central London and also enhance its accessibility from other key cities.

3.38 The Government's view is that this station has the potential to bring significant benefits, particularly at the regional level, not least for example in improving Birmingham Airport's accessibility from London and the cities of the North. Consequently, provision for a station has been made in the proposed network subject to the identification of an appropriate funding package, including third party contributions.

3.39 The proposed second phase of the high speed rail network would offer additional opportunities for direct airport links, and HS2 Ltd's work on route proposals for the Manchester and Leeds legs will assess options for links to Manchester and East Midlands Airports.

Funding

3.40 New high speed rail lines are major infrastructure undertakings and would necessarily involve significant cost during the design, preparation and particularly construction phases. As noted previously the Government's preferred initial network would cost approximately £32 billion. At this early stage in the process, it is not appropriate to specify precise funding arrangements.

3.41 The Government has, however, established a number of principles by which it expects that the funding of any new high speed lines would operate. These are:

- **Public funding.** Major transport infrastructure built in the national interest would require significant investment of public funds. While the Government considers that there are a range of opportunities to lever in third party funding – as discussed below – in developing a high speed rail network for the UK, it accepts that the project would be driven in large part from the public purse.
- **Phased construction.** The principal means of ensuring that the public finances can be managed responsibly is to phase the construction of any new lines. Main construction of the initial London – West Midlands line could be sequenced with the completion of Crossrail to form a continuous programme of major transport infrastructure investment.
- **Third party funding.** Significant numbers of individuals and organisations would stand to benefit from the construction of new high speed rail lines. This could include airport operators, businesses close to high speed rail stations and local authorities. The Government expects that such parties would therefore make a contribution to the cost of those links.
- **Property development.** The Government intends to work closely with property developers to ensure that the very significant development opportunities created by the proposed stations are maximised. Experience from other high speed schemes in this country and internationally shows this can provide a significant contribution to the overall funding of any new high speed lines.

3.42 Infrastructure UK is currently investigating the cost of civil engineering projects in the UK. In developing its proposals for new lines, HS2 Ltd would work closely with Infrastructure UK on how efficiencies could be achieved in the construction of a new high speed rail network.

Next Steps

3.43 The Secretary of State for Transport will announce the outcome of this consultation process and the Government's final decisions on its strategy for high speed rail before the end of 2011.

3.44 Subject to the results of this consultation, the Government proposes to seek the necessary powers and consents for constructing any new high speed lines via the Hybrid Bill process. Hybrid Bills were used to seek powers for both the HS1 line to the Channel Tunnel (enacted as the Channel Tunnel Rail Link Act 1996) and for Crossrail (enacted as the Crossrail Act 2008). They allow those affected by the proposals to directly petition Parliament to propose amendments to the proposals or to seek assurances or undertakings.

3.45 The Government's intention is that the necessary preparations, including Environmental Impact Assessment, should be carried out in time to introduce a hybrid Bill for the initial London – West Midlands phase of the proposed network in October 2013, with a view to achieving Royal Assent in the early part of 2015. This would enable construction of a new line to begin early in the next Parliament. The construction process would be expected to last approximately eight years, and would be followed by a period of testing and commissioning. The proposed line could be operational by 2026.

3.46 In respect of the proposed second phase to Manchester and Leeds HS2 Ltd will provide its advice to Government on route options later this year. Subject to public consultation, the Government's intention is to introduce a second hybrid Bill in the next Parliament. On that basis, it expects that construction could potentially commence in the mid-2020s, allowing the lines to open by 2032-2033.

Property Impacts

3.47 The Government and HS2 Ltd would ensure that timely and full information is made available to those affected by proposals for any new high speed line. Minimising uncertainty and protecting the legitimate interests of private property owners would be of paramount importance.

3.48 If the Government decides, following consultation, to go ahead with any new high speed line, it would aim to safeguard land from future development. Annex A gives details of the statutory provisions on blight and compensation that would apply for any new high speed line.

3.49 The Government is also considering what additional measures may be appropriate to help those whose properties were unlikely to need to be compulsorily purchased in order to build a new line, but who may still experience a significant loss in the value of their property as a result of its proximity. For the purposes of this consultation, the Government has identified a range of approaches that it is considering applying to any additional discretionary arrangements, and these are set out in Annex A.

3.50 Before taking decisions on such additional discretionary arrangements (including the final form of such discretionary arrangements), the Government believes it is essential to gather more evidence, including the views of the public on the available options, and conduct further detailed analysis. Some options for different types of possible arrangements are also included in Annex A and you are invited to give your comments on these.

Conclusion

3.51 The Government supports a Y-shaped high speed rail network linking London to Birmingham, Manchester and Leeds, and incorporating stops in the East Midlands and South Yorkshire, as well as direct links to Heathrow and to the HS1 line to the Channel Tunnel.

3.52 The Government's view is that this proposed network should be delivered in two phases.

3.53 The first phase would be an initial high speed line from London to the West Midlands, including the link to HS1, and connecting back to the West Coast Main Line in order to provide improved journey times to other cities on that corridor including Manchester, Liverpool and Glasgow. Part 2 of this document sets out the work carried out by HS2 Ltd to develop route options for this initial phase and describes the Government's preferred route.

3.54 The onward legs from the West Midlands to Manchester and Leeds would be constructed as the second phase of the network, together with the direct link to Heathrow.

3.55 The Government believes that the direct link to Heathrow should be taken forward as a spur from the main London – West Midlands line, broadly following the surface option identified by HS2 Ltd. To link to the HS1 line, the Government favours a single-track link including a tunnel from Old Oak Common to the North London Line and then using existing rail infrastructure to reach the tunnel portal north of St Pancras.

Consultation Question:
Do you agree with the Government's proposals for the phased roll-out of a national high speed rail network, and for links to Heathrow Airport and the High Speed 1 line to the Channel Tunnel?

PART 2

4. Developing a New High Speed Line

4.1 This chapter sets out the approach HS2 Ltd took in carrying out its remit from Government to develop proposals for an initial high speed line from London to the West Midlands. The following chapter provides a detailed description of the line of the Government's proposed route and its implication for communities and the environment.

4.2 The Government is seeking views on the approach that HS2 Ltd took to the development of the proposed route for consultation, and on the proposed route itself and how it could be further improved.

4.3 HS2 Ltd was tasked initially with developing proposals for a high speed line from London to the West Midlands. Subject to the outcome of this consultation, this would be the first stage of a wider national high speed rail network. Decisions taken on how this initial line would operate would drive the future development of high speed rail in the UK.

4.4 With that in mind, HS2 Ltd set about determining the fundamental guiding principles that would form the basis of high speed rail in the UK, beginning with London to the West Midlands, but with a view to the future development of a wider national network. The Government proposes to accept these principles for high speed rail in the UK, which can be summarised as:

- **Exploiting maximum benefit from high speed capacity**: With expected growth in demand, and the greater range of destinations that could be served with a wider network, the capacity of an initial London – West Midlands line would be fully used over time. Given also the high costs of construction, it is important to ensure that the best use could be made of available paths;
- **Long distance, city-to-city journeys**: Benefits and revenues would be maximised by focusing high speed services on direct connections between large markets;
- **High speed trains only**: Permitting only trains capable of operating at high speed would ensure that overall capacity of the line would be maximised;
- **Integration with the classic network**: This would enable high speed lines to serve more destinations, spreading the benefits of high speed rail more widely;
- **Greater segregation from the classic network over time**: The highest levels of capacity and reliability for passengers would be achieved on segregated networks;
- **Integration with other transport networks**: To fully realise the benefits of high speed rail it would be important that passengers could get easily from the station to their final destination.

4.5 A more detailed project specification was developed consistent with these guiding principles. It set out that HS2 would:

- Provide a safe and secure network for passengers, those who operate and maintain it and others that may come into contact with it;
- Ensure compliance with the EU Directive and Specifications for Interoperability to benefit from standard, proven, competitively sourced high speed rail equipment, systems and trains;
- Provide internationally recognised levels of availability, reliability and speed, with capacity maximised to allow as many as possible to benefit;
- Ensure that some high speed trains can run on the classic network;
- Apply the principles of sustainable development, where possible avoiding or minimising, and then mitigating, impacts on people and the environment.

High Speed Rail Design in the UK

HS2 Ltd sought to develop proposals for a safe and reliable railway, using proven European standards, technology and practice.

Speed

Maintaining high speed would reduce journey times. The proposed route has generally been designed for speeds up to 250 miles per hour – similar to routes currently being designed elsewhere in Europe. Line speed in built up areas would be lower reflecting environmental considerations. HS2 Ltd has assumed a maximum train speed of 225mph at opening; speeds above 225mph would not be allowed unless impacts of operation could be demonstrated to be no worse than currently assumed for operation at 225 mph.

Capacity

High capacity would maximise the benefits of the investment in a new high-speed line. That means long trains and maximising the number of trains that can be run per hour: at opening up to 14 trains per hour could run in each direction; future technological developments are expected to see that increased to 18 trains per hour on a wider high speed network. Trains would run throughout the day and evening, seven days a week, although no HS2 trains would run between midnight and 05.00 hours (08.00 hours on a Sunday), allowing time to be available for maintenance of the line.

HS2 trains would be up to 400 metres long – similar to the length of Eurostar trains – with up to 1,100 seats. This means stations would need to cope with high volumes of people and provide high quality links for their onward journeys. Shorter “classic compatible” trains, also capable of high-speed running, would serve cities off the high-speed network.

Minimising impacts on the environment

High speed rail should avoid, as far as practicable, impacts on communities and the natural and built environment. To that end HS2 Ltd developed a set of sustainable design aims – a set of principles of good practice for HS2 Ltd’s design teams. Further detail can be found in Appendix 1 of the Appraisal of Sustainability.

In developing its proposals, HS2 Ltd sought, where practicable, to follow existing rail or road transport corridors, with the track placed at or just below ground level. Bridges and viaducts have been proposed where the line would cross other transport corridors or where forced to do so because of topography or environmental features, for example rivers. Tunnels have been proposed where there would be no option for a route above ground due to population density or in some cases to mitigate environmental impacts.

Controlling Costs
In specifying the route, HS2 Ltd sought to achieve a balance between costs and design aims.

Establishing the benefits of HS2

4.6 The economic case for adding capacity to the transport network relies heavily on ensuring that decisions are informed by the journeys that people want to make. HS2 Ltd took a "demand-led" approach to developing its proposals. This led to city centre station locations with high quality onward transport links being selected, influenced by where people would start and finish their journeys.

4.7 HS2 Ltd used a transport forecasting model, based on the best available evidence of future transport trends, to test how effective its proposals would be in meeting demand for trips. To test how the proposed route would perform when it opened compared to a scenario without HS2, a number of assumptions were made about what developments would take place in transport policy and spending between now and then. This is called the 'reference case'. The following improvements to the transport network were assumed to have taken place before the opening of any new high speed line:

- Any highways, rail and local transport schemes that the Government has committed to build before 2015.
- Continued investment in the roads programme and London transport beyond 2015, consistent with the National Transport Model, which is unlikely to be affected by the building of a new high speed line.
- Investment in schemes to be completed beyond 2015 – including Thameslink and Crossrail.

4.8 HS2 Ltd has not included the proposed Evergreen III project on the Chiltern Line between London and Oxford in their reference case. HS2 Ltd's view is that implications for demand on HS2 would be likely to be small. Similarly Airtrack (between Heathrow Terminal 5 and the existing rail network to the south and west), has not been included but again the implications would be likely to be small.

4.9 HS2 Ltd's forecasting model also includes assumptions about likely UK economic growth, growth of demand for travel and the methods used in future to generate electricity. The assumptions used are in line with Government forecasts, including the OBR's forecasts of economic growth, DfT's forecasts for demand for travel, and DECC's forecasts on the future generation of electricity.

4.10 The introduction of HS2 services would trigger a full recast of the West Coast Main Line (WCML) timetable. This would affect both local and long-distance services. High speed services using HS2 (other than to Birmingham Curzon Street) would rejoin the West Coast Main Line to the north of Lichfield. The WCML is a 4-track railway at this point, providing sufficient capacity here for the HS2 services to join it without undue disruption to other users of the route. HS2 Ltd assumed that some existing long-distance services using the WCML would be recast with reduced frequency and amended stopping patterns, to reflect the changed market conditions upon the opening of HS2. This would free up sufficient capacity elsewhere on the network to allow the proposed HS2 services to run north of Lichfield and for new local and regional services, for example into Birmingham and London. HS2 Ltd would work with Network Rail to identify and resolve any capacity constraints resulting from the proposed introduction of HS2 services.

The Appraisal of Sustainability

4.11 HS2 would bring major economic and social benefits. Like any major infrastructure project, it would also result in some adverse environmental effects. Sustainability issues – embracing economic development and job opportunities, effects on communities, as well as environmental considerations such as landscape, noise, the natural environment and climate change – have been inherent in HS2 Ltd's design and a major determinant in the selection and definition of the proposed scheme, alongside other considerations of transport and economic objectives, construction costs and practicalities, and operational requirements.

4.12 These issues have been addressed through the Appraisal of Sustainability (AoS). Using the AoS, it has been possible to determine at each stage, the extent to which preliminary options and, ultimately, the proposed scheme would support principles of sustainable development, namely:

- reducing greenhouse gas emissions and combating climate change;
- protecting natural and cultural resources and enhancing the environment;
- creating sustainable communities (the issue of noise is included within this); and
- achieving sustainable consumption and production (efficient use of resources and materials, for example through re-use of waste materials).

4.13 HS2 Ltd structured its AoS around these four principles, but used a series of increasingly detailed criteria to further define the concept of sustainability, so helping to assess the benefits and disbenefits of different options. The AoS methodology has drawn on existing appraisal and assessment techniques, including: strategic environmental assessment (SEA), the Department for Transport's (DfT) WebTAG appraisal process, requirements of the European Habitats Regulations, equality impact assessment (EqIA), and health impact assessment (HIA).

Inviting external challenge

4.14 HS2 Ltd subjected its approach and outcomes to scrutiny and views from a broad range of sources:

- Three external challenge groups to provide independent expert scrutiny of its work:
  - i. Strategic – providing perspective on the overall programme;
  - ii. Technical – to scrutinise the engineering and environmental work; and
  - iii. Analytical – to scrutinise the economic modelling.
- An Appraisal of Sustainability Reference Group, comprising relevant Government Departments and other relevant statutory consultees including English Heritage, Natural England and the Environment Agency. This group provided direct input to the AOS scope and method.
- Ad hoc groups to seek views on and validate the approach to specific issues, including Project Funding and Delivery, Climate Change and Noise.
- Location-specific working groups, comprising representatives whose local and regional knowledge and experience was an important input to the option sifting (for example, station sites) and selection process.
- Discussions with rolling stock manufacturers and operators and local authorities, on the proposed maintenance and stabling strategy, including depot locations.
- Formal discussions with a wide range of interested parties through regional meetings.

The station and route selection process for HS2 (London – West Midlands

4.15 The process for selecting its recommended route began with HS2 Ltd identifying five distinct, but clearly interdependent, sections for consideration:

- A London terminal (including the section leading to a station at the Southern end of the route);
- An interchange station with Crossrail and Heathrow, including London approaches (the route of the track into the city);
- Lines of route (track) between London and the West Midlands;
- The case for an intermediate station between outer London and the West Midlands Metropolitan area; and
- West Midlands stations and approaches.

4.16 Options for each of these were sifted using a number of criteria, including cost and engineering feasibility, demand (i.e. how well they served the journeys people want to make), and environmental impacts. The proposed route was identified through a staged process of narrowing down options from a long-list to a single recommended option and, where appropriate, alternatives. HS2 Ltd submitted recommended and alternative routes to the Government in December 2009, and these were published in March 2010.

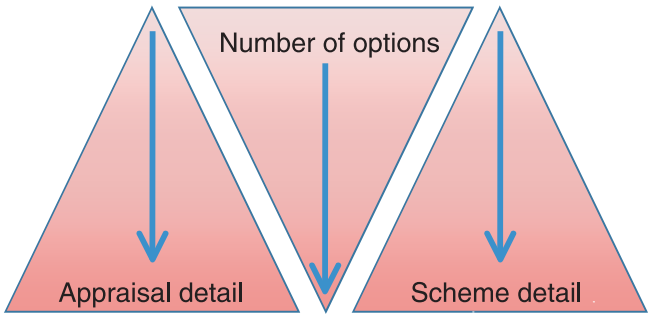


Figure 4.1 – **As options were narrowed down, the level of design and appraisal detail increased**

4.17 Subsequently, the Government asked HS2 Ltd to carry out additional work, including to develop proposals for serving Heathrow directly and a direct link to HS1, and to develop the recommended route further, including proposals for environmental mitigation. Additional advice was provided to Government between September and December 2010 and the Government has now decided on its proposed route for consultation in the light of that work.

Stage One

4.18 This stage began with a long-list of over 90 options. These were analysed at a very high level on the basis of engineering and operational feasibility, the relative likely demand and an indication of the relative costs (i.e. high, medium, low), while planning and environmental considerations were also addressed at a very high level at this initial stage. Those station options that had obvious significant operational difficulties were identified. Route options did not undergo a formal sifting process at this stage as there was insufficient information to decide between the various options; HS2 Ltd went straight into the more detailed assessment of Stage Two to produce the short-list of route options.

Stage Two

4.19 Just over 50 station and route options were taken forward to the second stage of the process and these were then developed to a higher level of design detail. At this stage sections of route, rather than full routes, were analysed. These could later be assembled into full length routes. For the route sections and stations identified in the shortlist each was considered in terms of how well it met the remit from Government, its relative cost, its construction and operational feasibility and its environmental impacts.

4.20 This included a review of how passengers would travel to and from HS2 stations covering road, rail and local public transport (including London Underground) links. The assessment also took into account environmental, social and spatial planning considerations, passenger demand and any relevant considerations of likely relative passenger numbers and journey times.

4.21 In addition to seeking to avoid settlements along lines of route, HS2 Ltd considered environmental and wider impacts as part of the AoS, which was an integral element of the sifting process. This looked initially at only high level priority factors such as nationally and internationally designated sites and areas, including Special Protection Areas and Areas of Outstanding Natural Beauty. These were documented in data sheets and frameworks specifically developed for the scheme, but based on industry best practice and in line with legislative and regulatory requirements. This is described in more detail within the AoS report published alongside this consultation.

4.22 The route sections which performed best were assembled into full length routes and in a second supplementary sift within Stage Two the number of options was reduced to a shortlist of routes and stations that were taken forward into Stage Three.

Stage Three

4.23 These options were developed to a greater level of detail thereby allowing a better understanding of their performance. Costs for the line of route were primarily estimated by identifying the types of line within each route section (e.g. open route, corridor widening or tunnel), the length of each type along the route, and then applying a standard cost per kilometre to each type of line. The economic analysis focused mainly on journey time comparisons. The AoS considered a more detailed level of information as set out in the AoS report. From this process HS2 Ltd identified a single recommended route together with a small number of main alternatives that were then assessed more fully and reported to Government in December 2009.

Shortlisted Routes and Stations

HS2 Ltd considered a number of alternatives to its recommended scheme.

London Terminus:

Three main options were considered for a London terminus. HS2 Ltd recommended a single-deck expanded station at Euston. An alternative for a double-deck solution on a smaller footprint at Euston was found to cost more to construct. It would have been very intrusive in the local area and would impose unacceptable disruption to existing services during construction. An alternative location on the Kings Cross Lands would have serious impacts on developments currently underway, and would present significant engineering challenges.

Line of Route

HS2 Ltd considered three main options for the line of route, and later considered a further route via Heathrow. HS2 Ltd recommended Route 3, crossing the Chilterns along the A413 corridor, and following the disused Great Central Line corridor towards the West Midlands.

An alternative route through the Chilterns, Route 2.5, would create an entirely new transport corridor through the Chilterns Area of Outstanding Natural Beauty (AONB) and would be very intrusive in the Hughenden Valley. It would cost more and lengthen journey times, reducing overall benefits.

HS2 Ltd considered a second alternative, Route 4, which would follow the West Coast Main Line corridor through the Chilterns. This option would have a shorter distance through the AONB, but would cost significantly more and have longer journey times. It would also make serving Heathrow unfeasibly expensive and impractical.

The final alternative route via Heathrow would be substantially more expensive and its longer journey times would lead to reduced benefits. Although it would have less direct impact on the Chilterns AONB, it would adversely affect other sensitive areas.

West Midlands
HS2 Ltd considered two main options for a city centre station in Birmingham, and recommended a new station at Curzon Street. HS2 Ltd also considered a new station at Warwick Wharf, but the Curzon Street site was found to have less effect on local conservation areas and would require fewer demolitions.

HS2 Ltd also considered an approach to the city centre along the Coventry (West Coast Main Line) corridor, but the recommended option along the Water Orton corridor performed better in terms of sustainability.

Further information on the sifting process and the main alternatives HS2 Ltd considered can be found in Annex B to this document: *Alternative Options for HS2 (London to the West Midlands)*.

Your views on the approach to developing proposals for HS2

4.24 This section has outlined the approach that HS2 Ltd is taking to developing proposals for HS2, including the specification for high speed rail in the UK that HS2 Ltd recommended, and how it is being applied to the development of proposals.

Consultation Question:
Do you agree with the principles and specification used by HS2 Ltd to underpin its proposals for new high speed rail lines and the route selection process HS2 Ltd undertook?

5. The Government's Proposed Route for HS2 (London – West Midlands)

Introduction

5.1 This section sets out in more detail the Government's proposed line of route for consultation and why it considers it better than the main alternatives. It describes the route in detail, including how HS2 Ltd sought to optimise the route to minimise environmental impacts. It sets out proposals for locations for supporting infrastructure for that route. It also covers the principles that would guide how the route would be constructed and how the impacts of construction would be minimised.

London Approaches and Interchanges

5.2 The shortlisted options for a London station were to redevelop Euston station, either on a single level or a double-deck station, and a new station at Kings Cross Lands. The Government considers that a single-deck redevelopment of Euston station is the best option for a London station. The key reasons are:

- As shown by HS2 Ltd's analysis, the strongest demand is for a central London station.
- Of the feasible central London locations, the Kings Cross Lands solution would have severe effects on development currently underway and would present significant engineering challenges.
- A double-deck solution at Euston would be very intrusive, would require demolitions and would impose unacceptable disruption to existing services during construction.
- The single-deck option, while requiring a larger number of demolitions, would provide the best opportunities for longer-term redevelopment of the Euston area.
- A single-deck option would cost no more than the other main options, and would cost less than a double-deck station.

5.3 The single-deck proposal would locate the 10 high-speed platforms alongside 14 classic platforms, some of which would be capable of being used by classic-compatible services. The station would need to be extended to the South and the West and, to obtain the necessary clearance under Hampstead Road Bridge, the platforms would need to be built two metres below the current level. This would allow new development over the platforms and open up east-west routes for local people across the site, which is largely occupied currently by a Royal Mail shed.

Rebuilding Euston

The redevelopment of Euston station would present a major opportunity to regenerate an area which has already been earmarked by the Mayor and the London Borough of Camden for improvement.

HS2 Ltd intends to work closely with the London Borough of Camden and the Greater London Authority with the intention of agreeing a joint strategy for the Euston area. This would include engagement with local people, businesses and community representatives affected by the proposals, providing the framework for consultation in this part of London.

The redevelopment would have a significant impact on the Regents' Park Estate, where a number of demolitions would be required, and therefore one area of focus would be working with LB Camden and the local community to ensure local residents are rehoused and demolished properties replaced with new, high quality social housing with access to local amenities. Another area of focus would be St James Gardens, part of which would need to be taken for the redevelopment.

There would also be some disruption during the construction period, but contractors would be expected to adhere strictly to best construction practice as part of a wider environmental management system. In the longer term there is huge scope to deliver benefits for the local community businesses and the travelling public.

Euston station currently has 18 platforms, served by a mixture of long distance inter-city trains, medium and short distance commuter services and overnight sleeper trains. The proposed design would extend the station to the west to accommodate new longer platforms for high speed trains, and also southwards to the edge of the gardens at the front of the current station.

Euston station would be one of the most complicated areas of HS2 to construct. It would be undertaken over a number of years in several stages. The first stage would be to construct new platforms on the western side to provide initially temporary platforms for existing 'classic' services during subsequent construction stages. This would require closure of areas of the current station to allow construction of the new building and platforms. Upon completion of each stage, the new platforms would be bought into service immediately. It is likely that during these early stages alternative accommodation would be constructed in advance of the start of demolition work to ensure residents could be relocated.

HS2 Ltd would work with Network Rail and Train Operators to develop the preferred staging arrangements to maximise train services during the construction period. Through careful planning HS2 Ltd would seek to ensure that the construction site did not extend beyond the proposed station boundary. Site accommodation and welfare facilities would also be located within the final station footprint.

Figure 5.1 – **Layout of rebuilt Euston Station**

HS2 Ltd would work closely with local authorities, residents and businesses to develop detailed construction plans which minimise the impact to surrounding areas. At this stage it is not possible to specify the quantity of materials which would be required and waste materials to be removed. However, materials would be delivered to site and removed by rail wherever possible, with road movements kept to a minimum.

5.4 HS2 Ltd has examined the implications that an initial London – West Midlands HS2 line could have on passenger dispersal at Euston, in particular on the Underground. By 2043, as a result of the proposed line, the number of passengers per day using Euston Mainline Station is estimated to increase by 31,700. Surveys of current passengers suggest around 50 per cent of passengers would arrive or depart by London Underground which, in the three hour morning peak, would mean 5,500 additional passengers using Euston Underground Station. Both the Northern and Victoria lines which stop at Euston are likely to be heavily crowded even without HS2. Although the introduction of HS2 would add to this pressure, the number of passengers added by HS2 is likely to be relatively small (around 2 per cent) compared to the number of passengers already forecast to be on London Underground services passing through Euston. HS2 Ltd would work closely with TfL as part of its wider ongoing strategy for modernising and improving Underground services.

Figure 5.2 – **The footprint of the redeveloped Euston Station**

5.5 Leaving Euston, the route would descend into tunnel for about four and a half miles (seven kilometres) with a maximum line speed of 140 mph (225 kph), curving round to the west, broadly in line with the West Coast Main Line, to a new interchange station at Old Oak Common where passengers from the West Midlands and beyond would be able to change onto Crossrail, the Heathrow Express, the Great Western Main Line or other local public transport.

Old Oak Common Station

HS2 Ltd was asked to provide an interchange between HS2 and Crossrail. Option development during 2009 investigated many different means of achieving this. The proposed solution is to locate a new station on former railway lands at Old Oak Common.

Old Oak Common provides a large area of land to locate a station without encroaching upon neighbouring property. It could provide an easy interchange between HS2 trains and Crossrail, as well as train services operating from Paddington to Reading, Wales and the West Country. This would also provide a rapid link to Heathrow Airport, using the existing Heathrow Express.

Stopping trains at Old Oak Common would mean that passengers travelling to and from Euston on HS2 would experience an additional journey time of around four minutes, but HS2 Ltd's analysis showed that overall there would be net benefits. Around one third of HS2 passengers would use Old Oak Common to change onto Crossrail to travel on into central London, in preference to leaving the train at Euston. In addition to providing better journeys for these passengers, this would also reduce the pressure of crowding at Euston and its Underground connections.

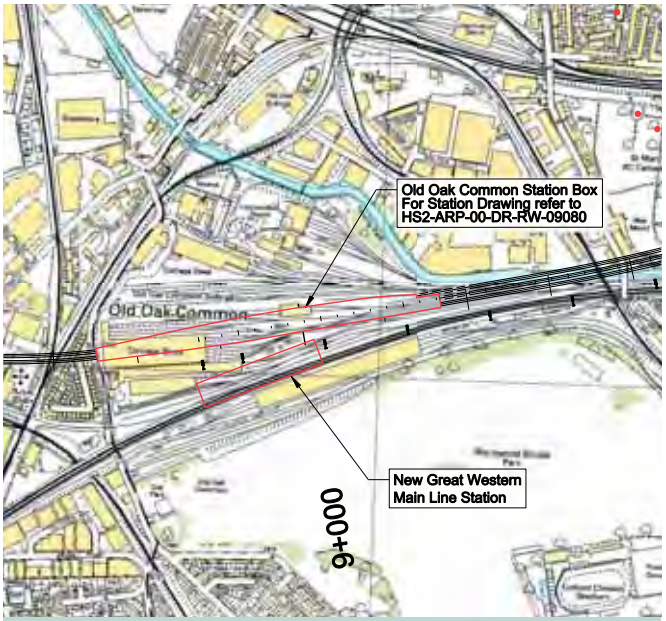


Figure 5.3 – **Proposed lay-out of Old Oak Common Station**

5.6 The Government agrees with HS2 Ltd's recommendation that an interchange should be provided at Old Oak Common because:

- It would help relieve the pressure on the underground at Euston.
- It would provide better access for those travelling to and from the City of London, the West End and Docklands.
- It would provide opportunities for transfer onto the Great Western Main Line and, in the first phase, before a direct connection to Heathrow would be provided, the interchange with the Heathrow Express at Old Oak Common would allow for considerably faster journeys to Heathrow from the West Midlands and northern cities than is possible today.
- A station at Old Oak Common would also provide opportunities for major regeneration in a deprived area of London.

A Connection to HS1

5.7 A single-track link to HS1 would be provided from Old Oak Common, heading east in tunnel alongside the tunnel into Euston before diverting off to join the North London Line at surface level. One line of the North London line would be upgraded through Camden to accommodate the larger high speed trains, and an existing link onto HS1 would be used for services to and from Kent and the Continent. Three trains per hour could operate in each direction between HS2 and HS1. HS2 Ltd is working with Network Rail and Transport for London to ensure that such a level of HS2 services would not affect the operation of the North London Line.

Old Oak Common to the West Midlands

5.8 HS2 Ltd developed seven lines of route, and from these a shortlist of three options – Route 2.5, Route 3, and Route 4 – was drawn up. A further option – Route 1.5 – was developed subsequently as part of HS2 Ltd's consideration of how Heathrow could be served directly.

5.9 The Government supports HS2 Ltd's view that Route 3, subject to the refinements that have been made since May 2010, would be the best option. The main reasons are:

- The Government considers that there is a compelling strategic case for being able to link the high speed network to Heathrow. HS2 Ltd's Route 4, following the West Coast Main Line Corridor more closely through the Chilterns, would make this unfeasibly expensive and impractical.
- The alternative route through the Chilterns, Route 2.5, would create a new transport corridor through the Area of Outstanding Natural Beauty and would be very intrusive in the Hughenden Valley. It would also cost more and mean longer journey times, and therefore lower benefits.
- The alternative route via Heathrow would be substantially more expensive and the longer journey times would reduce the benefits. Although it would have less direct impact on the Chilterns, it would adversely affect other sensitive areas.

5.10 The proposed route would leave Old Oak Common in a short tunnel, emerging at North Acton to run along the Chiltern Line corridor to the M25 with a maximum line speed of 155mph (250kph). Junctions for a future connection to Heathrow would be provided around Northolt, West Ruislip and the tunnel portal by the M25.

5.11 HS2 Ltd has revised the alignment in this area to avoid potential conflicts with the proposed Evergreen 3 upgrades to the Chiltern Line, for which funding has recently been approved. This would lower the HS2 alignment and raise the Chiltern Line to allow it to pass over HS2. This would require constructing a new section of track for the Chiltern Line as it approaches the Northolt Corridor, but it could be achieved with limited construction disruption to Chiltern Line services, and to local communities.

Serving Heathrow

The Government's assessment of the strategic case for a link to Heathrow is set out in Chapter 3. As part of an initial London – West Midlands line, the Government believes that a connection to Heathrow is best provided via the interchange station at Old Oak Common, and therefore HS2 Ltd's proposals for such a line do not include a direct link to Heathrow at this stage. Provision would be made along HS2 to allow a direct link to be constructed as part of Phase 2, at the same time as the proposed legs from the West Midlands to Manchester and Leeds. Subject to the outcome of consultation, this is intended to be via a spur line to a new station at the airport, although it could be extended into a loop formation at a later date.

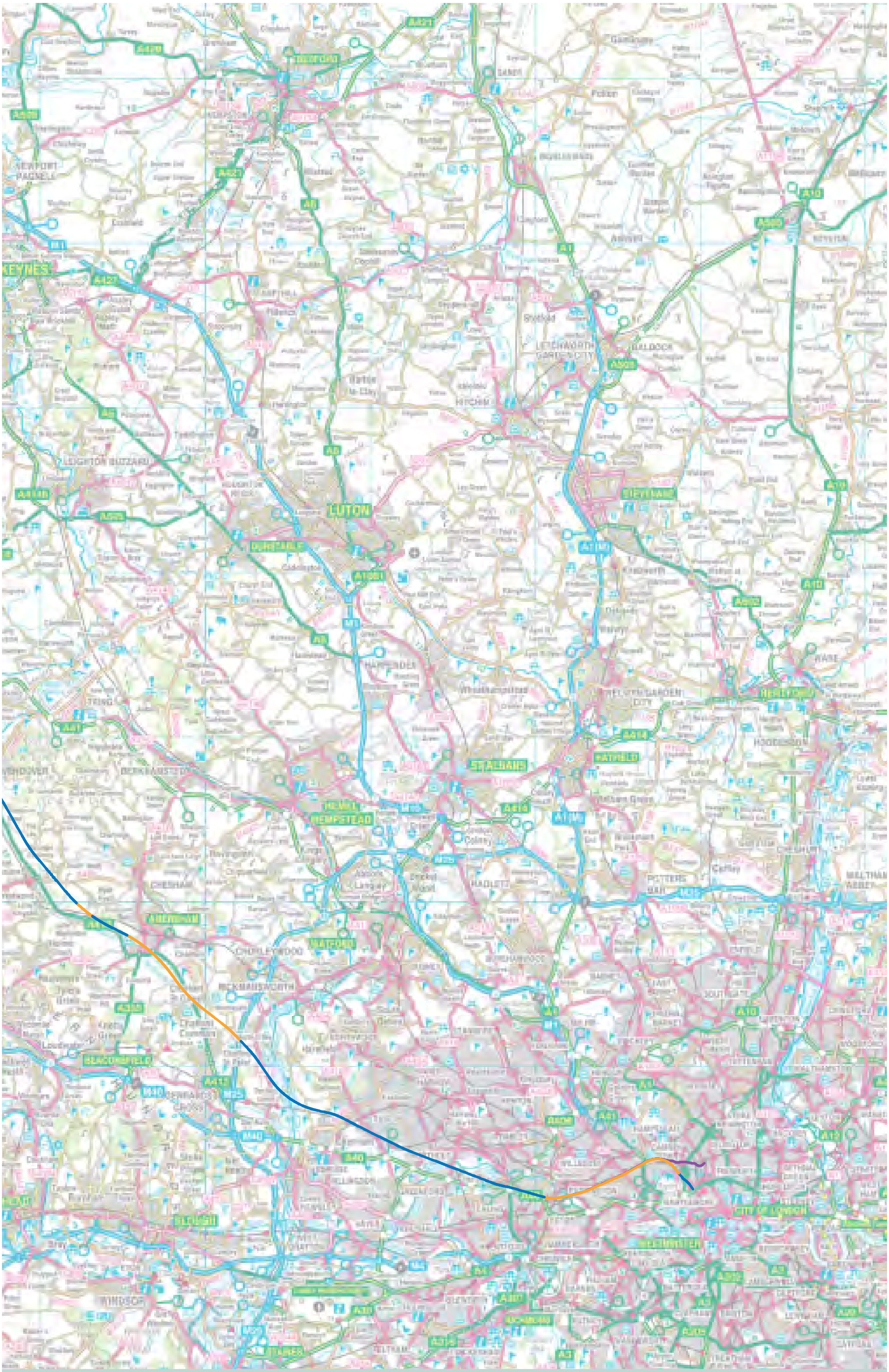
5.12 Between Ruislip and the M25 the proposed route would diverge from the Chiltern Line, crossing the Colne Valley on a two-mile long viaduct before entering a new six-mile long tunnel just before the motorway with a maximum line speed of 200mph (320kph). It would emerge from tunnel just north of Amersham and would continue in cutting to a shorter tunnel at Little Missenden. From there, HS2 Ltd has assumed 225 mph running (although, as described in Chapter 4, the line would be designed for a maximum theoretical line speed of 250 mph), following the A413 corridor to pass to the south-west of Wendover and Aylesbury. Beyond Aylesbury it would follow an existing freight line and then the disused Great Central Line rail corridor largely at surface level to Calvert. From there, it would continue towards Brackley mainly at surface or in cutting.

5.13 Passing to the east of Brackley the line would head north-west towards Edgcote and Ladbroke and passing to the south-west of Southam. It would then pass in tunnel under Long Itchington Wood for one mile before heading to a narrow gap between Kenilworth and Coventry, passing through part of the National Agricultural Centre at Stoneleigh, and then curving north towards Coleshill.

Intermediate Stations

HS2 Ltd also looked at the case for an intermediate station along the line of route. They concluded that an intermediate station at Bicester (serving Oxford) or Milton Keynes could generate significant benefits to users of the station. The case for such a station, however, also depended on the impacts that it would have on other HS2 passengers and the capacity of the line. HS2 Ltd concluded that an intermediate station would be detrimental to the HS2 business case unless a loss of services on the line could be avoided. This would not be achievable, and an intermediate station has not been included in the scheme.

Figure 5.4 – **Proposed line of route for HS2 (London – West Midlands)**


BEDFORD
LEIGHTON BUZZARD
LETCHWORTH GARDEN CITY
BALDOCK
HITCHIN
STEVENAGE
LUTON
DUNSTABLE
HARPENDEN
HERTFORD
TRING
BERKHAMSTED
ST ALBANS
HATFIELD
HEMEL HEMPSTEAD
CHESHAM
AMERSHAM
WATFORD
RICKMANSWORTH
BEACONSFIELD
SLOUGH
WINDSOR
WESTMINSTER
CITY OF LONDON

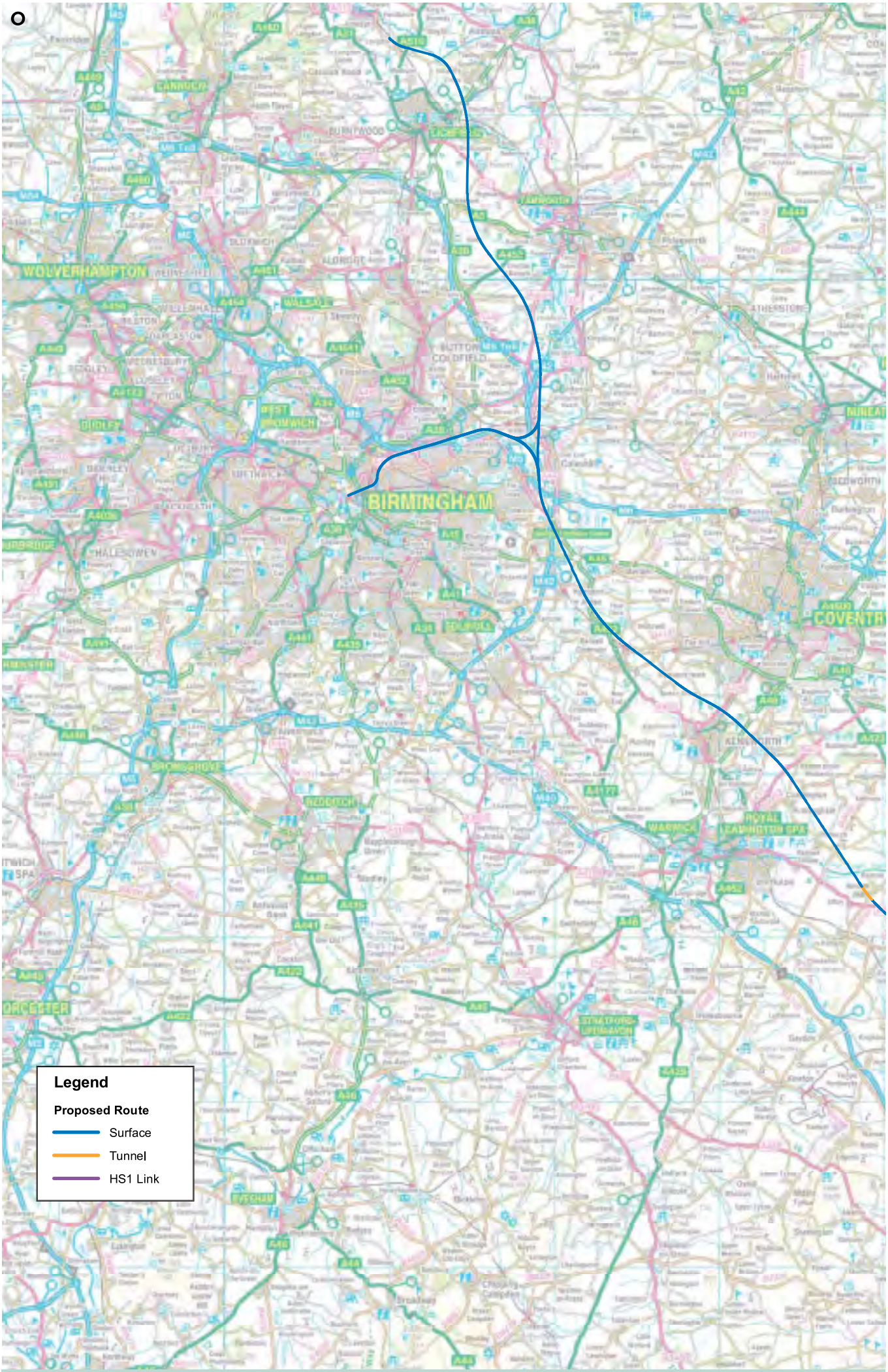
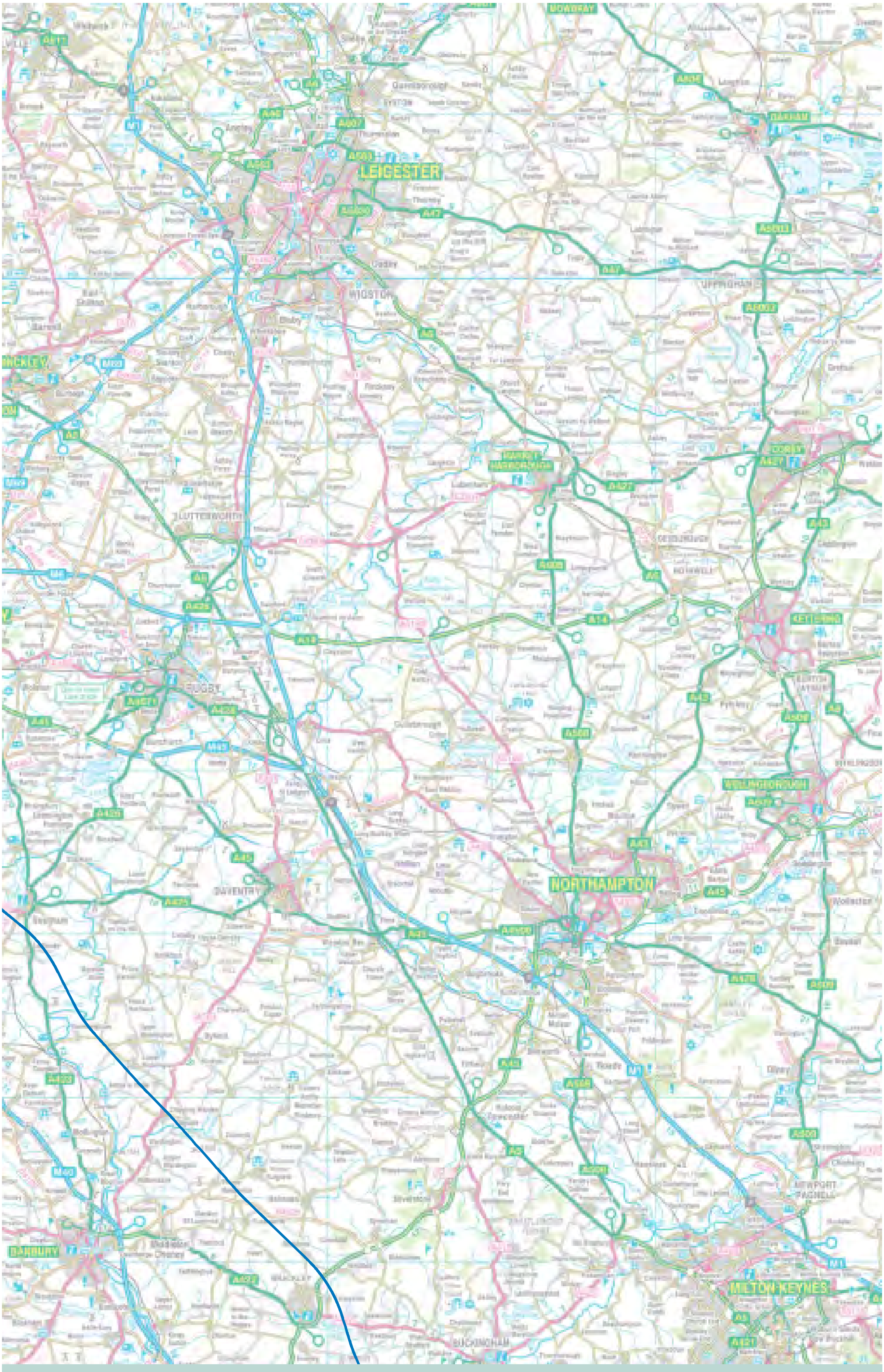


Figure 5.5 – **Proposed line of route for HS2 (London – West Midlands)**


LEICESTER
WIGSTON
OAKHAM
UPPINGHAM
MARKET HARBOROUGH
CORBY
LUTTERWORTH
KETTERING
RUGBY
WELLINGBOROUGH
DAVENTRY
NORTHAMPTON
NEWPORT PAGNELL
MILTON KEYNES
BANBURY
BRACKLEY
BUCKINGHAM
M1
A14
A43
A45
A47
A6
A5

Land Take and Visual Impact along the Line of Route

Width

Typically HS2 would be about 22 metres wide between fences on level ground in open country. This would provide space for:

- two sets of tracks (one northbound and one southbound);
- masts to hold overhead power lines over the track;
- communications cables;
- drainage; and
- access for maintenance purposes.

Putting the line in cutting or on embankment would require the overall width to be widened. In urban areas however, where line speed would be lower and surface route options are very constrained, it may be possible to reduce the width to an absolute minimum width of 15 metres.

Height

High speed trains are powered by electricity delivered at high voltage using wires suspended above the railway. This system is in widespread use in the UK and around the world and would be employed on HS2. Masts would be situated every 60 metres at both sides of the track; they are typically around eight metres tall and, for most of the route, this would be the maximum height of the railway.

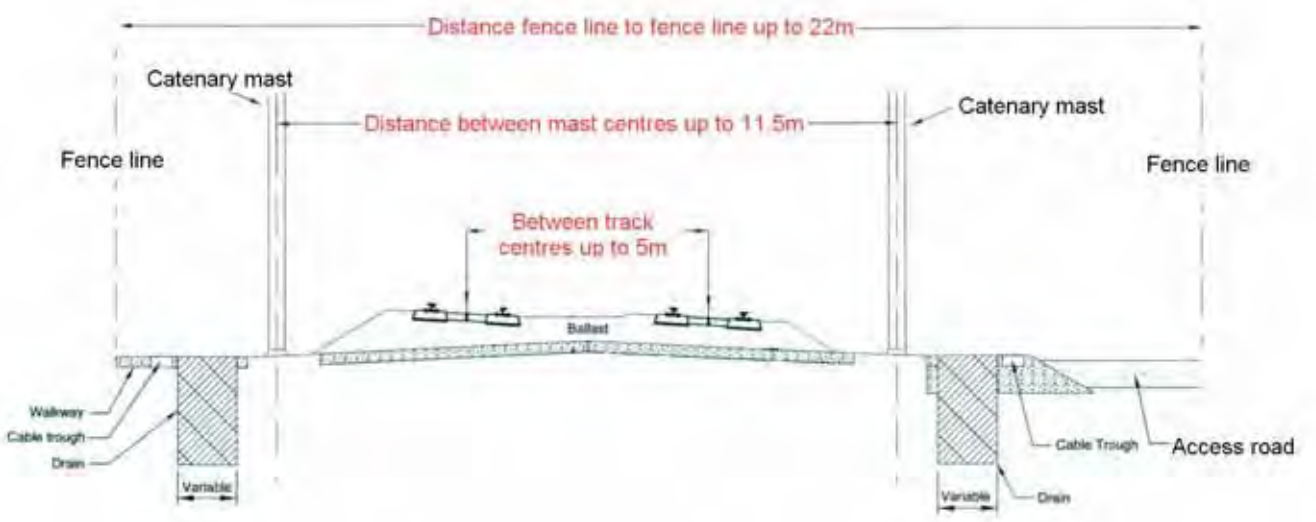


Figure 5.6 – **Cross section of a high speed rail line**

Refining the alignment

5.14 Since recommending the route to Government in December 2009, HS2 Ltd has continued to address how the environmental impact of the route could be mitigated, in particular the impacts on communities along the line of route. Refinements made to the proposed route since then include:

- Creating a "green-bridge" to the north of the proposed tunnel through the Chilterns to maintain access for local people across the line.
- Lowering the alignment between South Heath and Wendover and creating a 900 metre green-tunnel as it passes South Heath, which would be effectively screened from noise while the continuity of the land would be maintained to the south of the village.
- Moving the alignment further from the Grade I listed Hartwell House, allowing it to be screened from the alignment, and the integrity of the park and gardens to be maintained.
- A revised alignment in the Brackley area that would move the route eastwards away from Mixbury to pass in a deep cutting to the north of Turweston, passing further east of Brackley and Greatworth. It would be a little closer past Radstone but in deeper cutting.
- A revised alignment which would avoid the ornamental lake at Edgcote House before curving round Chipping Warden in green-tunnel. The realignment at Edgecote House would take the line through part of the site of the remains of a Roman Villa – the impacts and potential mitigation measures would be the subject of further investigation as part of the detailed design phase. The route would not pass any closer to the village of Lower Boddington than the previously published alignment.
- A more easterly alignment north of Upper Boddington, which would take the route away from the village of Ladbroke to a position halfway between there and Southam to the north east.
- At Stoneleigh, moving the alignment to the south west which would take it further away from Stoneleigh Village. This would take it closer to some properties on the eastern edge of Kenilworth and Cubbington although the alignment would also be lower. It would also go through part of the National Agricultural Centre.
- Lowering the alignment as it passes Burton Green and placing it in a green tunnel which would reduce noise and visual intrusion to local properties.

- Moving the alignment further away from Lichfield as it approaches the West Coast Main Line. Although this would reduce maximum line speeds to around 225mph (360kph) to make the turn back to the West Coast Main Line and lead to some increased wheel-rail noise and more intensive night-time maintenance, these factors are clearly outweighed by the benefit of being further away from Lichfield and other settlements in the area.

5.15 Further detail on the environmental implications of the proposed line of route can be found in the section Protecting the Environment and Promoting Growth, later in this document, and the accompanying Appraisal of Sustainability.

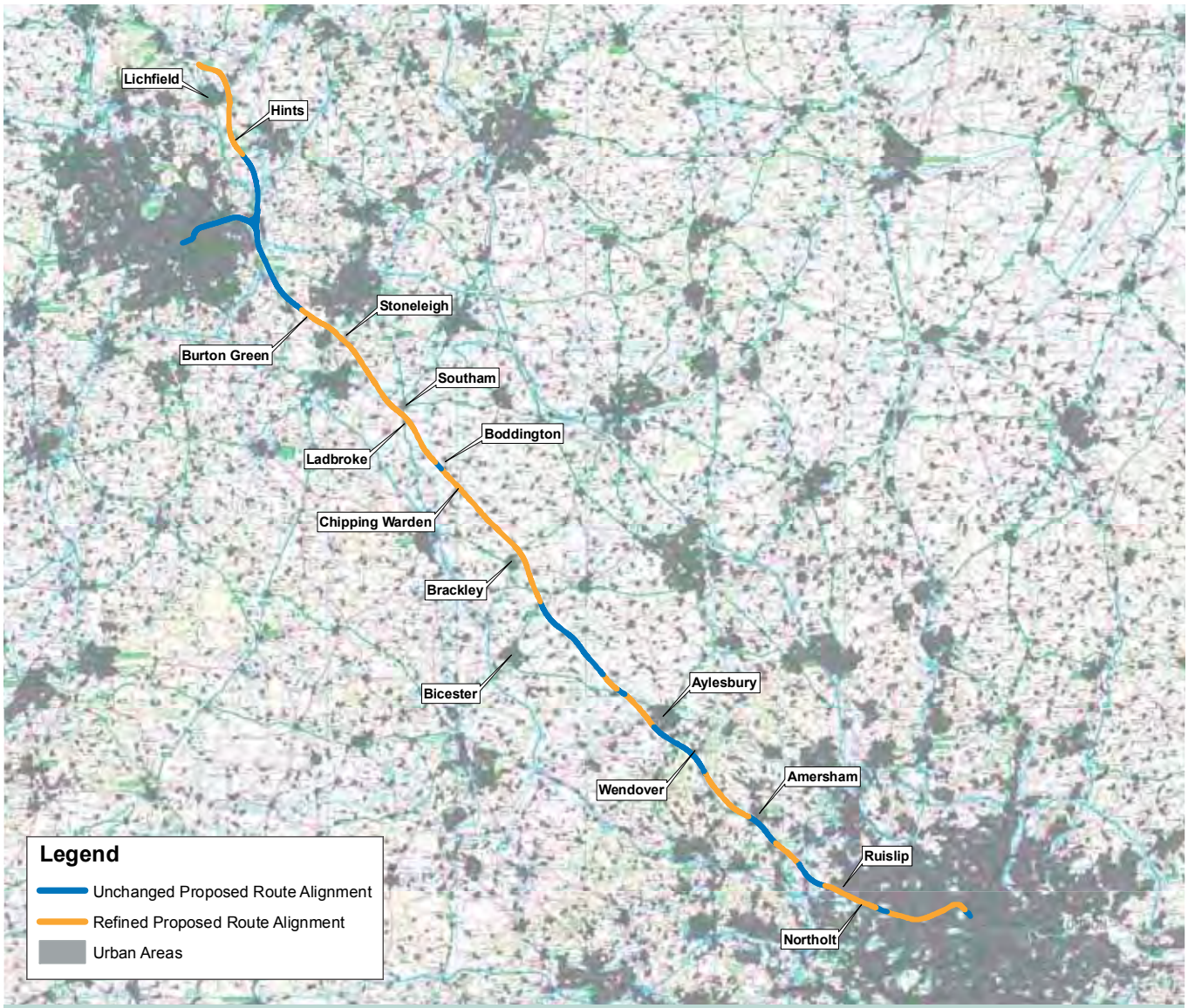


Figure 5.7 – **Sections of the proposed line that have been altered by mitigation**

Use of Tunnels on HS2

5.16 Tunnels are generally used for passing through higher ground and avoiding densely populated urban environments. On HS2, long tunnels would be included passing underneath significant sections of London and the Chilterns respectively, and around Little Missenden and Long Itchington Wood. "Green-tunnels" can also be created by covering the line where it is running in deep cutting, which can be a very effective way of minimising noise and visual impacts of high speed rail lines. On the initial London – West Midlands HS2 line this has been proposed around South Heath, Wendover, Chipping Warden and Burton Green. In total around 11 per cent of the entire route would be in tunnel.

5.17 Tunnels are not, however, appropriate in every circumstance. In particular they may not be a feasible option in low lying areas or areas prone to flooding.

5.18 Tunnels can be as much as five or six times as expensive to construct than a surface railway. They also generate substantial spoil (earth removed in the construction process) and embedded carbon (energy used in the construction process), while trains passing through long tunnels at high speeds can consume almost double the energy of a train running in the open air. They can also reduce line speeds, while longer tunnels (more than 2,000 metres) require vent shafts to the surface.

5.19 In respect of groundborne noise and vibration, experience from HS1 has shown that with mitigation using specialised track design such effects can be reduced and avoided. The engineering design of HS2 will build on this experience and it is not expected that there will be significant effects on properties above tunnels.

5.20 The HS2 tunnels in London would be generally 30 to 50 metres deep and trains would be moving at conventional rail speeds. As a result, the vibration effects would be imperceptible for HS2 tunnels in London where track and tunnel design would be similar to HS1 tunnels.

5.21 The proposed tunnel through the Chilterns would pass through chalk and at higher speeds and therefore, without mitigation, there would be greater potential for vibration effects. The proposed route, however, has been designed to pass beneath as few properties as practicable and would generally be greater than 30 metres deep. Major project experience is that further mitigation would be possible, if needed, meaning that, for this section, the risk of vibration effects would in general be negligible.

West Midlands Approaches and Stations

West Midlands Interchange Station

5.22 The Government's proposed route includes a new interchange station near Birmingham Airport which would allow a greater number of people to benefit from using HS2. A station in this location would also support regional development objectives.

5.23 The new interchange station would be constructed where the line of route passes the National Exhibition Centre (NEC) and Birmingham Airport close to Junction 6 of the M42. An Automated People Mover (similar to a shuttle at an airport) would link the interchange station to the Airport, the NEC and the existing classic rail station. A multi-story car park would be provided and significant improvements to the road network would accommodate additional demand created by the interchange. HS2 Ltd is working with the Highways Agency and local partners to identify the measures which would be needed to manage the impacts of the station. These would be the subject of a future local consultation.

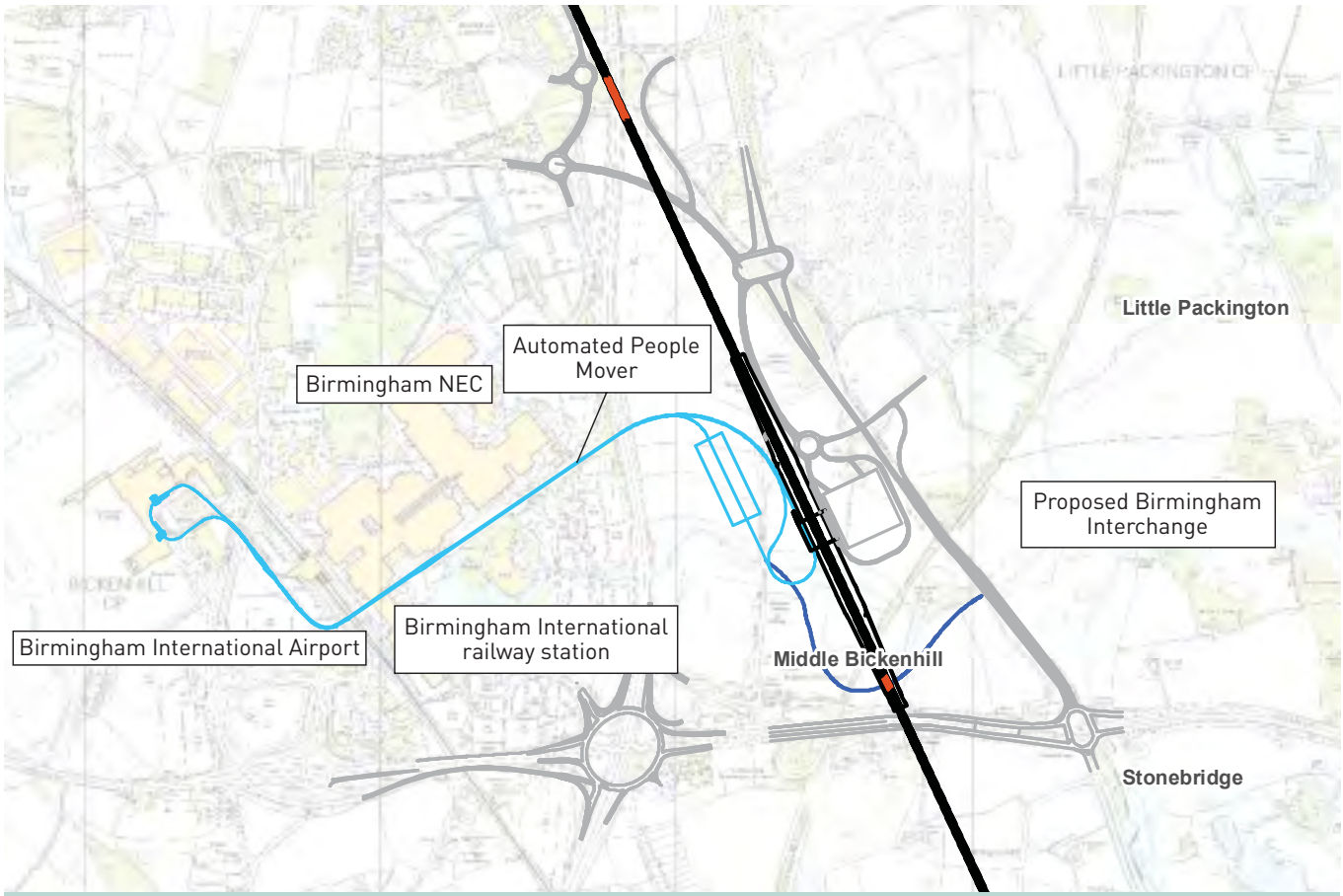


Figure 5.8 – **Layout of proposed Birmingham Interchange**

North of Birmingham Interchange

5.24 Leaving the interchange station the route would continue north over the M42, passing west of Tamworth to Lichfield where it would join the West Coast Main Line for services to Manchester, Liverpool and Scotland. As part of their work on serving Leeds and Manchester, HS2 Ltd will need to consider the implications of their proposals for the capacity and operation of HS2 north of the Birmingham Junction at Coleshill. Were this to result in any changes leading to impacts not considered in this consultation, these would be consulted on separately.

Birmingham City Centre

5.25 The proposed scheme includes a station in central Birmingham at Curzon Street, approached along the Water Orton corridor. The Government considers this the best way of serving central Birmingham because:

- The Curzon Street site would have a lesser impact on local conservation areas and would require fewer demolitions than the main alternative considered at Warwick Wharf.
- Although it would require revision of the current masterplan for Eastside, it offers great potential in the longer-term for regeneration of this area.
- The approach along the Water Orton corridor performs better in terms of sustainability than the main alternative using the Coventry corridor.

5.26 A junction on the initial London – West Midlands HS2 line to the north of the Birmingham Interchange would provide the link into Birmingham City Centre along the existing Water Orton rail corridor into the new High Speed station at Curzon Street. The station would have six platforms at a high level above Park Street and would feed onto Moor Street Queensway.

5.27 Much of the site of the station is within the Eastside area of the city that has been earmarked for substantial regeneration. While the currently planned regeneration would be affected, ultimately HS2 could be a catalyst for wider regeneration and job creation in the area. This is discussed in more detail in the section on Promoting Growth and Protecting the Environment. HS2 Ltd is working closely with Birmingham City Council and the West Midlands Integrated Transport Authority (Centro) to consider how people would continue their journey to their final destination, including how the new station could be linked to the existing stations within the city. These would be the subject of future consultation.

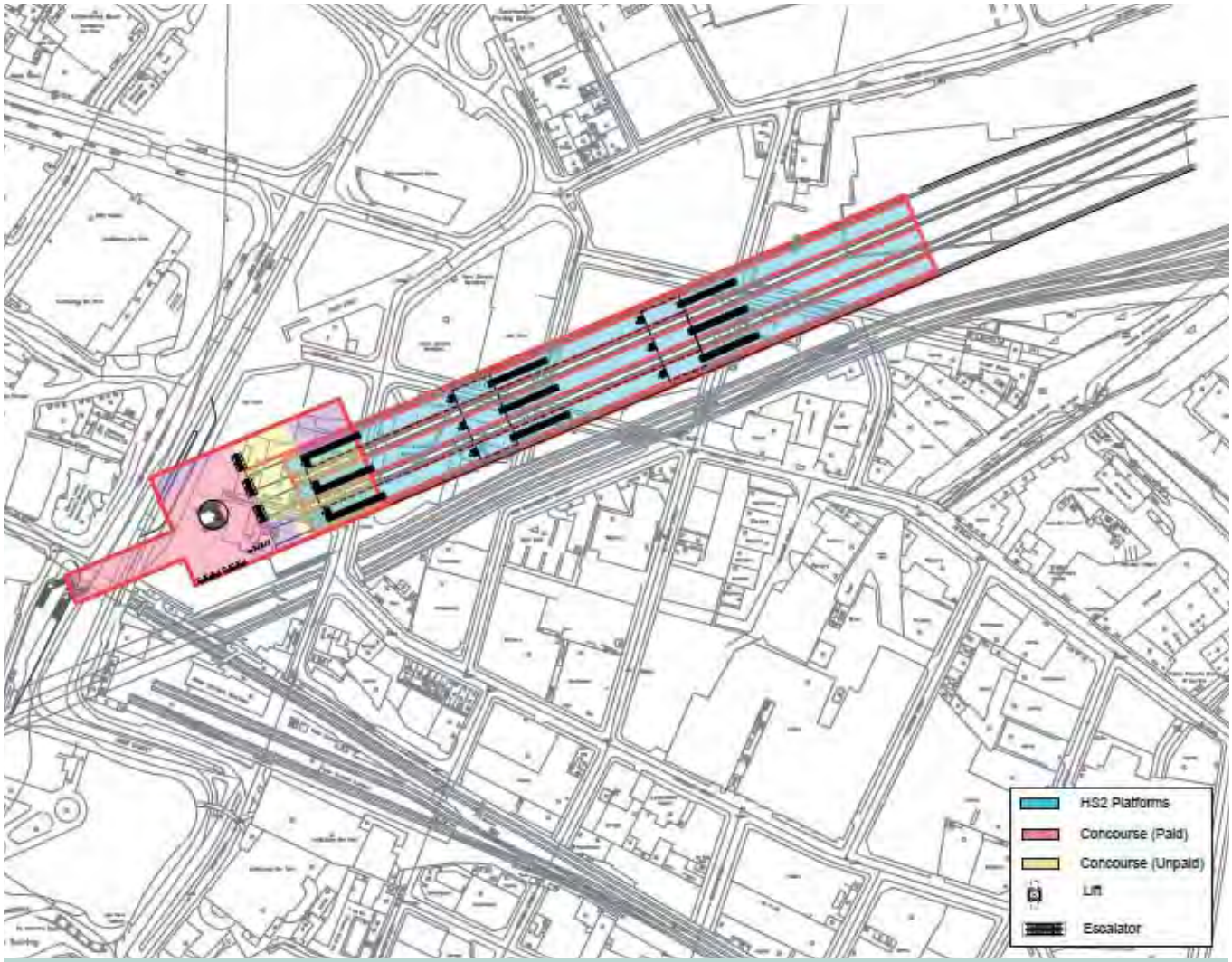


Figure 5.9 – **Layout of proposed Birmingham Curzon Street Station**

Supporting infrastructure

5.28 HS2 Ltd also looked at the supporting infrastructure that would be needed for the proposed route. That includes identifying locations for vent shafts for the longest tunnels on the route, locations for rolling stock and infrastructure maintenance depots, and infrastructure required for power supply. Preliminary consideration has also been given to the need for local road diversions, although further work on this would be required in further stages of scheme development.

Tunnel Vent Shafts

5.29 Vent shafts would be needed for the longer tunnels proposed on the route – through London and to HS1, and through the Chilterns – to provide for emergency access in the event of an incident and for fire control purposes. They would also relieve air pressure and therefore maintain passengers comfort. They would need to be positioned approximately every 1.25 miles (2km) with good road access. They would include a building to house the shaft plus an area to allow parking for the emergency services. For the proposed tunnel through the Chilterns, HS2 Ltd has assumed that the dimensions of the building would need to be 25 metres by 35 metres. This would allow the building to be single storey and therefore less visually intrusive. Given the particular space constraints in inner London HS2 Ltd assumed a taller building for the London tunnels but with a smaller footprint of 25 metres by 25 metres. HS2 Ltd expect that vent shaft sites would need to be secure but, based on evidence from other vent shafts, do not believe that under normal circumstances they would cause any additional noise in the vicinity.

London Tunnel

5.30 HS2 Ltd considers that three shafts would be needed for the London tunnel. The proposed locations of London shafts were as much driven by the availability of suitable land at surface level as the precise alignment of the tunnel. As HS2 Ltd was unable to find suitable locations directly over the original alignment, the search was broadened to include an area of around 100 metres either side of the alignment. This identified locations at:

- Adelaide Road in the London Borough of Camden;
- Alexandra Place West, also in Camden; and
- Salusbury Road in Brent.

5.31 These have been included in the proposed route. A slight realignment of the tunnel enables it to pass directly beneath the shaft locations, bringing it closer to the alignment of the West Coast Main Line. The tunnel would also be deeper, requiring about 35 metres between the tunnel and ground level to accommodate the necessary equipment. Each of the shafts would also be used for the tunnel linking HS2 to HS1. For that purpose, the shaft at Adelaide Road would be a larger construction than the other shafts.

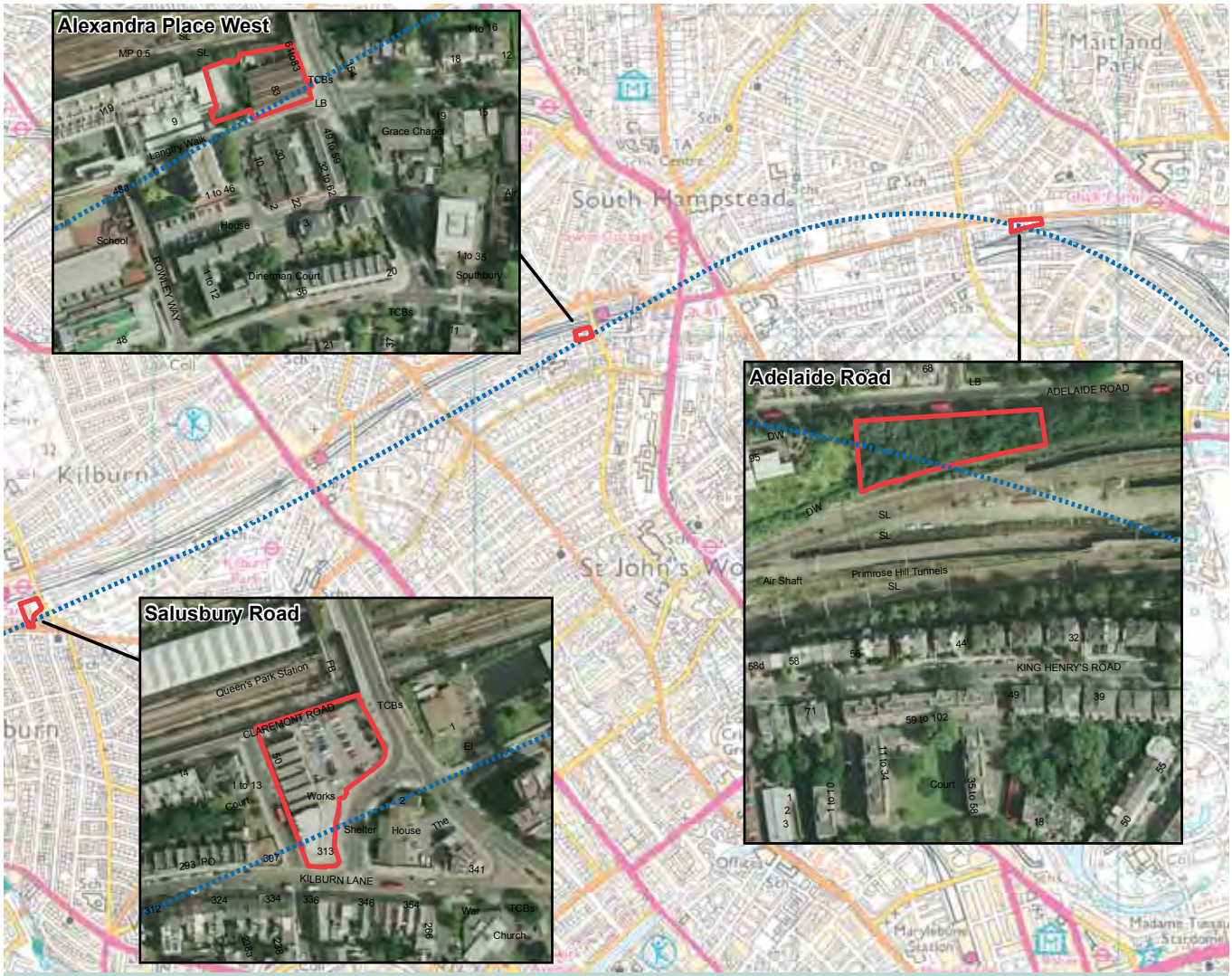


Figure 5.10 – **Proposed vent shaft locations for the London tunnel**

Proposed Tunnel Through the Chilterns

5.32 Four vent shafts would be required for the proposed tunnel through the Chilterns. HS2 Ltd focussed on identifying locations along the alignment where a shaft could be sited (for example where a road crosses or passes the alignment), and sites in lower lying ground than its immediate surroundings to minimise visual impact.

5.33 Following this process, HS2 Ltd has included the following proposed locations in the line of route:

- North-east of Chalfont Common;
- West of Chalfont St Giles;
- North of Chalfont St Giles; and
- South of Amersham.

5.34 Three sites would be located within the Chilterns AONB and within Green Belt designated land. The Chalfont Common site would be located outside the AONB but within Green Belt and the Colne Valley Park. HS2 Ltd would work with local partners to develop more detailed locations and landscaping proposals to integrate the structures with the surrounding environment and minimise local impacts. They would also incorporate protection of the chalk stream of the River Misbourne during construction, and from run-off from the completed site, into the detailed design of the shaft south of Amersham.

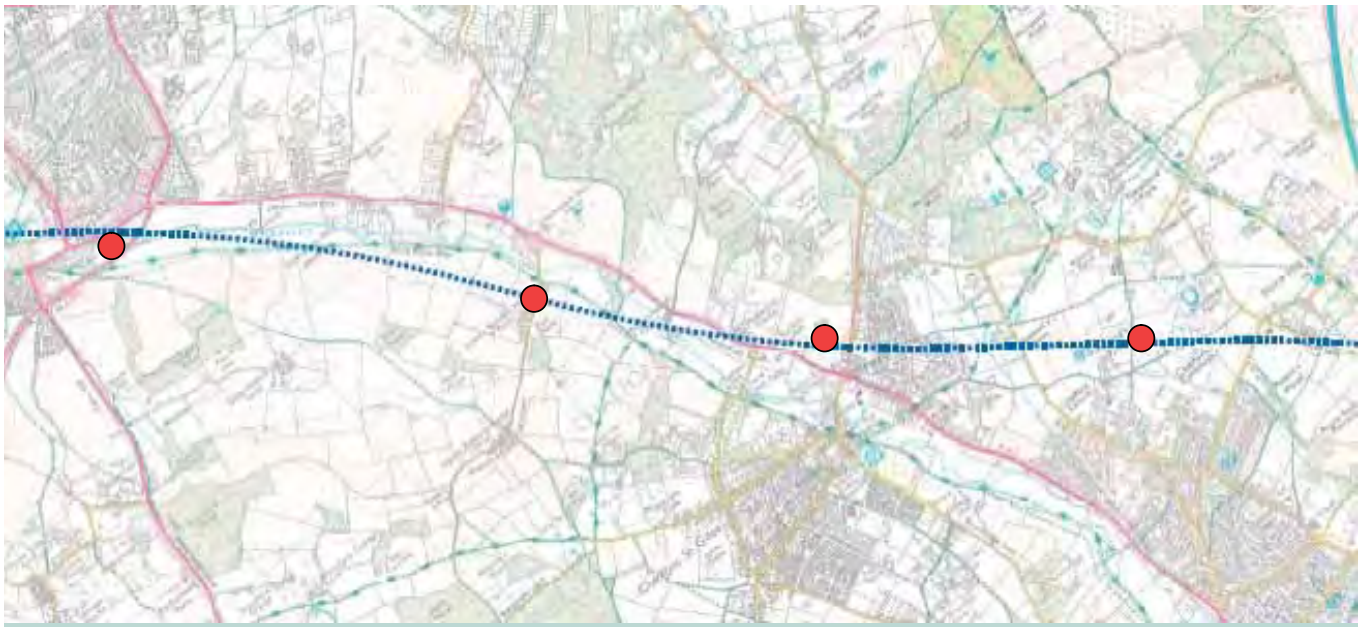


Figure 5.11 – **Proposed areas for vent shafts for the tunnel through the Chilterns**

Depots

5.35 HS2 Ltd identified a need for two major depots on an initial London – West Midlands HS2 line: an infrastructure maintenance depot for track repair and maintenance, and a rolling stock depot.

Infrastructure Maintenance Depot

5.36 An infrastructure maintenance depot would be needed as a base for maintenance of the track, signalling equipment, cuttings and embankments, and other elements of the HS2 infrastructure.

5.37 The depot would need to be located midway between London and the West Midlands to allow reasonable access to all sections of track. It would also need access to the classic rail network so that heavy rail machinery and supplies could be brought to the site without being delivered by road or affecting the service pattern on the proposed line.

5.38 An examination of the route identified only one area which fitted these requirements – where the route would cross the Bicester to Bletchley railway. Six sites were considered in the area around Calvert, and a seventh site around six miles away near Mixbury. A comparison of all sites identified the site at Figure 5.12 (below) as being the most favourable as it afforded excellent access to both lines and was located in a position which would minimise impacts on local communities. This location has been included in the line of route for consultation.

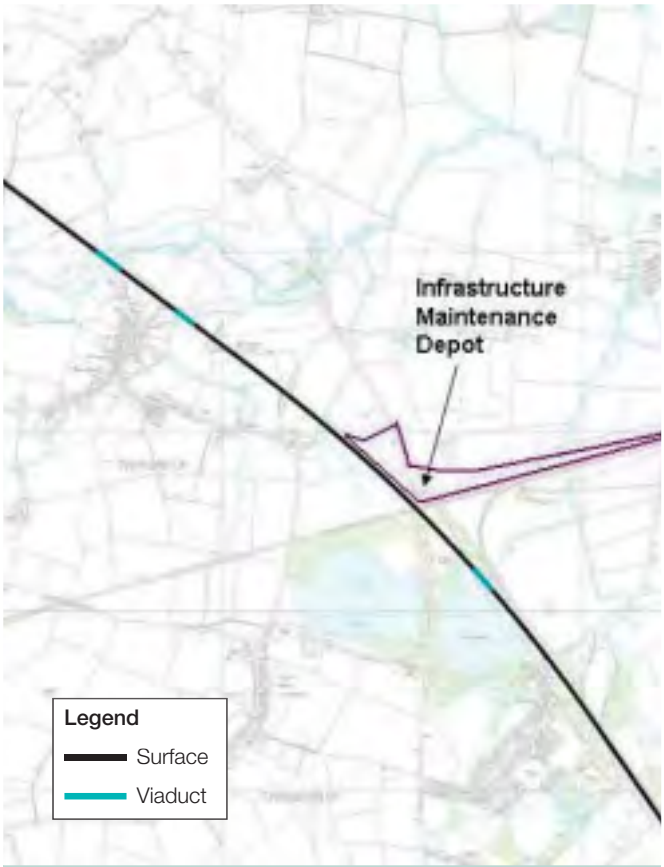


Figure 5.12 – **Proposed location of infrastructure maintenance depot**

5.39 The depot would be approximately 1000 metres long and 100-200 metres wide. It would need to be suitable for 24 hour operation, and would be used intermittently throughout the day and night for low level activities, such as plant maintenance, train formation and material deliveries. Efforts would be made to keep any local impacts to a minimum. The depot would employ in the region of 250 people.

5.40 The depot could result in some additional local noise and would need to be permanently lit, although the location and detailed design of the depot would mitigate impacts on local people.

Rolling Stock Depot

5.41 A rolling stock depot would be needed to service and maintain the trains operating on HS2. The key criteria for an HS2 rolling stock depot are:

- a location close to, and with a direct connection to, the HS2 route;
- a sufficient size (to allow more than half of both of the classic-compatible and dedicated HS2 fleets to be serviced each night) and ideally with space for expansion in consideration of the longer term network;
- fit with geography of the longer term strategy; and
- local appropriately skilled labour.

5.42 In addition to this, a depot would need to be at one end of the route so that trains could terminate and move straight to the depot, rather than having to undertake a further journey whilst empty to reach the depot, which could affect passenger services. HS2 Ltd concluded that the West Midlands end of the route provides greater advantages with respect to availability of suitable sites and appropriately skilled labour. The West Midlands end of route was therefore taken forward for consideration of rolling stock depot locations.

5.43 HS2 Ltd identified eight potential locations in the West Midlands for the depot; six on brown-field sites and two on green-field sites. These sites were then considered in consultation with local authorities. The proposed location for the depot is at Washwood Heath in Birmingham, on a site previously used for railway works. This site was rated consistently higher than other options on location, environmental and technical criteria. Figure 5.13 below shows the location of the Washwood Heath site.

5.44 The site at Washwood Heath would be around 2000 metres by 500 metres. It would require the demolition of around 30 dwellings, as well as the loss of a number of commercial premises. HS2 Ltd would seek to keep this to a minimum and would work with Birmingham City council, as well as with local residents and businesses, to help to minimise disruption to the local community. It would be a secure site, with 24 hour operation, seven days a week, meaning some potential additional noise and light pollution, although detailed design of the depot would mitigate this. It would employ around 300 people locally.

5.45 HS2 Ltd is developing proposals for a wider network to Manchester and Leeds. If the outcome of that work were to identify additional rolling stock maintenance requirements at Washwood Heath, this would require the design to be altered, increasing the size of the depot, but also increasing local employment opportunities.

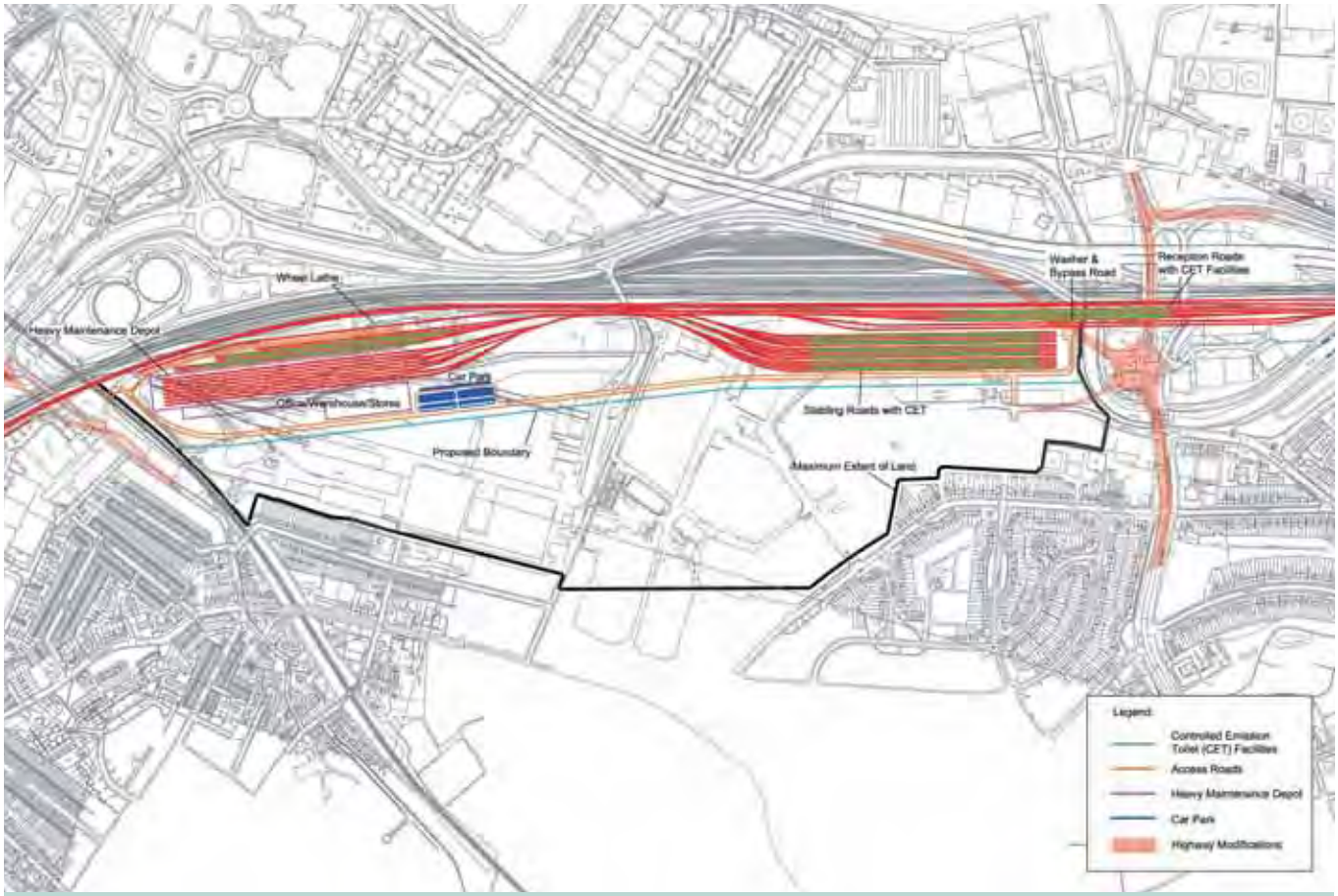


Figure 5.13 – **Proposed Rolling Stock Depot**

Power Supply

5.46 HS2 trains would be powered by electricity delivered at high voltage using wires suspended above the railway. About every 30 miles (50km) the wires would be connected to the National Grid to obtain a power supply, typically at locations close to an existing pylon route to minimise disruption and the need for additional infrastructure. A 'feeder station' would be constructed at this location to house electrical equipment that protects and controls the power supply. The site would be approximately 100 metres by 100 metres, designed to be secure from trespass and vandalism, and would require road access. Locations would be agreed with National Grid and local partners as part of detailed design work.

5.47 Every six or seven miles (10km) intermediate 'Autotransformer stations' would also be required to strengthen the power supply. These would, however, be considerably smaller than a feeder station, approximately 50 metres by 20 metres, and would sit within the footprint of the railway.

5.48 This type of electrification infrastructure is found all around the world without adverse effect on railway users and local people. Locations for all electrification equipment would be chosen with the aim to minimise the visual impact.

Construction

5.49 Subject to the outcome of consultation it is proposed that an initial London – West Midlands HS2 line would open in 2026, with mobilisation and construction beginning early in the next parliament, and a period of testing and commissioning taking place from early 2024.

5.50 HS2 Ltd has made a number of assumptions about how the proposed line would be constructed, but detailed consideration of the construction programme would follow once further design work had been undertaken. The detailed work programme would also depend on how the works are packaged and procured. That would inform the location of worksites, how construction materials would be transported, and the construction programme, both for the whole project and for specific worksites. At that stage, HS2 Ltd would formulate comprehensive and detailed proposals for mitigation of the impacts of construction both for the line of route as a whole and at a local level.

Contract packaging and procurement

5.51 HS2 Ltd has assumed that, at the highest level, construction would be split into packages of a manageable size and a similar contract value, covering:

- Euston Station;
- London Tunnels & Old Oak Common, including the HS1 link;
- Northolt Corridor (from Old Oak Common to West Ruislip);
- Colne Valley and the Chiltern Tunnels;
- Central Area (Amersham to Burton Green);
- West Midlands and Birmingham; and
- Railway Systems (System-wide).

5.52 These package areas would be sub-divided into further packages to create contracts of approximately equal value wherever possible, except for those that are of sufficient size or complexity to justify a single contract package.

Worksites and transportation of materials

5.53 The size and location of specific temporary worksite areas necessary to construct HS2 (London – West Midlands) would be tailored to the type of construction work. Along the route there would be a number of relatively small sites created for the period needed to establish earthworks or build specific structures such as bridges or viaducts. More substantial worksites would be necessary for the construction of stations and the long tunnels. The location and design of these would be determined following the development of plans for the supply of materials and removal of surplus spoil. It is envisaged that the construction of stations would not need acquisition of significant additional land other than that needed for the station site itself.

5.54 Worksite locations would be identified to make maximum practical use of existing rail and principal highway routes for materials supply. However, in some instances less accessible work sites may need to be served by new temporary junctions from existing trunk routes or enhancement to more minor roads, in

order to mitigate effects on local areas. It is intended that maximum use would be made of the route of the proposed new railway itself to transport materials and move spoil either for re-use or onward disposal. Proposals for construction logistics would be developed in conjunction with highways authorities and other interested bodies to minimise the effect of these temporary works.

5.55 System-wide railway elements such as track, signalling and power line construction would be most efficiently achieved through building progressively along the line of the railway once the civil engineering structures and earthworks had been well advanced. HS2 Ltd would expect that generally work would progress working out in both directions from a small number of locations with existing connections to the rail network.

Construction programme

5.56 The overall timescale of the construction programme for HS2 (London – West Midlands) would be determined by the Euston Station works, which would take between seven and eight years to construct given the need to maintain the existing railway operations through the construction period. The tunnelling works in the Chilterns and in London would be in progress throughout a substantial part of that period.

5.57 Elsewhere, most localities along the route would not see such a prolonged period of active construction, with many of the contract packages along the line of route being delivered within around two years.

5.58 The system-wide installations which cover the entire length of route would be carried out towards the end of the overall construction period.

Mitigation of the impacts of construction

5.59 Many people may have concerns about the potential impacts of construction, including noise impacts, dust and dirt from construction sites, local road diversions, and increased lorry movements on local roads. HS2 Ltd is committed to working closely with local authorities and communities to draw up a comprehensive and detailed package of measures to address potential impacts and mitigation, including remediation and restoration following the completion of construction works.

5.60 HS2 Ltd is developing a Code of Construction Practice that would define the principles of approach and conduct, and detailed measures that contractors would be required to comply with in order to minimise impacts during the construction period.

Protecting the Environment and Promoting Growth

5.61 This section describes the implications that the proposed route would have for sustainability, including local communities and landscapes. It also describes a range of mitigation measures that have already been included in the proposed route and outlines further measures that would be appraised for the purpose of formulating a comprehensive package of mitigation during the detailed design phase.

The findings of the Appraisal of Sustainability

5.62 As stated above, the design of the proposed route has been firmly focused on sustainability and addressing environmental and social issues. That said, some adverse impacts on the environment and local people would be likely to be unavoidable. There will also be positive effects. Both are summarised below:

Greenhouse Gases

5.63 As set out in Chapter 2, HS2 could provide a relatively low carbon form of transport, offering the opportunity to deliver a major improvement in capacity and journey time between our major cities to support economic growth, without an increase in carbon emissions.

5.64 The overall effect on carbon emissions of the initial London – West Midlands HS2 line would depend on a number of factors including the carbon efficiency of electricity generation and the level of modal shift achieved, particularly from aviation. Under the best case scenario, the proposed line would result in a total reduction in carbon emissions of 28 million tonnes over 60 years.

5.65 Even on the most pessimistic scenario in which the carbon efficiency of electricity generation remains constant and no modal shift is achieved, the overall increase in carbon emissions over 60 years would be 24 million tonnes over the same period. This is equivalent to around 0.4 million tonnes a year – just 0.3 per cent of total current annual domestic transport emissions.

Sustainable Communities

5.66 HS2 (London – West Midlands) would require the redevelopment of Euston station, which would also, as recognised by the Mayor of London and Camden Council, potentially act as a catalyst for the regeneration of the Euston area as a whole. In order to achieve this, however, substantial property demolition would be required, including around 200 dwellings largely in 4 local authority-owned blocks of flats on the Regent's Park Estate. It would also be necessary to take part of St James Gardens. The immediate effect of this upon the local community at Euston could be significant.

5.67 If the scheme were to go forward, HS2 Ltd would work closely with the London Borough of Camden and the GLA with the intention of agreeing a joint ambition for the Euston area.

5.68 HS2 Ltd is also committed to working closely and at an early stage with the London Borough of Camden and the GLA and with community groups, residents' associations and affected residents in the Euston area generally to ensure that effective arrangements would be put in place to meet the housing needs of those affected by demolition of these dwellings, and to help to address any wider impacts on the local community. This would include working with LB Camden to ensure demolished properties were replaced with new, high quality social housing with access to local amenities.

5.69 Other communities in London affected by potential demolitions include those along the route between Old Oak Common and West Ruislip, where around 15 residential properties would be demolished. In

addition, an estimated seven properties would need to be demolished to construct the vent shaft at Alexandra Place West.

5.70 In Birmingham around 30 dwellings would need to be demolished to make way for the rolling stock maintenance depot at Washwood Heath. A similar approach to that proposed at Euston, involving close working between HS2 Ltd and Birmingham City council and with local residents and businesses would be undertaken to help to minimise disruption to this community.

5.71 Elsewhere property demolitions, although significant to those people directly affected, would be relatively low in number.

5.72 There would be localised disruption along the route during construction. HS2 Ltd would develop and implement a code of practice that would contractually bind the companies building the route to reduce impacts to a practicable minimum and protect the environment and the amenity of people along the proposed route.

5.73 During operation railway noise could affect people living along the proposed route. HS2 Ltd's further appraisal work has made some assumptions about what could realistically be achieved through additional mitigation, such as noise barriers. This has established that high noise levels would affect only around 10 dwellings along the entire line of route. Approximately 150 properties would be likely to experience levels of noise which would qualify for noise insulation under Noise Insulation Regulations. Up to 4,700 dwellings on the proposed route corridor would be likely to experience a noise change of 3 decibels or more (3dB being a just perceptible change in total noise over an assessment period) and resulting in a daytime noise level of 50 decibels or more (termed a 'noticeable' noise change). Further detail of these assessments can be found in the Appraisal of Sustainability.

5.74 Experience from HS1 and other high speed railways shows that potentially significant effects from vibration and ground-borne noise (audible vibration) in properties over tunnels can be avoided. The engineering design of HS2 will build on this experience and it is not expected that there will be significant effects on properties above tunnels.

Landscape, townscape and cultural heritage

5.75 The proposed route between London and the West Midlands would include around 140 miles (225km) of new railway, passing through a variety of metropolitan, suburban and rural areas. Surface sections follow existing railway and road corridors for around 34 miles (55km). Tunnels, totalling some 18 miles (29km), would be provided to pass through hilly ground and to avoid the densest population in London. Green bridges have been proposed in rural areas and adjacent to certain villages. The proposed route has been lowered in places and around 56 miles (90km) is now in deep or very deep cutting. Around 53 miles (85km) would be at ground level or on embankment and around 12 miles (20km) would be on viaduct.

5.76 The Chiltern Hills, much of which is designated as an Area of Outstanding Natural Beauty (AONB) would be crossed predominantly in tunnel and deep cutting, with some short elevated sections variously on embankment and viaduct to the south of Wendover where the route is in close proximity to the A413 and

Chiltern Railway. Some visual impact would be inevitable but, of the 12.5 miles of railway through the AONB, all but 1.2 miles (2km) would be either in tunnel, in cutting and/or in the corridor of the A413 main road. Extensive tree planting, as well as the creation of planted earth mounds or 'bunds', carefully blended into the contours of the landscape, would help to further screen views and integrate the railway into the landscape. Overall HS2 Ltd expect to plant more than two million trees along HS2.

5.77 Refinements to the route have ensured that no Grade 1 or Grade II* historic buildings would be demolished, although the setting of three Grade II* buildings would be likely to be affected. Fifteen Grade II listed buildings would need to be demolished. Some listed structures in the Euston area would need to be relocated and the design of Euston Station and its associated development over the station would need to take into account the setting of the Euston Gardens and northern part of the Bloomsbury Conservation Area. The route would pass through three Registered Parks and Gardens along the route, at Hartwell House, Shardeloes and Stoneleigh Abbey. However in each case further route refinement has been undertaken to limit the landtake and effects upon the settings of these features.

5.78 Two protected sites of importance for archaeology would be directly affected. These scheduled monuments, Grim's Ditch in the Chilterns and a Roman villa site in the vicinity of Edgcote would be subject to prior archaeological investigation and academic study, in line with Government guidance.

5.79 No internationally protected sites of ecological interest would be adversely affected and impacts to nationally protected sites are restricted to just a few locations. Partial landtake would be required from the Helmsdon Disused Railway site of special scientific interest (SSSI), and a number of locally designated sites and important habitats, such as ancient woodlands, would be directly affected. Where sites of ecological interest and local importance are considered likely to be affected, further work would be undertaken during more detailed design, and management plans would be drawn up and implemented to help minimise adverse effects on biodiversity.

5.80 The new railway would present a major opportunity to reinforce and enhance biodiversity. It would provide a green corridor to be colonised by plants and animals, and could link with and form connections between existing habitats. There would, however, be adverse effects at a number of sites, including Mid Colne Valley and River Blythe SSSIs (although in both cases the impacts would be limited as the proposed line would cross the sites on viaduct, and there would be potential for further mitigation to be identified as part of more detailed design work).

5.81 Where the proposed route would cross rivers it has been designed to take account of future flood risks by the inclusion of structures to bridge these areas. In some places, the proposed route would pass in tunnel through important ground water resources, for example the chalk stream of the River Misbourne. Measures to protect these would be incorporated during construction and operation to reduce such risks to a minimum.

Sustainable consumption and production

5.82 The proposed new railway would make good use of land that has had a previous industrial or railway use, with around 146 hectares of previously developed brown-field sites being brought back into productive use. However, some productive agricultural land would be lost. Although the most important Grade 1 land would not be affected, the proposed route would pass across Grade 2 agricultural land for some 12 miles (20km). Further work would be undertaken during later design stages to examine how agricultural landtake could be reduced.

5.83 Construction of the proposed scheme would generate and consume large quantities of materials and opportunities would be taken to re-use spoil as part of embankments and landscaping.

Mitigation of impacts

5.84 A range of measures could be employed to mitigate the impacts described above. Where adverse impacts have been identified, the AoS has enabled the introduction of mitigation into the design: for example by prompting shifts in the alignment of route options away from sensitive features, and by identifying possible mitigation options that might be considered as design detail increases. As part of this, HS2 Ltd would look to use earth moved during construction to create bunds to shield properties from noise and visual impact. This should significantly reduce the noise impacts, although it would not be possible to mitigate the impacts entirely.

How impacts on local people and the environment could be mitigated

Were HS2 to be taken forward, HS2 Ltd would work closely with local groups and relevant advisory bodies to identify the most appropriate ways to mitigate the impacts of the line on local people and the environment. That would include:

- Developing a Code of Construction Practice to minimise the impacts during the construction period.
- Sustainable re-use of materials, for example using spoil from tunnels and cuttings for noise bunds and landscape screening.
- Noise barriers constructed alongside the line.
- High quality design of structures to fit with the landscape.
- Planting to encourage and sustain biodiversity.
- Proposals developed with relevant advisory authorities and, for example, local wildlife trusts and community groups.

5.85 If the scheme is taken forward, further consideration would be given to mitigation and how this is best developed, refined and incorporated into the design and into the way that HS2 (London – West Midlands) would be built and operated. Such mitigation options cannot be identified in full or committed to at this stage, since they rely on design detail that has not yet been developed. For example, to design the provision of noise barriers alongside the route would first require assessments of noise impacts. Appropriate local mitigation would be discussed and agreed with local authorities and communities through ongoing local consultation processes.

Regeneration and Growth

5.86 The initial London – West Midlands HS2 line would present major opportunities for regeneration and growth at key locations along the route. Stations are proposed at Euston, Old Oak Common, and Birmingham Curzon Street, each of which is identified in existing plans as a key regeneration or growth area. The potential for HS2 to contribute to the implementation of regeneration and development proposals at or around these locations is recognised in emerging planning policy. Although the new Birmingham Interchange station would be constructed on open land designated as Green Belt, this is the most appropriate location for the interchange as it is adjacent to the motorway network, Birmingham Airport and the NEC. Solihull Metropolitan Borough Council supports the principle of a high speed rail link and one of its key objectives is supporting the continued economic success of key regional assets, including Birmingham Airport and the NEC.

5.87 Experience shows that high speed rail stations present opportunities to enhance existing regeneration areas and support regeneration and growth in other new locations, due to their ease of access to city centres, airports, and other transport systems such as underground rail, buses and taxis. They can help to attract visitors and investment, seeing new businesses, office development, hotel and conference centres emerging, alongside the creation of new residential districts, improved public space and accessibility for pedestrians and cyclists. An example is the redevelopment of St Pancras station, to accommodate HS1 services to Europe, and regeneration at Kings Cross. In Lille, the thought given by local planners to the internal transport links alongside high speed rail contributed to the success of the Euralille district.

5.88 The proposed HS2 terminus at Euston station would present a major opportunity for regeneration, acting as a catalyst for the area to achieve its potential of providing 1,000 new homes and 5,000 new jobs, as recognised by the Mayor of London. New development including residential and business uses, streets and public spaces could be created above the proposed new platforms. Improvements to the interchange between rail, bus and taxis could be put in place and current estimates suggest that HS2 could contribute to the creation of 2,000 jobs in the area.

5.89 The development of an HS2 station at Old Oak Common would create a major interchange providing connections between HS2, Crossrail, Great Western Main Line services and to HS1. The interchange would support regeneration and growth at Old Oak Common and the wider area, acting as a catalyst to transform the existing industrial area and surrounding neighbourhoods, providing new housing and major employment opportunities. The London Borough of Hammersmith and Fulham (LBHF)'s vision is to transform the area with substantial mixed use regeneration, having the potential to provide 1,600 homes and 5,000 new jobs. Over the wider area, current estimates suggest that the proposed HS2 interchange at Old Oak Common has the potential to contribute to the creation of 20,000 jobs.

5.90 The development of Birmingham Interchange station will support and create growth opportunities close to

Birmingham Airport, the National Exhibition Centre and the existing Birmingham International rail station. The interchange would provide enhanced access to the airport for HS2 passengers, and would improve connections for a wide range of travellers to and from the West Midlands. As investment and businesses are attracted to the area, estimates suggest that HS2 could contribute to the creation of 3,800 jobs.

5.91 The proposed HS2 terminus at Birmingham's Curzon Street would be situated within the Eastside regeneration area. The construction of the station would create a landmark gateway to Birmingham, with wider redevelopment of the area taking place in parallel, creating new opportunities, including contributing to the creation of 4,500 new jobs, and new homes.

5.92 Opportunities for enhanced commuter services on the West Coast Main Line would support regeneration and growth in areas between the major cities, such as Northampton, Milton Keynes and Coventry.

5.93 If the scheme is taken forward, HS2 Ltd would work collaboratively with local authorities and other stakeholders, including local communities, to shape plans for areas where there are regeneration opportunities to maximise benefits.

Your views on proposed line of route for HS2

5.94 This section has set out in detail the proposed route for the initial London – West Midlands HS2 line, including the environmental and social impacts and how these could be mitigated.

5.95 The Government believes that HS2 (London – West Midlands) could deliver major economic benefits, and opens up the prospect of more significant benefits as the first stage of a wider high speed network. It also believes that many of the environmental impacts of the proposed route, although significant to local people, could be mitigated effectively. The Government believes that there is a strong case for proceeding with the proposed route for the initial London – West Midlands HS2 line.

Consultation Question:
Do you agree that the Government's proposed route, including the approach proposed for mitigating its impacts, is the best option for a new high speed rail line between London and the West Midlands?

Consultation Question:
Do you wish to comment on the Appraisal of Sustainability of the Government's proposed route between London and the West Midlands that has been published to inform this consultation?

PART 3

6. Responding to the Consultation

This consultation seeks views on the proposed national high speed rail strategy described in Part 1 and on the proposed line of route for an initial London – West Midlands line set out in Part 2.

The questions on which the Government is seeking views are set out below. In each case, the Government is interested in whether or not you agree with its proposals and why, as well as any additional evidence that you feel it should consider in reaching its final decisions.

i) **This question is about the strategy and wider context (Chapter 1):**
Do you agree that there is a strong case for enhancing the capacity and performance of Britain's inter-city rail network to support economic growth over the coming decades?

ii) **This question is about the case for high speed rail (Chapter 2):**
Do you agree that a national high speed rail network from London to Birmingham, Leeds and Manchester (the Y network) would provide the best value for money solution (best balance of costs and benefits) for enhancing rail capacity and performance?

iii) **This question is about how to deliver the Government's proposed network (Chapter 3):**
Do you agree with the Government's proposals for the phased roll-out of a national high speed rail network, and for links to Heathrow Airport and the High Speed 1 line to the Channel Tunnel?

iv) **This question is about the specification for the line between London and the West Midlands (Chapter 4):**
Do you agree with the principles and specification used by HS2 Ltd to underpin its proposals for new high speed rail lines and the route selection process HS2 Ltd undertook?

v) **This question is about the route for the line between London and the West Midlands (Chapter 5 and Annex B):**
Do you agree that the Government's proposed route, including the approach proposed for mitigating its impacts, is the best option for a new high speed rail line between London and the West Midlands?

vi) **This question is about the Appraisal of Sustainability (Chapter 5):**
Do you wish to comment on the Appraisal of Sustainability of the Government's proposed route between London and the West Midlands that has been published to inform this consultation?

vii) **This question is about blight and compensation (Annex A):**
Do you agree with the options set out to assist those whose properties lose a significant amount of value as a result of any new high speed line?

Responding to the consultation

The consultation closes on Friday 29 July 2011. Responses cannot be accepted after the closing date.

Online:

You can provide your answers online via the High Speed Rail Consultation website at:

http://highspeedrail.dft.gov.uk

By response form:

You can complete the response form and send it by post to the address below. Copies of the response form can be requested from:

Telephone: 0300 321 1010
http://highspeedrail.dft.gov.uk

By post:

Freepost RSLX-UCGZ-UKSS
High Speed Rail Consultation
PO Box 59528
London
SE21 9AX

All responses must include your name and organisation (if applicable).

Confidentiality and data protection

Information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the access to information regimes (these are primarily the Freedom of Information Act 2000 (FOIA), the Data Protection Act 1998 (DPA) and the Environmental Information Regulations 2004).

If you want information that you provide to be treated as confidential, please be aware that, under the FOIA, there is a statutory Code of Practice with which public authorities must comply and which deals, amongst other things, with obligations of confidence.

In view of this it would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded as binding on the Department or HS2 Ltd.

The Department and HS2 Ltd will process your personal data in accordance with the DPA and in the majority of circumstances this will mean that your personal data will not be disclosed to third parties.

Finding out more

A series of public roadshows will be held along the line of route. Further details are available on the consultation website and will be advertised locally.

Additional copies of consultation materials can be ordered from:

Telephone: 0300 321 1010
http://highspeedrail.dft.gov.uk

If you require any further information about the consultation please call 020 7944 4908 or email hs2enquiries@hs2.gsi.gov.uk

Annex A: Blight and Compensation

1. This annex describes the existing statutory mechanisms in place for providing assistance to property owners affected by construction projects such as a new high speed rail line. It also discusses the approach and options for additional assistance the Government is considering providing to the owners of properties which experience a significant diminution in value as a result of proximity to any new high speed rail line between London and the West Midlands.

2. Blight is a term used to describe the impact on the property market when a piece of new infrastructure is being planned which might impact on properties. The term "blighted land" is defined in statute and applies (amongst other things) to land which is safeguarded because it is required to build new infrastructure. This is often referred to as "statutory blight". The term blight can also be used to mean generalised blight. This is not legally defined but is a term used to describe the impact on the property market in a certain area as a result of the perceived impacts of a proposed or planned new development.

Safeguarding

3. If, following public consultation, a decision is taken to proceed with a high speed line, at the point that the Secretary of State for Transport confirmed the line of route the next step would be to safeguard the land required to build the line. The safeguarding of land is an established process within the planning regime in which the Secretary of State directs local authorities to safeguard portions of land for a particular development.

4. Before issuing safeguarding directions the Government would consult affected local authorities and other interested parties. This would be likely to run for around 12 weeks in early 2012. Subject to the outcome of the consultation the safeguarding directions would then come into force. This means that local authorities have to consult with the Secretary of State and others named in the safeguarding directions before granting planning approval for land within the safeguarded area.

5. For home owners, the safeguarded area would be the first formal indication of where land and property might need to be compulsorily purchased in order to build the new line.

Statutory blight

6. Statutory blight provisions would become available to qualifying property owners within a safeguarded area from the date at which any safeguarding directions are made.

7. Under the Town and Country Planning Act 1990, qualifying property owners of blighted land can serve a blight notice on the appropriate authority (which in the case of high speed rail would be the Government), which requires the authority to consider buying their property in advance of any compulsory purchase. In deciding how to respond to such a notice the

Government would take into account, amongst other things, whether the property would need to be compulsorily purchased or would otherwise be rendered uninhabitable by the existence of a new line. The purpose of the provisions is, in effect, to enable property owners to bring forward the compulsory purchase of their property, rather than remaining in the property until compulsory purchase orders are made.

8. More information about compulsory purchase and statutory blight, including the categories of property which qualify for protection under statutory blight arrangements, is available on the Department for Communities and Local Government website at: www.communities.gov.uk/publications/planningandbuilding/compulsorypurchase.

Statutory compensation

9. Under Part 1 of the Land Compensation Act 1973, people would be entitled to claim for loss of value on their property due to the impact of 'physical factors' from the operation of any new high speed line (known as Part 1 claims). Physical factors mean noise, dust and vibration, smell, fumes, smoke, artificial lighting, and the discharge of substances onto land. Compensation is available for owner-occupiers of residential properties, small businesses[16] and agricultural units.

10. Claims could be submitted once the railway line had been open for a year – this allows the actual impact of the infrastructure to be understood, and gives time for that impact to be reflected in the property market. It is typical for affected property prices to recover somewhat during this period – as the 'uncertainty effect' disappears.

11. The level of compensation to be paid would be assessed by professional, independent valuers using recognised procedures. A dispute over the level of compensation payable may be referred to the Lands Tribunal.

Generalised blight

12. Generalised blight is a term used to describe the impact on the property market in a certain area as a result of the perceived impacts of a proposed or planned new development.

13. Blight of this kind is strongly associated with fear of the perceived impacts from a future development before the actual impacts are known, often coupled with uncertainty as to what property owners who do experience impacts once a development is built would be entitled to claim in compensation.

14. The Government recognises that the proposals for a new high speed rail line between London and the West Midlands have inevitably given rise to generalised blight in some areas along the proposed line of route. Experience of past major infrastructure projects has shown that the effect of blight is strongest at the point of most uncertainty and least definite information.

15. At this formative stage of the high speed rail proposals there is understandably a considerable amount of fear and uncertainty within communities about what impact a line, if built, would have

16 Currently those with an Annual Rateable Value not exceeding £34,800.

on the areas along its route. The blight situation in these areas would be expected to improve over time as more became known about plans for any new high speed rail line and more detailed measures were developed to mitigate impacts such as noise. But the Government is aware that, if a decision is made to go ahead with a new high speed line, blight may well continue to have a detrimental effect on the property market in areas along the proposed route.

16. Because of this, the Government is considering whether additional support arrangements for property owners may be appropriate, if a decision is taken to go ahead with a new high speed line, in addition to those already provided under the statutory blight and compensation provisions.

17. Such additional – or 'discretionary' – support arrangements would be available to those whose properties were unlikely to need to be compulsorily purchased in order to build a new line, but who may still experience a significant loss in the value of their property as a result of its proximity.

Approach to discretionary support arrangements

18. The Government is considering the following issues in determining the most appropriate discretionary support arrangements for affected property owners. The Government would welcome views and comments on these issues to inform the development of a preferred approach to be consulted on in early 2012.

- **Assisting those whose properties lose significant value**
  The Government is considering its approach to discretionary support arrangements and in particular how to assist members of the general public if they bear a significant reduction in the value of their property as a result of a new high speed line.

- **Enabling the normal functioning of the property market**
  The Government is interested in whether there is a case for taking action to ease the effects of blight by introducing a scheme which allows the property market in areas close to the proposed route to function as normally as possible, and if so how this would best function.

- **Reassuring now that fair compensation will be paid**
  The Government understands that people are concerned and unsure about what compensation they would be entitled to if and when a new high speed rail line is built, and wants to offer people real reassurance now that they will be treated fairly. The Government will consult in early 2012 on its preferred approach for minimising blight and for providing additional compensation for blight effects of a new high speed line, so that decisions can be taken as soon as possible to reduce uncertainty for affected property owners.

- **Enabling people to stay in their homes and communities**
  The Government believes that encouraging substantial numbers of people to sell their properties and leave an area would have a detrimental effect on local communities. Additionally, many people may have no wish to move home, but are concerned about

the effect a new railway line might have on future value of their property. The Government is considering whether it could make it easier for people to stay in their homes if the potential impact from a new line could be mitigated as far as possible, and if steps can be avoided which encourage or incentivise people to move home unnecessarily.

- **Avoiding Government owning large numbers of properties**
  While a certain number of properties would inevitably need to be purchased in order to build a new line, the Government considers that it is unlikely to be in the local or national interest for the state to buy up large numbers of properties in the areas near the proposed route which would then need to be managed, tenanted and eventually sold on. This could disrupt the property market and contribute to its stagnation, and the presence of many tenanted rather than owner-occupied properties may have an effect on community life and property values. Purchasing, maintaining and managing properties would also require significant outlay of public funds. The Government is considering whether purchasing properties along the proposed route can be avoided except where absolutely necessary.

Options for discretionary support arrangements

19. The Government is considering the different options available for discretionary support arrangements. These options have been developed building on the issues outlined above, as well as experiences from other major infrastructure projects. The Government wishes to offer these options for general comment and consideration, and to undertake further analysis, before taking a decision on which option should be taken forward for further consultation.

Statutory scheme

20. The existing legal framework for both statutory blight (prior to construction of a new line) and statutory compensation (following construction of a new line) has been explained earlier in this chapter. It would therefore be an option for Government to do nothing to supplement the existing statutory arrangements. However the Government has made clear its intention to introduce additional discretionary arrangements to support affected property owners.

Hardship-based property purchase scheme

21. One option for additional support would be a hardship-based property purchase scheme. Schemes of this type were used on the High Speed 1 (Channel Tunnel Rail Link) and Crossrail projects, and the current Exceptional Hardship Scheme (EHS) for HS2 is an example of such a scheme. A hardship-based property purchase scheme would supplement the statutory blight provisions so as to incorporate people outside the safeguarded zone who were nonetheless affected by generalised blight and suffered hardship as a result.

22. A scheme like this would be open to property owners who met certain eligibility criteria (these would need to be determined and would not necessarily be the same as those used for the EHS or under the statutory blight provisions). The property

owner would apply to the Government to purchase their property. If the criteria were met, valuations of the property would be carried out based on the property's unaffected market value and an offer to purchase the property would be made. The owner could then choose to sell their property to the Government at the agreed valuation.

23. Such a scheme would inevitably lead to the Government owning some properties which would not be needed for the construction of a new line, and which may need to be tenanted until such time as they could be resold. As outlined in the issues above, the Government is concerned about the effect this would have on the property market and local communities. The Government is therefore also considering options which do not involve property purchases.

Bond-based scheme

24. Bond-based property purchase schemes have been previously used by Central Railway Ltd (for its proposed rail freight line from Liverpool to Lille) and BAA (at Stansted and Heathrow). In such a scheme a qualifying property owner applies to the Government for a 'bond' or guarantee to purchase the property at a future date. Rather than leading to an immediate sale, the bond guarantees the holder that once a certain stage in the project has been reached, they will be able to sell their property to the Government at its unaffected market value. Because this option is transferable to new owners, it may give prospective purchasers the confidence to buy, thus helping the market to continue functioning.

25. Such a scheme may still lead to the Government owning significant numbers of properties in the longer term. The Government therefore wishes to consider whether the mechanism of the bond or guarantee can be applied not to property purchase but to a promise of compensation.

Compensation bond scheme

26. A compensation bond scheme would give property owners a guarantee that, if their property were to lose significant value as a result of a new high speed line, they would receive compensation for that loss after the line opened. Such a scheme would be a new approach rather than a tried-and-tested method.

27. In such a scheme a qualifying property owner would apply to the Government for a compensation guarantee certificate. This would provide people with a formal, Government-backed guarantee that if the property were to lose significant value due to a new line, the holder would be fairly compensated for that loss.

28. As with the existing statutory compensation rules, claims under such a guarantee could be made once the railway had been built and in operation for a year. This is because it is only at this point that the true impact of the railway could be properly understood, and accurately assessed by valuers.

29. Such a guarantee would be intended to provide comfort and reassurance for property owners in the period between any Government decision to proceed with the proposed high speed line and the date at which, in that situation, compensation assessments would become available. As a result, it should incentivise people living locally to the

proposed route to stay in their homes with a promise of compensation, rather than seek to move away. However, for those who wished or needed to move house before compensation became available, a guarantee would be transferrable to new owners in order to maintain confidence in the property market within blighted areas.

30. For any compensation-based approach, the level of compensation to be paid would need be assessed by professional, independent valuers. This is in line with the method currently used for statutory compensation payments. The methodology for calculating the extent of loss in value on any property is something that the Government would need to give further consideration to, and would welcome your views on.

What happens next

31. The Government is keen to hear your views and comments about the approaches identified and the options for a discretionary support scheme. The responses from this consultation will help to inform the detailed development of a scheme. This will include exactly what any scheme might look like, how it might operate, who would be eligible and how it would be administered.

32. If the Government decides to go ahead with a new line from London to the West Midlands, people would have another opportunity to have their say in a further consultation on a detailed scheme. This would be targeted at those living close to the line of route who would be most likely to have an interest in the proposal.

33. This consultation would be likely to begin in early 2012 – probably alongside consultation on safeguarding land – and would last around 12 weeks. It would give people who might be affected by a new rail line an opportunity to consider the most up to date and detailed information on the Government's intentions.

34. Following the consultation period, and after considering the responses, the Government would intend to launch any such scheme by summer 2012, at the same time as statutory blight provisions would come into effect.

The existing Exceptional Hardship Scheme

35. In August 2010 the Government launched the Exceptional Hardship Scheme (EHS). The EHS is available to eligible property owners who can demonstrate that they have an urgent need to sell but have been unable to do so, other than at a substantially reduced price, as a direct result of the announcement of the high speed rail proposals. Those property owners who apply to the EHS and meet the eligibility criteria can then have their property purchased by the Government at its unaffected realistic open market value (that is, what the value of the property would have been without any adverse effect arising from the high speed rail proposals).

36. The Exceptional Hardship Scheme was designed as a temporary measure to suit the particular set of circumstances following announcement of the route recommendation, but prior to final decisions on any route being made.

37. Whichever option for a new scheme is chosen, it is anticipated that the current EHS would close to new applications at the same time as any replacement

scheme opened (expected to be around summer 2012).

38. This would also align with the anticipated timing for the issuing of any safeguarding directions, which would make available the statutory blight provisions to property owners within the safeguarded zone.

Future phases of the network

39. This consultation document began by setting out the Government's strategy for a high speed rail network. The issues and options set out in this chapter relate to the first phase of such a network, a new line from London to the West Midlands. Route options for the second phase of the network, which would provide lines to Manchester and Leeds, are currently being prepared by HS2 Ltd.

40. Until the options for routes to Manchester and Leeds are known, and the potential effect of blight considered, it would be premature to decide what support arrangements may need to be put in place. Following publication of those route options the Government would consider, and consult on, the question of whether the approach taken for the first phase of the network would also be effective for lines further north, or whether an alternative approach would be more appropriate.

Consultation Question:
Do you agree with the options set out to assist those whose properties lose a significant amount of value as a result of any new high speed line?

Annex B: Alternative Options for HS2 (London – West Midlands)

1. This annex provides further detail on the options for stations and routes that HS2 Ltd considered, how these options were sifted, the main alternatives identified and the factors that it took into account in reaching its conclusions.

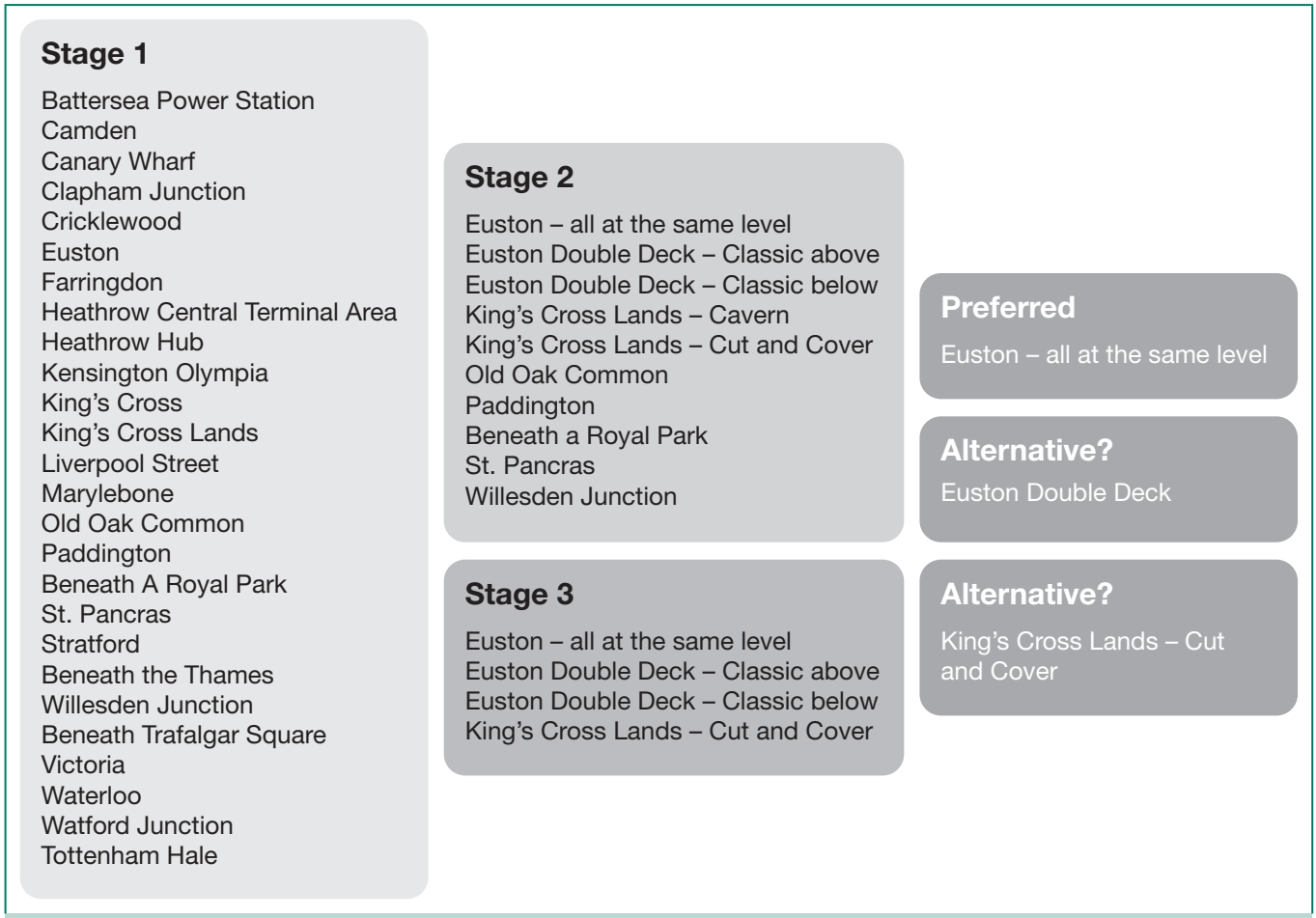


Figure B1 – **London Terminus sifting process**

London Stations and Connections

A London Terminus

2. Given the challenges in finding available development sites in Central London large enough to accommodate a high speed rail terminus station, HS2 Ltd cast its net widely in search of a location. It identified an initial 'long list' of 27 possible sites across London, including existing terminus stations in Central London, a number of sites outside of Central London, and Heathrow Airport.

Options for a London Terminus

The creation of the long list of options was informed by HS2 Ltd's assumptions about the required size of a London terminus for a London to West Midlands line, and for a potential wider network. They considered it would need a site large enough to accommodate 10 high speed platforms, 415 metres long and 12 metres wide, to allow up to 18 trains per hour. It would also require large enough concourse areas and platform access to cope with HS2's expected high passenger numbers. It would also require good public transport links to London's key destinations for onward travel and to minimise the impact upon the surrounding area. It should provide a safe and secure environment for users.

3. Canary Wharf, Farringdon, Kings Cross, Liverpool Street, Marylebone, Paddington, St Pancras, Trafalgar Square (Charing Cross) and Victoria stations were found to have insufficient platform length or capacity to accommodate high speed services, meaning that expansion on the surface would require the construction of an entirely new station. Whilst other options remained in play, HS2 Ltd judged that such a significant requirement for land on the surface was unacceptable given that they were in highly built up areas. Most stations in outer London were also ruled out as the longer interchange and journey time for most passengers to get to and from the stations would erode much of the benefits of the high speed line. Stations at Old Oak Common and Willesden were, however, retained given their potential to link to Crossrail.

4. This left options at Euston, Kings Cross Lands, Old Oak Common, a deep-tunnelled cavern at Paddington, a new station constructed above the existing St Pancras station, as well as options at Willesden Junction and beneath a Royal Park:

- Options beneath a Royal Park were not pursued as they were deemed to be difficult to justify in terms of their performance when compared to other options, and the widespread opposition likely to be generated against building in these nationally protected open spaces.
- A deep-tunnelled cavern at Paddington was not pursued as it was considered that excavating an underground cavern in the vicinity of the Paddington Basin would be a high cost and complex engineering challenge, and would pose a risk to buildings over a wide area, including the existing Paddington station.
- Options at St Pancras were not pursued further as they would have proved too disruptive either to the existing station – which would have to be completely closed during construction – or the local community.

- Willesden Junction and Old Oak Common were not pursued as a possible terminus as HS2 Ltd's demand analysis suggested that the additional time penalty for the majority of passengers travelling into Central London was likely to reduce significantly the benefits of HS2. They were, however, retained as options for an interchange station with Crossrail.

5. That left options for a single or a double-deck station at Euston, and a new station at Kings Cross Lands. HS2 Ltd concluded that an expanded single-deck station at Euston presented a credible and viable option. The alternatives for a double-deck station at Euston and a station on Kings Cross Lands were not recommended as viable alternatives. They are set out below, however, for the purposes of consultation.

Euston (Double-Deck)

6. HS2 Ltd developed two options for a double-deck station at Euston:

- A new 10-platform HS2 station built above the existing station. The new station would be located above the existing station, with the 10 platforms (five "islands") projecting between the two office buildings to the south of the station to provide the platform length required, while the concourse would be sited between the two deck levels. The new platform deck would be approximately 20 metres above the existing track level to enable the throat (where the lines divide before entering the station) and approach tracks to pass over Hampstead Road Bridge. The tracks would then descend to a point under Park Road on the easterly side.
- A new 10-platform HS2 station at surface level with the displaced 'classic' platforms built above them. The new HS2 platforms would be located just below ground along the west side of the station, with classic services on an elevated deck above and the concourse between the two deck levels. The classic station would be about 23 metres above HS2 with the throat passing over Hampstead Road Bridge before the tracks descended immediately to the existing tunnels above the new HS2 tunnels.

7. Although no different in terms of demand or accessibility, both options were found to be more complex and expensive to construct when compared with the recommended option at Euston, more disruptive to existing services, and would be worse in terms of sustainability.

Strategic fit

8. As with the option for a single deck station, either of these options would have had a strong fit with HS2 Ltd's remit, situated in central London with an extensive network of links to key onward destinations.

Engineering & operational factors

9. Construction over a live railway would be a major engineering challenge and would be highly disruptive to the operation of the existing station. The support structure for the elevated platform deck and station throat would require reconstruction of most of the classic station and the London Underground concourse.

10. In both cases there would be a requirement for additional land to be acquired immediately north of the station

at Hampstead Road to enable the high speed track fan to be developed along its west side, together with the demolition of Grantley Road bridge and Mornington Street bridge due to insufficient clearance. This would mean significant additional disruption during the construction period.

11. Preliminary consideration was given to the practicalities of construction and how much of Euston Station could reasonably be kept open during construction of either option. The construction could probably be carried out in two phases, necessitating the closure of half the existing station; this would lead to the potential loss of eight platforms during the works, severely impacting on the operation of the station. The construction period would also be extended by up to two years compared with the single-deck option.

Cost

12. HS2 Ltd estimated that a double-deck station would cost around 15 per cent to 20 per cent more to construct than a single deck station, and would involve a significantly higher level of risk.

Demand

13. There would be no difference in levels of demand between this option and the single-level option at Euston.

Sustainability

14. The double deck alternative would have fewer community impacts than the recommended scheme as it would require fewer demolitions, with approximately 90 dwellings taken from the Regent's Park Estate. It would be similar to HS2 Ltd's recommended scheme in terms of townscape effects with the greater prominence of the new station building offset by its smaller footprint. Fewer listed buildings, however, would be affected by the station and its high level approach than the recommended single deck option.

15. It would, however, have significantly worse impacts in terms of noise and visual intrusion. The new high level platforms and the structure carrying those lines would introduce a 23 metre high, visually intrusive structure and an elevated operational railway in a heavily built-up area. The Ampthill Estate, Regent's Park Estate, properties to the south of Park Village East and properties adjacent to the railway corridor in the vicinity of Mornington Crescent would be affected.

16. This option also performs less well in terms of future development, since it offers less over-site development potential. With the completed scheme, west-east access would be improved providing enhanced permeability to pedestrian movement in the area, although to a lesser extent than for the single deck option.

Kings Cross Lands

17. This site, which consists of former railway lands to the north of Kings Cross station, is currently earmarked for major development and regeneration which is already underway. In addition to presenting a significant engineering challenge, and therefore significant expense, it would also perform poorly in planning terms as it would effectively blight the Kings Cross Masterplan for many years to come and require the demolition of a number of recently completed buildings.

Strategic fit

18. As with the recommended option for a single deck station at Euston, this option would have had a strong fit with HS2 Ltd's remit, situated in central London with an extensive network of links to key onward destinations.

Engineering & operational factors

19. An HS2 station on this site would need to be located about 35 metres below surface level so that the tracks could exit the station below the existing Thameslink tunnels. Ground conditions mean this could only be constructed in a cut and cover box, making this a major engineering challenge. It would require a supporting structure beneath the Regents Canal and diversion of the Camden Sewer. Many of the listed buildings preserved during the regeneration of the earlier Kings Cross redevelopment would require demolition and reconstruction.

20. The site itself is bounded by a number of existing or planned major structures which limit the scope for a station in this area, including St Pancras International Station, the North London Line and Thameslink, the gasworks tunnels serving Kings Cross, and the Piccadilly Line tunnels, the Thames Water Ring Main (about 25m below ground), the new London Underground concourse and service yard and the mixed use developments in the Kings Cross Masterplan.

21. The area is also characterised by the number of listed or locally protected structures together with plans for numerous new developments with planning permission granted.

Cost

22. The option at Kings Cross Lands was estimated to cost broadly the same as the single deck option at Euston.

Demand

23. There would be little difference in levels of demand between this option and HS2 Ltd's recommended scheme at Euston as they are close together and well linked to London's existing public transport network.

Sustainability

24. In sustainability terms, the Kings Cross Lands station alternative would be inferior to both the recommended scheme and the double deck Euston alternative: it would effectively blight the Kings Cross Masterplan over the medium term and compromise, or at least delay, its anticipated socio-economic benefits, such as local job creation, social mobility and social inclusion in an area recognised as one of the most deprived in London.

25. In addition, committed development and a substantial portion of the railway heritage that would otherwise be protected by the Masterplan, would be demolished by this option. The area includes a number of listed buildings and other important structures around the Regent's Canal and former rail lands that would be lost, including the German Gymnasium (Grade II); Stanley Building and Offices (Grade II); Eastern Coal Drops and Offices (Grade II); the Granary (Grade II), Western Transit Shed and Regeneration House.

26. Two culverted watercourses would be crossed by the proposed station and their course might conflict with the proposed structures required. The Regent's Canal

would need to be diverted and would need to be accommodated in a structure above the proposed cut and cover station. The additional tunnels to link Route 3 to a Kings Cross Lands terminus, the approach tracks below ground and the cut and cover station would cause substantial additional spoil in comparison to the recommended scheme.

27. The Kings Cross Lands option would, however, be better than the recommended scheme in some respects. Although it potentially impacts communities and their facilities, the direct impacts would be substantially on a community that is not yet in place. This does, however, need to be balanced against the impact on the Masterplan and regeneration of the area. This option would also be better in terms of noise and vibration as few airborne noise effects could be anticipated from the below ground station. The station and the tunnelled approaches may give rise to ground-borne noise and vibration however, given they would be closer to surface level, although it would be possible to mitigate this so that these effects could be reduced and, in the case of vibration, avoided.

A Crossrail and Heathrow Interchange Location

28. To maximise the benefits of the investment in HS2 the principal London station would need to be in central London. However, HS2 Ltd's remit from Government included provision of an interchange station between HS2, the Great Western Main Line and Crossrail with convenient access to Heathrow.

The objectives of the interchange station would be twofold:

- To provide good access for HS2 passengers to London, whilst relieving pressure at the London terminus; and
- To provide access to Heathrow airport for HS2 passengers.

29. HS2 Ltd recommended an interchange at Old Oak Common where passengers could change onto Crossrail or the Heathrow Express to get to Central London or Heathrow. The Government has asked HS2 Ltd to develop proposals for a spur to Heathrow as part of Phase 2 of HS2 to Manchester and Leeds. They will report their findings to Government in December 2011.

Line of Route from London to the West Midlands

30. HS2 Ltd considered a number of route options from London to the West Midlands, recommending Route 3, a line of route from London to the West Midlands that would cross the Chilterns in tunnel and then largely in cutting along the A413 corridor, before broadly following the disused alignment of the former Great Central Main Line towards the West Midlands.

31. A key consideration in identifying options for the line of route was whether it would be possible to follow existing transport corridors (e.g. the M40). Running at high speed, however, requires track to be straighter than would be the case for classic speed rail or motorways. For example, closely following the route of the M40 would limit speeds to around 90mph

through the Chilterns and around 125mph thereafter. Compared to the proposed scheme, that would mean a longer journey time from London to the West Midlands by around 19 minutes. A route following the M1 and M6 would allow higher speeds, up to around 150mph, but this would still mean a longer journey time by around 12 minutes when compared to the proposed scheme. Many of the existing corridors also pass very close to, or even through, built up areas. That means that in many cases it would be impractical for HS2 to follow existing alignments exactly.

32. Therefore HS2 Ltd also took into account the maximum amount that a track could curve in order for trains to maintain high speed, and the sensitivities of building through centres of population and areas of environmental importance. Potential routes were compared with each other. To do this the long routes were divided into route sections, allowing comparisons to be made between these shorter sections to clearly understand the different implications of choosing one over another, for example in terms of journey time, cost or sustainability.

33. Figure B2 shows how HS2 Ltd started out with many different route options. In order to evaluate the routes and make decisions it carried out comparisons between options or groups of options – known as 'pairwise comparisons'. To do this it divided the long routes into route sections allowing comparisons to be made between these shorter sections to understand more clearly the different implications of choosing one over another.

34. As there are fewer distinguishing features for lines of route than between the long list of stations, HS2 Ltd started with the more detailed criteria to narrow down the long list:

- Engineering and construction feasibility.
- Costs – based on an initial evaluation of the high-level scope with a generic unit rate applied to different types of route, for example tunnels and open sections.
- Environmental, social and spatial considerations – a simplified sustainability framework.
- Demand – any relevant demand assessment mainly focused on journey time benefits.

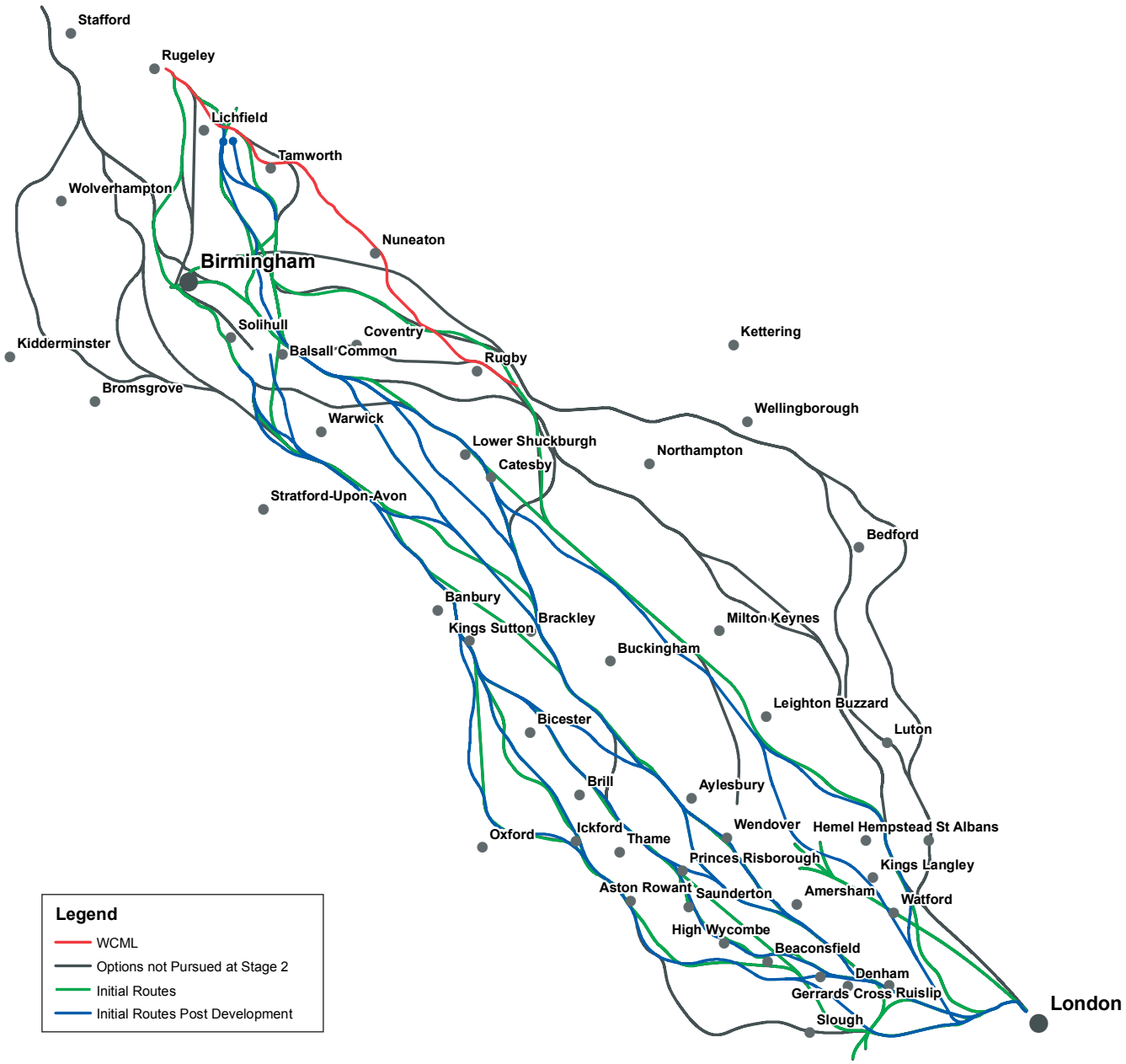


Figure B2 – **Long-list of routes considered from London to West Midlands**

35. The lines coloured dark grey in Figure B2 are those routes that HS2 Ltd decided not to pursue at that stage. The pairwise analysis demonstrated that the construction of these route sections would have resulted in a longer journey times than those provided by the alternatives. The sustainability appraisal indicated that these routes were no better than the remaining routes and in some places were significantly worse.

36. This analysis removed a number of route sections that would have resulted in longer journey times without being any better in terms of sustainability. The remaining routes were refined to improve journey times, adapt the route better to the lie of the land, avoid particularly sensitive locations and, where possible, minimise the requirement for substantial land purchase and demolitions. This process generated seven route options:

1. Via Heathrow and the M40 corridor (Route 1)
2. The Chiltern Railways Main Line and M40 corridor (Route 2)
3. A new transport corridor through the Chilterns, crossing the Hughenden Valley (Route 2.5)
4. The A413 Corridor (Route 3)
5. Via Berkhamsted (closest to WCML) (Route 4)
6. The M1 corridor (Route 5)
7. The Midland Main Line (MML) rail corridor (Route 6)

37. Routes 1, 2, 5 and 6 were not selected for shortlisting. This was on the basis that they had longer journey times (and therefore impact on demand) and higher cost and were not considered better than the shortlisted options in terms of sustainability.

- Route 1, which passed Heathrow and broadly followed the M40 corridor, was considered to be clearly inferior to the shortlisted routes in sustainability terms; in particular it was found to have major adverse impacts on landscape, biodiversity and water resources. It would also be more expensive to construct and would have longer journey times than Route 3.
- Route 2, which broadly followed the Chiltern Railways Main Line and M40 corridors, would have been more expensive to construct and would have longer journey times than the shortlisted routes. It performed better than Route 1 in sustainability terms and, although it was not pursued further, the southern section through the Chilterns was considered worth pursuing further and formed part of Route 2.5 considered below.
- While Routes 5 and 6 performed better than Routes 1 and 2 in terms of impacts on landscapes, largely because of their reduced impacts on the Chilterns AONB, they both generated significant impacts on communities and were considerably slower and more costly than the shortlisted routes. Furthermore, they would be sufficiently far to the east to make a feasible direct connection to Heathrow extremely challenging and expensive at best.

Crossing the Chilterns

It is important to highlight the reasons why HS2 Ltd decided not to pursue the two most easterly options just north of London as these are the only two options that would avoid the Chilterns Area of Outstanding Natural Beauty (AONB). As these routes continue further north they are substantially longer than the other alternatives under consideration at the time. They would require either substantial tunnelling to avoid major population centres (particularly Luton) or could have resulted in significantly more potential demolitions than the routes taken forward for further appraisal. They would also result in longer journey times than the other routes under consideration at the time (about ten minutes if they go via Old Oak Common) and they would make a direct connection to Heathrow impractical.

38. Routes 2.5, 3 and 4 were selected for shortlisting. In terms of sustainability Route 3 had few significant differences to Route 2.5, although the nature of the impacts would be different, and was better in terms of cost and journey time. Route 4 would deliver longer journey times than Route 3, which would impact on demand and benefits, and would be significantly more expensive to construct. Importantly, however, a direct link from Route 4 to Heathrow would be very much longer than from the other routes, itself traversing sections of the Chilterns, and would cost in the region of £4bn-£5bn.

39. In the process of looking further at options for serving Heathrow after submitting its report to Government in December 2009 a further alternative – Route 1.5 – was developed. This was based on a combination of Route 1 and Route 2.5 to take the route via the Airport. This route has not been the subject of a detailed Appraisal of Sustainability as it was decided not to pursue it on the basis of additional cost and journey times. A high level assessment of this route indicated that while it would have a lesser impact on the landscape of the Chilterns, it would affect other sensitive areas.

Alternative Lines of Route from London to the West Midlands

40. The routes described below refer to the routes HS2 Ltd presented to Government in December 2009 and were published in March 2010, other than Route 1.5 which was developed subsequently in considering options for how Heathrow could be served directly. The Government accepted HS2 Ltd's recommendation that Route 3 be included in the scheme for HS2 as it was better than the next best route in terms of cost and journey time, and no worse on sustainability grounds. Since March 2010, in response to requests by Government, further work has been undertaken on Route 3 to mitigate the impacts of the recommended route on people and other aspects of the environment, which has led to that route being refined for consultation.

41. Similar work was not undertaken on the alternative routes presented here. Route 3 offers significant advantages over the main alternatives in terms of cost, as well as fit with Government strategy and journey times. Given that important sections of the routes, for example in London and

the West Midlands, are shared, HS2 Ltd do not consider that there is sufficient scope for mitigation of the impacts of the alternatives to make up for the significant advantages of Route 3.

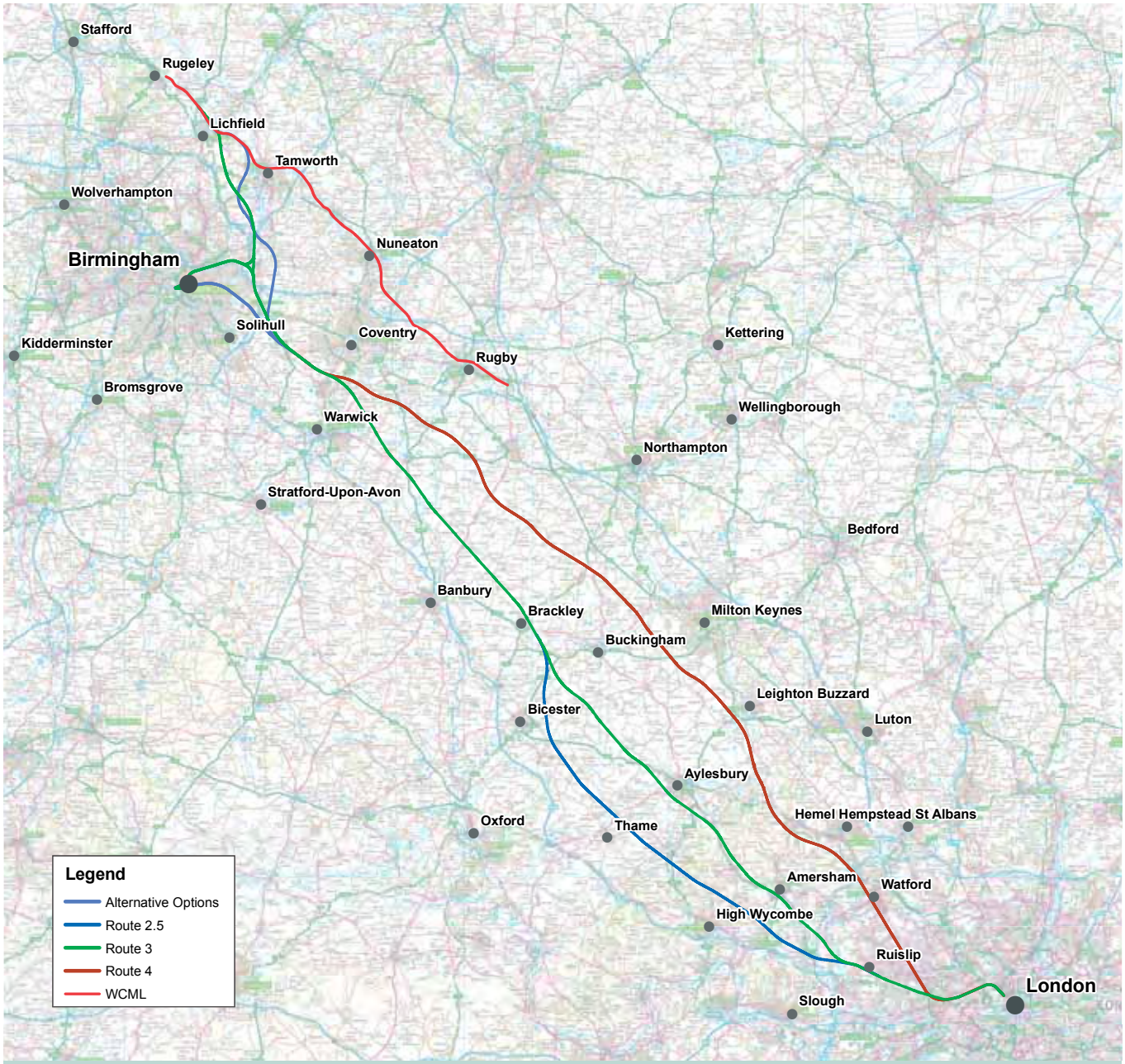


Figure B3 – **Recommended route and main alternatives**

Route 2.5

42. This route was developed to offer an alternative route through the Chilterns AONB that would reduce impacts on larger centres of population. It would be common with the recommended Route 3 between Euston and West Ruislip, where it would diverge to pass Beaconsfield and High Wycombe on their eastern sides, entering the Chilterns AONB near Seer Green. It would avoid impacts on other areas of habitation by means of two long tunnels through the remainder of the Chilterns AONB separated by a 720m viaduct to span the lower reaches of the Hughenden Valley. The route would surface north of the Chilterns, outside the AONB to the west of Princes Risborough, then strike north to rejoin the recommended Route 3 and the former Great Central corridor south of Brackley.

43. Although overall it would have few significant differences in terms of sustainability than the recommended Route 3, it would create a new transport corridor through the Chilterns, it would be more expensive to construct and journey times would be longer. The viaduct through the Hughenden Valley would be notably intrusive.

Strategic fit

44. From this route it would be possible to make a direct connection to Heathrow if required.

Engineering & operational factors

45. The length of tunnelling on this route would be over four miles longer than for the recommended Route 3, adding to construction cost and risk. Both of the tunnels through the Chilterns would require vent shafts.

Cost

46. This alternative was estimated to be about £0.5bn (£0.8bn with risk) more expensive than the recommended Route 3.

Demand

47. The route was estimated to be about one and a half minutes slower than the recommended Route 3, which would have a small but measureable impact on the benefits of HS2.

Sustainability

48. The route would follow the same alignment as the recommended route from Euston to West Ruislip and from Brackley to the West Midlands, therefore would have the same impacts in terms of sustainability as the recommended route along these sections. The differences between Route 2.5 and the recommended Route 3 are chiefly associated with the Chilterns. Although Route 2.5 would have a shorter distance on the surface in the Chilterns AONB (five and a half miles compared with around eight and a half miles for Route 3), it would cut a new transport corridor through that landscape. This would include an 700 metre-long viaduct, up to 22 metres high, across the Hughenden Valley, which would give rise to a large number of people likely to be affected by noise in that valley, as well as visual effects. It would also have greater

impacts on townscape than Route 3, albeit in different locations. This would include around Haddenham, Ilmer, Chearsley, Dorton and Kingsey, while the tunnel under Gerrards Cross would be likely to require a vent shaft in or close by the town.

49. In the assessment made in 2009 it was estimated that around 3,500 properties would be at risk of operational noise impacts compared to 4,000 for Route 3. Slightly more properties could be at risk of impacts from vibration compared with Route 3 due to the greater length of tunnelling required. In both cases, however, there is scope to mitigate these impacts that would reduce, or in the case of vibration, avoid the effects. Route 2.5's greater lengths of tunnel would result in larger quantities of spoil, which have implications for land resources, and climate change.

50. In terms of community integrity, Route 2.5 would result in 50 more demolitions than Route 3, of which 30 would be residential, and around 190 residential properties would become isolated by transport infrastructure, compared with around 160 for Route 3. Impacts would be little different in terms of biodiversity, water resources, flood risk and health risks. Route 2.5 would have, however, slightly fewer impacts on cultural heritage, notably avoiding the scheduled monument Grim's Ditch.

51. Overall HS2 Ltd's view was that the sustainability effects of Routes 2.5 and 3, while different in nature, were broadly comparable.

Route 4

52. This route would leave the Old Oak Common area northwards in a tunnel for almost 17 miles to a point near Kings Langley near the M25. From Kings Langley the route would pass through fairly open countryside by a series of cuttings and embankments passing close to Berkhamsted and entering the Chilterns AONB at surface for approximately four miles. It would then head across country to pass over the West Coast Main Line on a viaduct before leaving the AONB, traversing open countryside to the West of Milton Keynes, away from the West Coast Main Line corridor. It would continue towards Kenilworth on a new route through open countryside, from where it would share the same alignment as the recommended Route 3. The line would include two further tunnels in the Catesby area but otherwise would be a mix of embankments, cuttings and a number of low viaducts with similar impacts to the recommended Route 3.

53. This route would be considerably more expensive to construct than the recommended Route 3 and it would deliver longer journey times, which would impact on demand and benefits. Importantly, a direct link from Route 4 to Heathrow would be very much longer than from the other routes, itself traversing sections of the Chilterns, and would cost in the region of £4 billion to £5 billion. In terms of sustainability, the route would be better in some respects than the recommended Route 3 but worse in others.

Strategic fit

54. If a direct connection from this route to Heathrow were required it would be a major undertaking. It could only be achieved by crossing the Chilterns AONB on a completely new corridor in a mix of cutting and viaduct from Berkhamsted, past Amersham, to near Gerrards Cross. It would cost around £4 billion to £5 billion to construct and would have significant environmental implications.

Engineering & operational factors

55. The London tunnel would be a major construction challenge. It would require the construction of approximately 14 vent shafts and possibly additional means of evacuating passengers. As with the Channel Tunnel this could include construction of an emergency station at its mid-point in the northern outskirts of London, or provision of an additional service tunnel bore. HS2 Ltd's cost estimate did not include these additional features.

Cost

56. The extent of tunnelling for this route option means that it is considerably more expensive than the recommended Route 3. It is expected to be around £1.4 billion (£2.5 billion with risk) more expensive.

Demand

57. The route was estimated to be about one and a half minutes slower than the recommended Route 3 which would have a small but measureable impact on the benefits of HS2.

Sustainability

58. As the route follows a completely different alignment than Route 3 from Old Oak Common to the Kenilworth area, the nature of the sustainability impacts would be different. In some respects it would be better, in others it would be worse. It would have a shorter length of crossing in the Chilterns AONB at surface level than Route 3 (around 4 miles compared with around 8.5 miles for Route 3) meaning fewer landscape impacts, and it would have fewer impacts on cultural heritage, in particular on registered parks and gardens, and would avoid impacts on a scheduled monument (Grim's Ditch in Buckinghamshire). It would also have fewer impacts on water resources and flood risk, while fewer properties would be at risk of construction disturbance.

59. It would also have fewer adverse impacts on townscape and operational noise, largely due to the length of tunnel beneath London. Around 1,850 people would potentially be annoyed by operational noise, compared with 4,000 for Route 3, though mitigation could reduce these effects. The length of tunnel means that a larger number of dwellings could be affected by vibration compared with Route 3, but – as with Route 3 – there is scope for mitigation to avoid these effects. The additional length of the tunnel would result in greater emissions of greenhouse gases together with greater resource use and waste generation during construction.

60. Route 4 would result in around 30 fewer dwellings being at risk of demolition than for Route 3, although around 75 more dwellings would be at risk of isolation. Effects on biodiversity would be slightly worse for Route 4 than for Route 3, largely

due to its impacts on a number of sites of special scientific interest around Oxley Mead, Pokers Pond Meadow, High Wood and Meadow and Whittlewood Forest.

Route 1.5

61. This route would follow the same alignment from Euston to Old Oak Common (regardless of whether an interchange was provided) but from there would head to a new station in the Heathrow area in a continuous tunnel for more than 10 miles. Leaving Heathrow it would pass under the M25 and turn north, leaving tunnel towards the broad corridor of the M40 near Gerrards Cross after passing close to Fulmer on a low viaduct across the river valley. The route would enter a further tunnel of approximately seven and a half miles under the western edge of Beaconsfield and then High Wycombe, surfacing in the Chilterns AONB to the north of Bradenham Village. The route would then continue north past Princes Risborough on its western edge before leaving the AONB. In common with Route 2.5 it would then head north to rejoin Route 3 and the former Great Central corridor south of Brackley.

62. This route was developed further after submission of HS2 Ltd's report, published in March 2010, to provide a route option for serving Heathrow via a through route. It is similar in concept to the route identified by Arup for its "Heathrow Hub" proposal. HS2 Ltd's work confirmed the journey time, cost and general impact of the route to the same degree as the options presented in to Government in December 2009, although a detailed appraisal of sustainability was not carried out. HS2 Ltd also considered possible variants to the preferred Route 1.5 alignment, involving longer lengths of tunnel. These had a significantly greater cost without significant additional benefits in terms of sustainability or journey time and were therefore not pursued further.

63. Option 1.5 for routing the high speed line via Heathrow was considered inferior to Route 3 because it would have been considerably more expensive to construct, at least in the first phase, and would have delivered longer journey times. Alternative options for accessing Heathrow via Old Oak Common, with the potential for a direct link to be constructed at a later date, provided a better balance between the objectives of serving Heathrow and providing access to London and relieving pressure at Euston.

Strategic fit

64. This option would provide a more direct service to Heathrow for airport passengers than the recommended Route 3. In doing so it would, however, provide longer journey times to London. Were the Heathrow station to be instead of Old Oak Common, it would be a less attractive option for passengers who would have used Crossrail from Old Oak Common to reach central London. This could increase the number of passengers travelling through Euston, and using its already crowded underground connections, compared to the recommended Route 3.

Engineering & operational factors

65. The length of tunnelling on this route would be significantly more than for the recommended Route 3, adding considerably to construction cost and risk. The proposed

tunnels through London and the Chilterns would require vent shafts. In the case of the London tunnel these would have to be placed carefully in the suburban environment, while those for the Chiltern tunnel would be likely to have some impact on Beaconsfield and High Wycombe.

66. There would also need to be a cut and cover box in the Stockley Park area to allow track turnouts for the Heathrow station stopping trains although this impact would be largely in the construction phase.

67. The exact alignment through Heathrow would depend on the location of the station although high level design work suggested that the journey times and costs would not be materially different between the feasible station locations at Heathrow (although costs would vary for the construction of the stations and onward links to the airport complex itself).

Demand

68. This route is estimated to be around three to four minutes slower than the recommended Route 3, depending on the location of the interchange at Heathrow, which is significant enough to have a noticeable impact on demand. Were an interchange at Heathrow to result in services not stopping at Old Oak Common it would reduce demand further as Heathrow would be a less attractive interchange for Crossrail.

Cost

69. This route would be around £3bn to £4bn (including risk) more expensive than Route 3 without a spur or a loop, depending to some extent on the station location. This cost estimate is based on a full surface route between the M25 and Beaconsfield, though it is recognised that impacts on recreational parkland and on Fulmer village might lead to demands for a lower profile with up to three miles of tunnelling at additional cost.

Sustainability

70. The route would follow the same alignment as the recommended route from Euston to Old Oak Common and from Brackley to the West Midlands, therefore would have the same impacts in terms of sustainability from the recommended Route 3 along these sections.

71. The extent of tunnelling in the London area between Old Oak Common and Heathrow would mean that fewer people would be at risk of noise impacts than for Route 3, although more properties would be at risk of vibration effects. Mitigation would, however, reduce the noise effects, and could avoid vibration effects.

72. The Chilterns Area of Outstanding Natural Beauty (AONB) would be crossed for 2.5 miles (four kilometres) at surface level, and it would pass through the Grade II Langley Park Registered Park and Garden, and Black Park Country Park. There would also be impacts on the village of Fulmer and local recreational parkland. The design would need to allow for four major river crossings and protection of important flood areas and groundwater resources. Land take of approximately 80ha of Grade 1 and 2 agricultural land would also be required.

Other routes considered

Route 1 (Via Heathrow and the M40 corridor)

73. This route would take HS2 through Heathrow Airport before turning north to follow the M40 corridor from the M25 to the West Midlands. Although remaining as close to the M40 as possible, maintaining a straighter alignment to allow high speed running means it would be necessary to cut a new corridor using high viaducts and tunnels through the Chilterns AONB. Further north, the route could stay nearer to the M40, running close to both Bicester and Banbury, but still deviating for significant stretches with tunnelling or large viaducts needed to negotiate the various motorway interchange areas.

74. It was estimated to be some five to six minutes slower than Route 3 and £3.5 billion (£5.5 billion with risk) more expensive, and was considered to be clearly inferior to Route 3 in terms of sustainability, mainly because it had major impacts on landscape, biodiversity and water resources.

75. Several protected sites would be affected by this option including potential impact to an internationally designated biodiversity site – the Aston Rowant Special Area of Conservation.

76. The route could also bring operational noise and vibration impacts (although these could be mitigated), demolitions and severance to communities including Woodburn, Flackwell Heath, High Wycombe, Ickford, and a number of small towns located adjacent to the route. To the north of Bicester the route largely shadows the M40 corridor, which would help to mask impacts to communities.

77. Although the route was not progressed to the shortlist, elements of it form part of Route 1.5 through Heathrow outlined above.

Route 2 (The Chiltern Railways Main Line and M40 corridor)

78. Route 2 would be common with the recommended Route 3 until the M25 where it would follow the Chiltern Railways Main Line. It would tunnel under Gerrard's Cross, surfacing to pass through the area around Seer Green before entering a seven and a half mile tunnel under both Beaconsfield and High Wycombe. It would then surface again within the Chilterns AONB near Bradenham, continuing across open countryside to avoid Princes Risborough. Once out of the AONB, it would broadly follow the Chiltern Railways Main Line corridor to Bicester, although on largely new alignment given the curves on that line, before following the M40 corridor on the same alignment as Route 1.

79. Route 2 was estimated to be about two and half minutes slower than Route 3 and £2.5 billion (£4 billion with risk) more expensive, and was not considered to be better in terms of sustainability. This route was not progressed to the shortlist, although the southern element through the Chilterns formed Route 2.5 outlined above.

Route 5 (The M1 corridor)

80. This route could leave London either via Old Oak Common or by a more direct alignment but in either case would run in a continuous tunnel of some 16 miles to emerge north of the M25 close to the M1 alignment. It would then follow the motorway to the West Midlands passing through a gap in the Chilterns AONB by means of a further tunnel under the western edge of Luton, before approaching Birmingham along the M6 corridor. Whilst notionally described as "the M1" route, Route 5 would largely be in open countryside rather than near the M1 itself, in order to avoid the frequent significant centres of population, such as Luton, which are on or alongside the motorway itself.

81. Route 5 performed worse than Route 3 in terms of its strategic fit, in that it would be sufficiently far to the east for there to be no feasible way of serving Heathrow directly and even a connection via Old Oak Common would be difficult, adding significantly to cost, journey time and environmental impacts. Without a connection at Old Oak Common it was estimated as being around five minutes slower than the recommended Route 3 and £4.4 billion (£7 billion including risk) more expensive. In terms of sustainability, there would be no direct impacts to the Chilterns AONB compared to Route 3 but it would have required substantial tunnelling to avoid major population centres, particularly Luton, or could have resulted in significantly more potential demolitions, than the shortlisted routes.

82. A decision was made during Stage Two not to pursue this route option further and it did not therefore make the shortlist of options considered in greater detail in Stage Three.

Route 6 (The Midland Main Line rail corridor)

83. As with Route 5, this route could leave London either via Old Oak Common or by a more direct alignment but in either case would be by a continuous fifteen mile-long tunnel to beyond the M25, where it then surfaces briefly before entering tunnel again to pass under St Albans. It would then follow the Midland Main Line corridor passing close to Harpenden before tunnelling under Luton to pass through a gap in the Chilterns AONB. The route would then skirt Flitwick and Bedford before passing close to Wellingborough and Northampton and then merging with the alignment of Route 5 near Rugby.

84. As with Route 5, Route 6 performed worse than Route 3 in terms of its strategic fit, in that it is also sufficiently far to the east for there to be no feasible way of serving Heathrow directly and even a connection via Old Oak Common would be difficult, adding significantly to cost and journey time. Whilst notionally described as in the Midland Main Line corridor, Route 6 would be either in tunnel or close to significant centres of population for most of its length. It was estimated as being some nine minutes slower than Route 3 and £4.6 billion (£7.3 billion including risk) more expensive.

85. Although this route option also avoids the Chilterns AONB, like Route 5, it would have required substantial tunnelling to avoid major population centres, particularly Luton, or could have resulted in significantly more potential demolitions, than the shortlisted routes. Being even longer and more expensive than Route 5 it too failed to make the shortlist of options considered in greater detail during Stage Three.

Selecting a West Midlands Route and Stations

86. HS2 Ltd considered a range of options for a route and stations in the West Midlands. That included routes through Birmingham, and routes around the city to the east or west, with a spur into the city centre. HS2 Ltd's recommended scheme was to route HS2 to the east of Birmingham with a spur into a new station at Curzon Street in the city centre. The route would also include an interchange station close to Birmingham Airport and the NEC, and would reconnect with the West Coast Main Line (WCML) near Lichfield.

87. A guiding principle for HS2 has been integration with the classic network to serve more destinations, spreading the benefits of HS2 more widely. To achieve this HS2 would need to reconnect to the WCML for services towards Manchester, Liverpool and Scotland. Options for such a connection are constrained by a number of factors. The WCML itself passes through Nuneaton, much further to the east of Birmingham than HS2 would, and then continues north-west towards Tamworth and Lichfield. Just north of Rugeley the line then divides with a branch to Manchester. That effectively restricts options for connecting HS2 to the WCML to the area around Lichfield and further north.

88. As you approach the West Midlands from the South East the area becomes increasingly densely populated, with larger towns becoming more common, meaning that the options for alignments which avoid centres of population are limited. A range of options for approaching the West Midlands was considered. The recommended Route 3 and the main alternatives all enter the West Midlands between Kenilworth and Coventry although HS2 Ltd also considered options passing to the west of Warwick (Routes 1 and 2), and to the north of Coventry (Routes 5 and 6). These were not, however, pursued for the reasons described above.

89. HS2 Ltd's process for determining the recommended station in the West Midlands was broadly similar to that for London. Given that it would link to the West Coast Main Line for services further north there was an additional consideration of whether the principal station should be on a spur off the main line or a through station on the main line itself.

90. Although the initial long-list of options included locations for a principal station across the West Midlands area, early analysis of the demand for HS2 showed the importance of serving Birmingham city centre directly. As with London stations, a long-list of options for a city centre interchange was developed with interested parties which were subject to a staged sifting process.

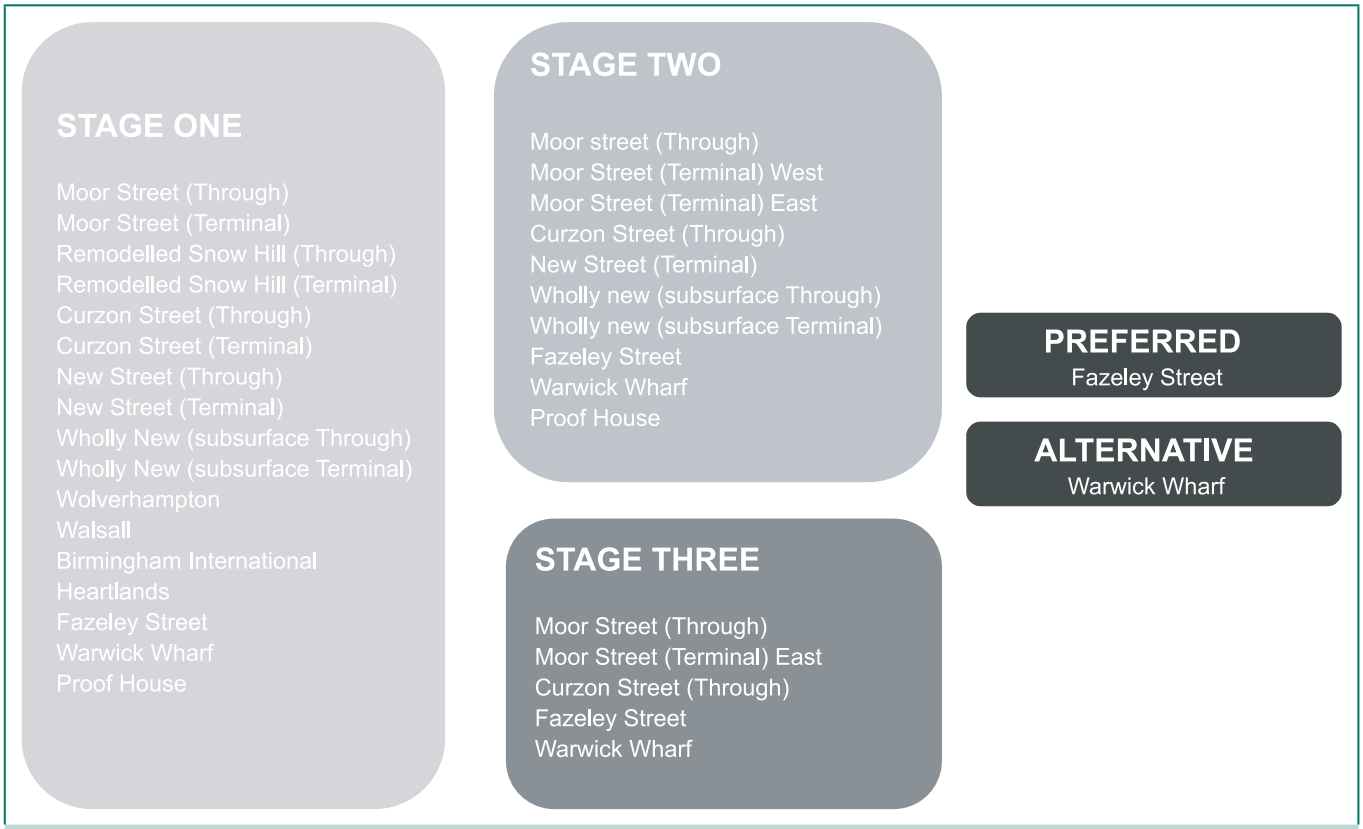


Figure B4 – **West Midlands Stations sifting process**

N.B. the recommended option at Fazeley Street has since been renamed Curzon Street The previous name has been retained in the above diagram, however, to distinguish from the other options at Curzon Street).

- Options in the Snow Hill area were not pursued because they would be too complicated to construct alongside existing infrastructure, with associated implications of cost and risk.
- HS2 Ltd looked in some detail at options for a high speed station at New Street, but concluded that as well as being a major engineering challenge with a high level of construction risk it would also be highly disruptive during the construction period and would severely restrict access for regional rail services into the city centre. It was not, therefore, pursued.

Birmingham New Street

New Street station currently operates at close to capacity, requiring all of its thirteen platforms, including platform sharing, to provide for the full range of services on any typical day. The neighbouring station at Moor Street is already being expanded to cater for planned development of the West Midlands local rail network. New Street is bounded by tunnels at either end and city infrastructure on either side making expansion to accommodate an additional high speed train network impractical without displacing a significant proportion of existing services.

The platform formation would need to provide for high speed services (which would approach New Street from the east) and yet still maintain through operations for some classic services at the western end. Even this only gives three full length high speed platforms to the north side, in place of existing platforms 1-3, sufficient only for services to London. One of these would be of sub-standard width for unrestricted passenger movement and all three would extend outside the existing station boundary to the northwest, requiring demolition of buildings. Two further platforms of up to 341 metres, giving some scope for the anticipated wider network, could be created by removing the existing platforms 4, 4C and 5.

Under this scenario, the overall capacity for classic services at New Street would be severely reduced from today's levels. In order solely to maintain existing service levels into the centre of Birmingham (leaving aside the prospect of growth), an additional new station (of possibly 7 platforms) would be required elsewhere in the city centre.

Additionally, the significant engineering changes to New Street and its tunnelled approaches would necessarily be very expensive. The tunnels to the east of New Street would need to be lowered and widened to achieve the desired European gauge clearance. The station area and approaches in each direction would require resignalling and remodelling to maintain access for remaining classic services. Levels of disruption during construction would be very significant over a number of years.

The total costs of converting New Street for high speed use, while also maintaining current capacity for classic line services was estimated at around £1.6 billion, exclusive of risk and optimism bias.

91. The remaining options were subjected to further detailed analysis which left options for through and terminal stations at Moor Street, a through station on a site at Curzon Street, and stations nearby at Fazeley Street (the recommended station, now referred to as Curzon Street) and at Warwick Wharf.

92. Given the interdependencies, from this stage, options for West Midlands approaches and stations were considered alongside each other. A key factor in this was whether to run the main line through Birmingham city centre, or to serve the city by a spur from the main line. The option of routing HS2 directly through Birmingham was not pursued on the basis of the land take a "through" station would require in the city centre and, although it may offer better journey times into the city centre, there was no significant time saving to through-running services. Consideration was therefore focussed on routes to the east of the city and surface-level routes along the Solihull and Coventry railway corridors from the south and east of the city, and the Water Orton railway corridor from the east and north east

93. That left three options: a terminal at Moor Street approached along the Solihull corridor, and termini at Fazeley Street (now known as Curzon Street) and Warwick Wharf approached by the Coventry or Water Orton corridors.

94. The station and approach 'package' of Moor Street and the Solihull corridor was pursued no further, for the following reasons:

- The south east/north west alignment into the terminus station effectively rules out the prospect of future high speed services north from Birmingham. High speed trains departing Moor Street for Manchester, for example, would need to travel south down the spur in order to rejoin the main HS2 line and travel northbound round the east of the city.

- While the Solihull corridor was less costly, it was inferior to the Water Orton alternative – and comparable with the WCML corridor – in terms of its environmental and social impacts, particularly in terms of noise, vibration, air quality (due largely to its proximity to densely residential areas) and waste generation.

- The proposed station at Moor Street performed poorly against the option at Fazeley Street in terms of its impacts on the existing buildings and townscape. In these respects it was broadly comparable with the Warwick Wharf option. There would also be disruptive effects on existing rail users.

95. The alternative approach to Birmingham along the Coventry corridor, and alternative Birmingham city centre station at Warwick Wharf are considered below.

An alternative line of route through the West Midlands and Birmingham Approach: the Coventry Corridor

96. The alternative route would join the WCML corridor from Coventry to Birmingham to the east of the existing Birmingham International Station and M42 motorway, with the tracks aligned within the existing rail corridor. The route would run to the north of the existing Birmingham International Station. At this point additional land would be required to accommodate the additional tracks and alignment to allow a 125 mph (200kph) line speed. From there the route would follow the current corridor until Stechford where it would rise above the junction and WCML, re-joining the tracks to the west of Stechford. As the route approaches Soho Junction the line would be elevated above the existing tracks and could turn into either Curzon Street (Fazeley Street) or Warwick Wharf.

97. To make the connection onto the WCML the main HS2 route would continue heading north on the eastern side of Birmingham, crossing the M6 south of Coleshill. The line would curve to avoid the village of Whitacre Heath, Shustoke Reservoirs and the SSSI of Whitacre Heath Nature Reserve, with speeds restricted to 186 mph (300kph). The route would rejoin the WCML north west of Tamworth, avoiding the settlements of Middleton, Bangley and Mile Oak, as well as Drayton Manor Park and Hopwas Hays Wood.

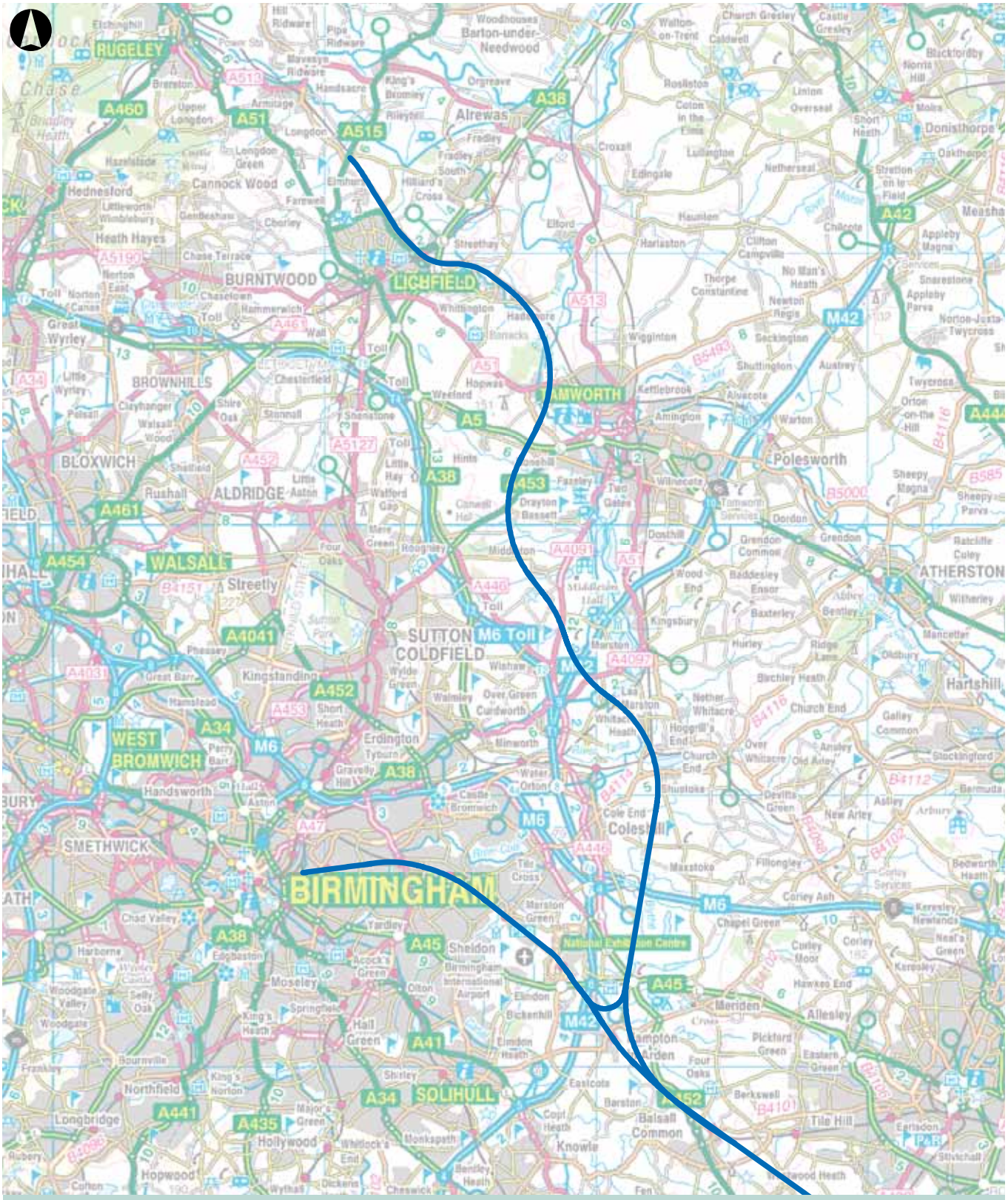


Figure B5 – **Alternative Line of Route Through the West Midlands and Birmingham Approach**

Strategic fit

98. Accessing Birmingham via the Coventry corridor would restrict the value of northbound services from Birmingham on a wider high speed network. To access the main HS2 route north would require services to travel south first, lengthening journey times. It would also limit the potential of an additional West Midlands interchange station (see below). There is no obvious site to place a Birmingham interchange station on this route with comparable connectivity. That would mean that any interchange station would have to be in the corridor into Birmingham, which would prevent trains from London heading north on a wider network from calling at the interchange.

Engineering and operational factors

99. The current Coventry corridor into Birmingham is two tracks, although historically sections of the route from Birmingham International through to Stetchford had been three. The intention under this option would be to widen the north side of the existing corridor using either existing rail land or through local acquisition. The installation of additional tracks along side the WCML pair would create a significant interface issue and HS2 Ltd expect this would entail significantly more disruption to existing services than the recommended route. This is partly because the corridor is much more heavily used. A further factor is that there is considerably less space in which to construct, making more substantial impacts on the WCML inevitable even after mitigation.

Cost

100. Construction costs were broadly comparable between the two options.

Demand

101. Journey times from London to Birmingham would be broadly comparable between the two options. However, as part of a wider network, the alternative option effectively precluded an interchange on the main HS2 line to the north, which would have impact on demand for services from the West Midlands to the north. Similarly, by having to travel south before making a slow turn to the north, it would lead to longer journey times from Birmingham to the north.

Sustainability

102. The alternative route through the West Midlands would result in a worse performance against sustainability objectives than the recommended route. An additional 400 people would potentially be annoyed by operational noise, and 750 more dwellings would qualify for noise insulation under the Noise Insulation Regulations. It would result in around 100 fewer demolitions than the recommended route, but it would result in 300 more properties becoming isolated by transport infrastructure. It would also have more adverse impacts on both surface and ground water resources.

Alternative Birmingham City Centre Station: Warwick Wharf

103. The Warwick Wharf station alternative would be an elevated structure sited a little to the south of the recommended option at Curzon Street (Fazeley Street) in the fork of land between the WCML and the Solihull line. The station would be aligned approximately east-west with its approach curving back towards either the Water Orton Corridor or the Coventry Corridor. The station would be aligned to avoid the Grade II listed buildings along its northern edge and would span over the Digbeth Branch Canal. New viaduct arches beneath the station could allow traffic and pedestrian movements beneath the station to be maintained.

104. Although very similar in terms of demand, it would be more challenging and expensive to construct. In terms of sustainability it had greater townscape, cultural heritage and community effects than the recommended scheme at Curzon Street (Fazeley Street) and on balance these were considered to outweigh the effects on the planned regeneration for the Curzon Street area. Indeed, it was felt that a new terminus at Curzon Street could be a catalyst for the implementation of (an albeit amended) masterplan.

Strategic fit

105. As with the recommended option for a new station at Curzon Street, this option would have had a strong fit with HS2 Ltd's remit.

Engineering & operational factors

106. The topography of the land in this area is significantly more challenging than at Curzon Street, meaning that the station would be elevated on a viaduct some way above current street level

Cost

107. The station at Warwick Wharf is estimated to cost around £260 million, around £25 million more than the recommended scheme.

Demand

108. A station at Warwick Wharf would have little difference in terms of passenger demand from the recommended scheme given their broadly similar location.

Sustainability

109. Although the alternative would deliver largely the same facility in more or less the same part of Birmingham, the recommended scheme performs slightly better than the Warwick Wharf alternative in terms of sustainability. The recommended scheme was considered to perform better in terms of townscape and cultural heritage as Warwick Wharf would cut across the Warwick Bar Conservation Area and the Digbeth / Deritend Conservation Area affecting the historic street patterns and the built character of the area.

110. The alternative scheme would also require approximately 5 per cent more demolitions of buildings (including dwellings) than the recommended scheme and would increase the number of properties at risk of isolation by about 8 per cent, although in overall numbers of properties involved this represents a small difference between

the two. It would have less impact on the planned regeneration of the eastern part of Birmingham city centre, but it is envisaged that the new station would be a catalyst for development in this central part of Birmingham: while some currently planned development would be frustrated in the short term, in the longer term it is likely to proceed, albeit in a different way.

Birmingham Interchange

111. Interchange stations on the outskirts of cities can broaden the market for high speed services, especially when well linked to other transport modes. HS2 Ltd's remit did not require an interchange station in addition to a city centre station. HS2 Ltd therefore looked to see whether an interchange station in the West Midlands could be shown to increase the overall economic case for HS2. To that end they looked for locations that would maximise demand for trips on HS2 – particularly by attracting people from existing car journeys – but that did not overlap too much with the market for the city centre station. Interchange stations should also provide good opportunities to change onto other transport modes, i.e. public transport or cars including, where appropriate, space for large-scale parking provision.

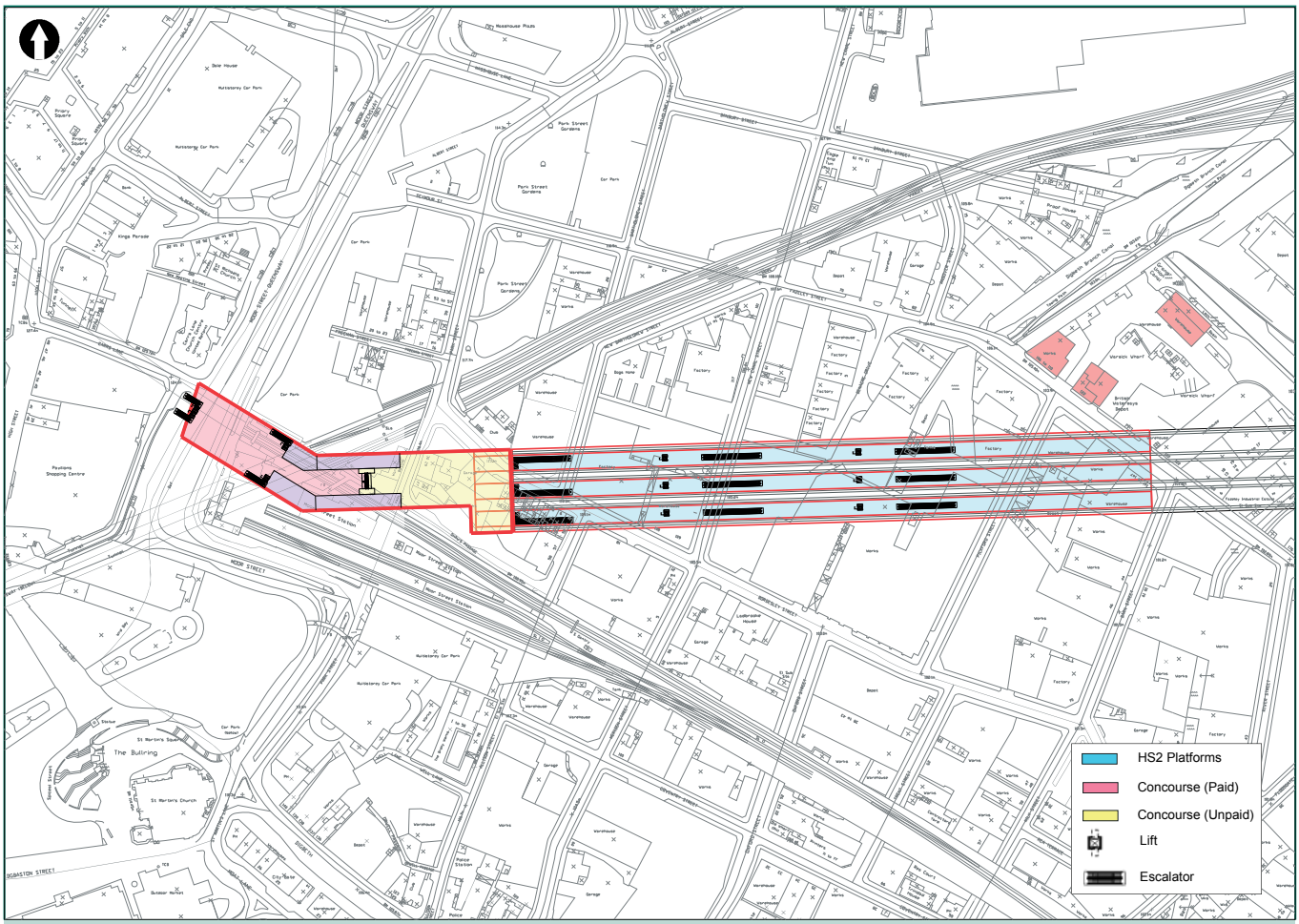
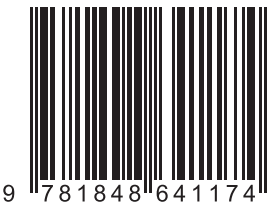


Figure B6 – **Alternative Birmingham City Centre Station at Warwick Wharf**

112. An initial long-list of ten options was shortened by ruling out options that were not compatible with the parallel decisions taken on the line of route, while options to the north-east and north-west of the city were ruled out because they offered relatively poor demand prospects. An option at Birmingham Heartlands was not pursued on the basis that it overlapped with the city centre catchment area, leaving options at Water Orton, Birmingham Airport and near Widney Manor station in Solihull.

113. Although an interchange at any of the locations would add to the transport benefits of HS2 by broadly the same scale, the Solihull option would not be compatible with the recommended approach to Birmingham.

114. HS2 Ltd did not favour the Water Orton station on the basis that, despite having very slightly higher pure transport benefits than Birmingham Airport options, it would also be more difficult and expensive to construct. A Birmingham Airport station option gives a broadly similar level of transport benefits, which could be enhanced by a high quality Automated People Mover (APM) connection to the airport and classic rail station. It also offers a strong fit with strategic objectives for the area. HS2 Ltd therefore decided to include a Birmingham Airport option as a Birmingham Interchange station as part of the recommended route.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