

High Speed UK – Connecting the Nation

**HSUK**

Delivering the  
**High Speed Network**  
the Nation Needs



[www.highspeeduk.co.uk](http://www.highspeeduk.co.uk)

**High Speed UK (HSUK) is an alternative high speed rail network developed by professional railway engineers to address the shortcomings of HS2.**

The promoters of HS2 say:

**“The aim of the HS2 project is to deliver hugely enhanced capacity and connectivity between our major conurbations”<sup>1</sup>**

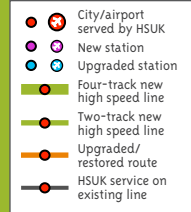
However, HS2’s promoters must confront a highly inconvenient truth. Even in conjunction with Northern Powerhouse Rail (HS3), HS2 does not deliver the basic connectivity and capacity necessary for a modern well-connected rail network which is essential for a prosperous Britain.

Inside, the key issues are addressed.

## **HIGH SPEED UK: The Fully Networked Alternative to HS2**

### **The HSUK Proposal**

All principal UK cities and major airports interlinked with frequent high speed services



<sup>1</sup> Andrew McNaughton, Technical Director HS2 Ltd; Evidence to HS2 Select Committee, 30 November 2015

## Introduction

HSUK is the result of over ten years' work by two professional rail engineers: Colin Elliff, BSc, CEng, MICE and Quentin Macdonald, BSc(Eng.), CEng, FIRSE, MIET, who have over 90 years of railway engineering experience between them. HSUK will use high speed trains similar to Eurostars built to the standard UK loading gauge. They will operate on a mixture of new-build high speed line, and the existing rail network sections of which will require upgrading for higher speed and greater capacity. The core route will follow the M1 northwards, having 4 tracks between London and Sheffield where there is a trans-Pennine spur to Manchester and Liverpool. Birmingham and other Midland cities are served via upgraded existing routes. The new line continues northwards to Leeds, Teesside, Tyneside, Edinburgh and Glasgow to complete the core network. It has been designed to 1:25,000 scale throughout and fully timetabled. HSUK's proposal interconnects over 20 major cities with hourly or more frequent high speed services and provides low cost connections to Heathrow and HS1.

## HSUK and HS2 Compared & Contrasted

### 1 Connectivity between major cities (see figure 1 and page 6-7)

**HSUK's** service timetable is based on the route design of over 1,000 km of new and upgraded railway. HSUK fully interlinks 21 principal cities with direct high speed services, providing 210 possible journeys between pairs of cities. Of these, 208 journeys are improved compared with current services, providing an average journey time reduction of 45%. Only 2 are unaffected, none are made worse.

**HS2 and HS3** will, at best, improve 43 journeys of the same 210 journeys noted above. 119 will remain unaffected, while withdrawal of long distance services from existing main lines will make 48 journeys worse.<sup>2</sup> HS2 Ltd has neither designed HS2 and HS3 as a network nor developed a timetable to determine how the system will operate. HS2 and HS3 are imposed on the existing network leaving the Train Operating Companies and Network Rail with the difficult task of integrating them.

### 2 Capacity to serve all major cities (see figure 1 and centre-spread)

**HSUK's** 4-track spine from London to South Yorkshire will bring additional high speed services to all cities served by the East Coast, Midland & West Coast Main Lines.

**HS2's** 2-track stem has insufficient capacity to serve all major cities. Milton Keynes, Coventry, Leicester, Derby, Stoke and others will be bypassed, with existing intercity services cut<sup>2</sup>.

### 3 Station Locations

**HSUK** will serve existing central stations in all primary cities, maximising economic benefits, and linking directly with existing local rail and other public transport networks.

**HS2's** stations are either termini or remote parkways. This greatly restricts both local connectivity and economic benefits and requires major investment, as yet unspecified, to modify local networks.

### 4 Direct HS services to Heathrow from UK regions (see figure 2)

**HSUK's** proposed links to the existing Heathrow Express system will allow direct hourly services to Heathrow from all principal regional cities.

**HS2's** lack of connectivity with regional cities results in insufficient demand to justify the proposed direct connection. In addition, HS2's 2 track stem has insufficient capacity for Heathrow services. In March 2015 the Heathrow spur was cancelled but the overall budget was not reduced.

<sup>2</sup> HS2 service predictions in Table 23, HS2 Regional Economic Impacts Report, September 2013

## 5 Link to HSI for future direct regional services to Europe

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**HSUK's** route to central London alongside the Midland Main Line allows for a simple link to HSI, costing less than £1 million, built on existing operational railway land.

**The HS2-HSI** link was a key requirement of the original remit for the scheme. It has been abandoned due to its huge £700M cost and large-scale disruption to the built environment of Camden. The budget was not reduced and HS2 Ltd. is now in breach of its remit.

## 6 Impact on Chilterns AONB (see page 11)

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**HSUK's** route north of London follows the M1 and entirely avoids the Chilterns AONB. It requires only 12 km of tunnel to reach Birmingham and serves all principal communities en route.

**HS2's** 2-track route crosses the Chilterns AONB at its widest point and passes through much unspoilt country further north. It requires at least 50 km of tunnel to reach Birmingham and bypasses all intermediate communities.

## 7 Euston Station Rebuild

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**HSUK** includes 2 km of new 2 track railway at Old Oak Common (costing circa £70M) to extend Crossrail onto the West Coast Main Line. This enables most commuter services to be diverted away from Euston allowing Euston to be efficiently rebuilt within its own footprint, without any need to expand into Camden.

**HS2 Ltd** has developed no strategy to divert commuter flows away from Euston. This greatly complicates reconstruction and dictates major expansion of the station. It requires the demolition of 200 homes, the closure of Melton Street, and the relocation of 20,000 graves. The works will take up to 20 years and will have a huge impact on the community and the travelling public.

## 8 Carbon footprint

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**HSUK's** comprehensive intercity connectivity and enhanced capacity will combine to create the possibility for step-change road-to-rail modal shift. Outline studies indicate that this modal shift could reduce transport CO<sub>2</sub> emissions by up to 600Mt over 40 years.

**HS2's** ultra-high speed and poor connectivity will result in low modal shift. It will only be carbon neutral, even after 60 years. This is incompatible with the statutory 80% CO<sub>2</sub> reduction target of the 2008 Climate Change Act.

## 9 Northern Powerhouse objectives (see figure 3)

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**HSUK** meets all the journey time objectives for links between Northern cities and for links to Manchester Airport. It provides improved trans-Pennine freight links including a Manchester – Sheffield roll-on/roll-off lorry shuttle in lieu of the proposed trans-Pennine road tunnel; which would be 25% longer than the current world record holder.

**The HS3** strategy is disjointed and incompatible with existing HS2 proposals for stations in Leeds, Sheffield and Manchester. No HS3 timetable has been defined.

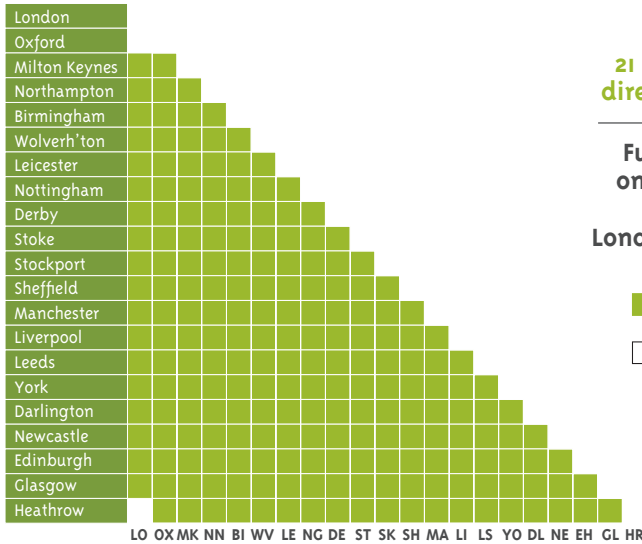
## 10 National network and national timetable

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**HSUK's** connectivity and capacity benefits are proved by the national timetable that has been developed. HSUK predicts average journey time reductions of 45%, made possible through full integration and use of classic compatible UK loading gauge trains throughout.

**HS2 Ltd** has neither designed HS2 and HS3 as a network, nor developed a timetable to determine how the UK rail system will operate. Use of double-decker trains too large to fit on the existing rail network prevents integrated operation.

Figure 1a:



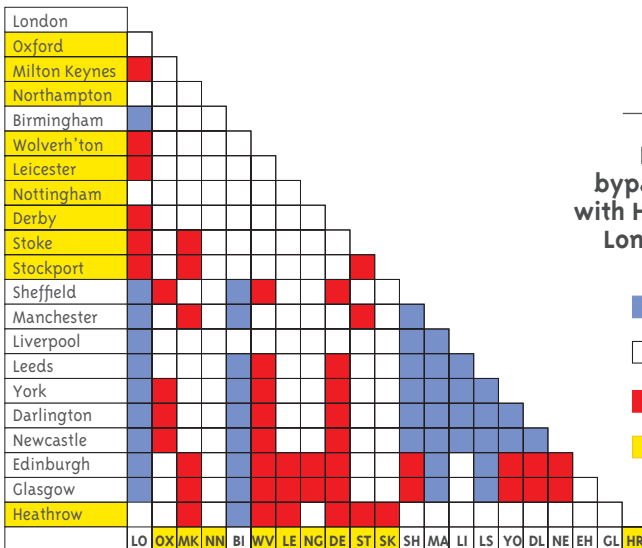
**High Speed UK**  
21 cities interlinked with direct highspeed services

Full interconnectivity is only possible with HSUK  
4-track spine from London to South Yorkshire

- Improved direct intercity journey offered by HSUK
- Intercity journey not improved by HSUK

Source info: HSUK timetable based on design of 1,000km of new and upgraded railway

Figure 1b:



**HS2 & HS3**  
43 links improved  
48 made worse

Poor connectivity and bypassed cities inevitable with HS2 2-track spine from London to West Midlands

- Improved direct intercity journey offered by HS2/3
- Intercity journey not improved by HS2/HS3
- Intercity journey made worse by HS2 intervention
- Community bypassed by HS2

Source info: Table 23, HS2 Regional Economic Impacts (2013)

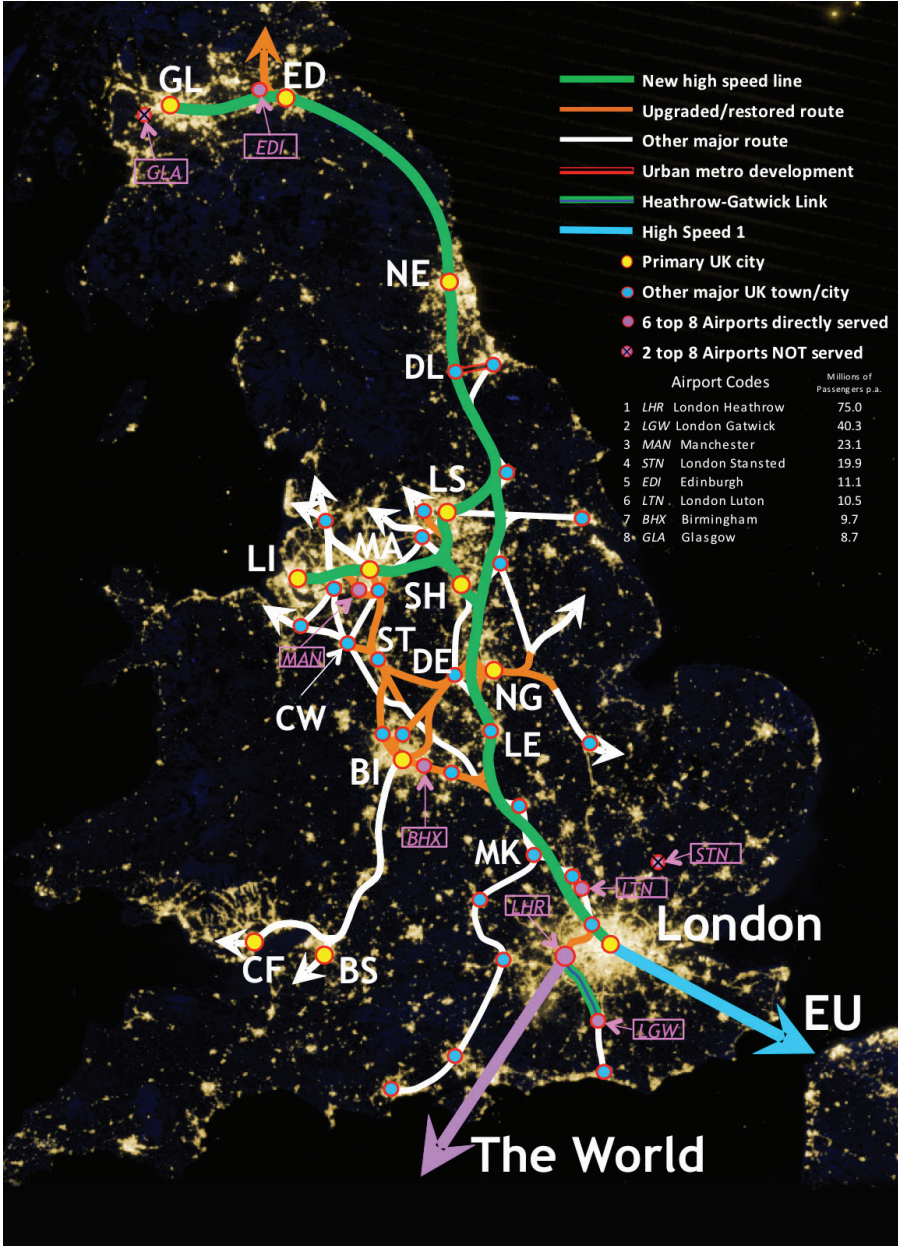
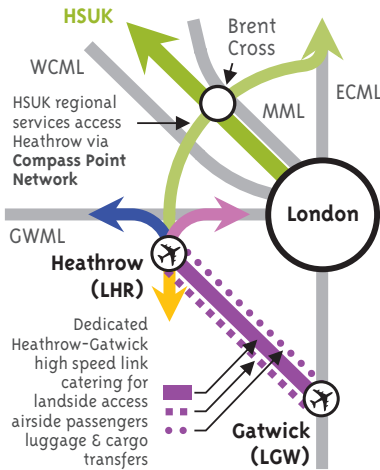


Figure 2:

**HSUK provides direct regional services from Heathrow to:**

Luton, Milton Keynes, Northampton, Coventry, Oxford, Birmingham, Wolverhampton, Stoke, Leicester, Nottingham, Derby, Sheffield, Stockport, Manchester, Liverpool, Leeds, York, Darlington, Newcastle, Edinburgh, Glasgow, Perth, Aberdeen.



**HS2 falls to provide direct regional services from Heathrow to:**

**Any regional cities**

Services were planned to Sheffield, Leeds & Manchester, but were abandoned due to poor business case for dedicated single use spur and lack of capacity of HS2's 2-track spine.

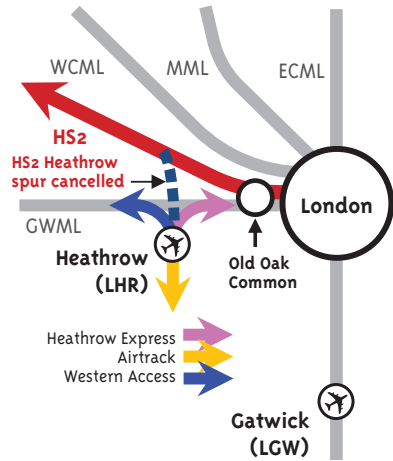


Figure 3:

**Northern Powerhouse: HSUK has all the answers**



**HSUK calculated journey times (in minutes) vs Northern Powerhouse specification**

Between:	NP	HSUK
Manchester - Leeds	30	25
Manchester - Sheffield	30	20
Manchester - Liverpool	20	19
Sheffield - Leeds	30	17
Leeds - Manchester Airport	40	36
Sheffield - Manchester Airport	30	29
Liverpool - Manchester Airport	30	29

# HSUK & HS2/HS3

Scheme elements necessary to connect 7 primary cities ie London, Birmingham, Nottingham, Sheffield, Manchester, Liverpool & Leeds.

## HSUK

- New 4-track HS line
- New 2-track HS line
- Upgraded route
- Primary city linked by HSUK Phase 1 & 2
- Other city
- New London station connecting with Thameslink & Heathrow
- ⊗ Existing airport stations

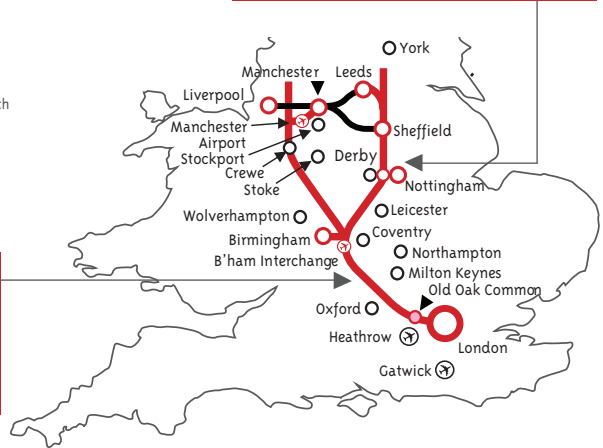


HSUK 4-track spine from London to South Yorkshire gives double the capacity of HS2.

Note proposed provision of HS2 parkway station at Toton, 9 km from central Nottingham.

## HS2 / HS3

- New 2-track HS2
- New 2-track HS3
- Primary city linked by HS2 Phases 1 & 2
- Other city
- New London station inter-connecting with Crossrail & Heathrow
- ⊗ Existing airport stations
- ⊗ New airport parkway station



HS2's 2-track spine has inadequate capacity to serve all major UK cities. Its 'Y'-shaped route requires 215km more new railway than HSUK.



### Cost Comparisons between High Speed UK and HS2/HS3

HSUK is designed to 1:25,000 scale for both vertical and horizontal alignment. This allows all structures necessary to fit the new line onto the landscape – i.e. viaducts, tunnels, cuttings etc. to be defined. Direct comparisons can then be made between HSUK and HS2 as shown below. Because HS2 Ltd. has chosen a ‘Y’ design for its route, HS2 completely fails to connect the Northern cities, unlike HSUK. To make a proper comparison between the two schemes it is necessary to include the cost of the proposed Northern Powerhouse ‘HS3’ Trans-Pennine line linking Liverpool, Manchester, Sheffield and Leeds.

**HSUK’s cost comparisons (including £8 billion allowance for rolling stock) show the following:**

HS2 cost estimate:	£55 billion
Allowance for extra costs of local connections to HS2	£4 billion
HS3 cost estimate:	£14 billion
<b>Total cost estimate:</b>	<b>£73 billion</b>

**HSUK cost estimate (including 4-track spine route):** £52 billion

(This £52 billion is the cost of fully interlinking the 7 primary cities and providing the 4 track spine.)

**HSUK core cost saving:** £21 billion

**This huge cost saving can be simply explained by 3 key factors:**

- HS2 and HS3 require 215km more new build high speed line than HSUK to interlink the 7 primary cities considered in this comparison.
- HS2 and HS3 require around 69km more tunnel.
- HS2 and HS3 are generally located in more difficult, more sensitive and less accessible terrain clear of existing transport corridors.

**Benefit to Cost Ratio (BCR)**

In its report of 28th June 2016 the National Audit Office reported that the Benefit to Cost Ratio<sup>3</sup> of HS2 phases 1 & 2 is 1.8 if wider economic impacts are excluded and 2.2 if they are included. These are not really very inspiring figures from an investor’s point of view.

The BCR for HS2 + HS3 can be used to reveal the value of the Benefit including the wider economic benefits.

So the HS2 + HS3 Benefit is 2.2 x £73 billion = £161 billion.

HSUK will certainly generate at least the same Benefit as HS2 + HS3 but for Costs of only £52 billion – £21 billion less.

$$\text{HSUK BCR} = \frac{\text{£161 billion}}{\text{£52 billion}} = 3.1$$

However, HSUK is expected to generate far more benefit than HS2 by means of its comprehensive intercity services and far superior interchange with local networks. HSUK analysis indicates 7 times better connectivity. Using a very cautious 50% uplift to the Benefits gives a very juicy result indeed.

$$\text{HSUK BCR} = \frac{\text{£161 billion} \times 1.5}{\text{£52 billion}} = 4.6$$

<sup>3</sup> **Benefit to Cost Ratio (BCR)** is an indicator to show the overall value for money of a project in a single number allowing different options for the same project to be easily compared. To calculate the BCR, all the benefits of the project are expressed as money. The benefits that occur in the future are discounted at a rate of 3.5% per annum (The Green Book [para 5.49] – HM Treasury). They are then summed giving the Benefits expressed in a single figure, in today’s money (the Net Present Value). The Costs are treated in The Benefits are then divided by the Costs and the result is a measure of how worthwhile it is to invest in the project. Investors usually look for a figure of at least 2, with 3 or 4, being much more desirable.

## High Speed UK at a Glance

It is important to appreciate that High Speed UK is far more than just hopeful lines on a map; it is a complete design. It is the result of ten years' work to design a better-connected and higher capacity UK rail network as a single holistic system. Its scope far exceeds that of HS2. Every straight, transition and curve has been mapped all the way from London to Birmingham, Sheffield, Leeds, Manchester, Liverpool, Teesside, Tyneside, Edinburgh and Glasgow. The HSUK scheme is ready for detailed design to start immediately. With much simpler construction along a far less controversial route following existing transport corridors, HSUK can be completed much more quickly than HS2 and HS3, at lower cost and to a higher specification.

These are the key High Speed UK achievements:

1. **Network design principles established** – adherence to 6 key principles governing railway network design ensures an efficient, inclusive and resilient national network;
2. **Route designed to 1:25,000 scale, horizontally & vertically** – comprising over 1,000 km of new and upgraded railway, extending from London to Glasgow;
3. **Complementary national mapping** – 21 A3 maps summarise the HSUK design;
4. **Fully developed timetable showing:**
  - a) 45% average journey time reductions;
  - b) Capacity requirements for national network;
  - c) Basic feasibility of full integration.The timetable is based on 1:25,000 route design, Network Rail Sectional Appendix and over 50 connections between HSUK and the existing network;
5. **City centre stations not parkways for all major cities** – this includes a restored Sheffield Victoria station in lieu of HS2's Meadowhall;
6. **Substantial cost reductions over HS2 and HS3** – comparisons based on detailed route designs for both HS2 and HSUK;
7. **Regional integration strategies** – compiled for all regions served by HS2/HSUK, these show how HSUK will be fully integrated with local rail networks;
8. **High level 'carbon accountancy' undertaken** – this assesses HSUK's potential for huge CO2 reductions arising from step-change road to rail modal shift;
9. **Audit trail of the HS2 design process** – this demonstrates total failure of due process, extending from remit formulation to option selection to design development, with consultation responses ignored at all stages;
10. **Comprehensive responses to HS2 consultations** – HSUK has engaged with all major official consultations on HS2 to explain the consequences of HS2 Ltd's failure to develop an efficient and optimised railway network;
11. **Complementary London airports strategy** – this shows a new way forward, with transformed surface access and a high speed link between Heathrow and Gatwick;
12. **Design for an HS1 Link** – a link to HS1 along existing lines for less than £1 million;
13. **Complementary freight strategy** – this uses the intervention of HSUK's new high speed lines to create a gauge-enhanced 'prime user' freight network on existing lines.

Figure 4:

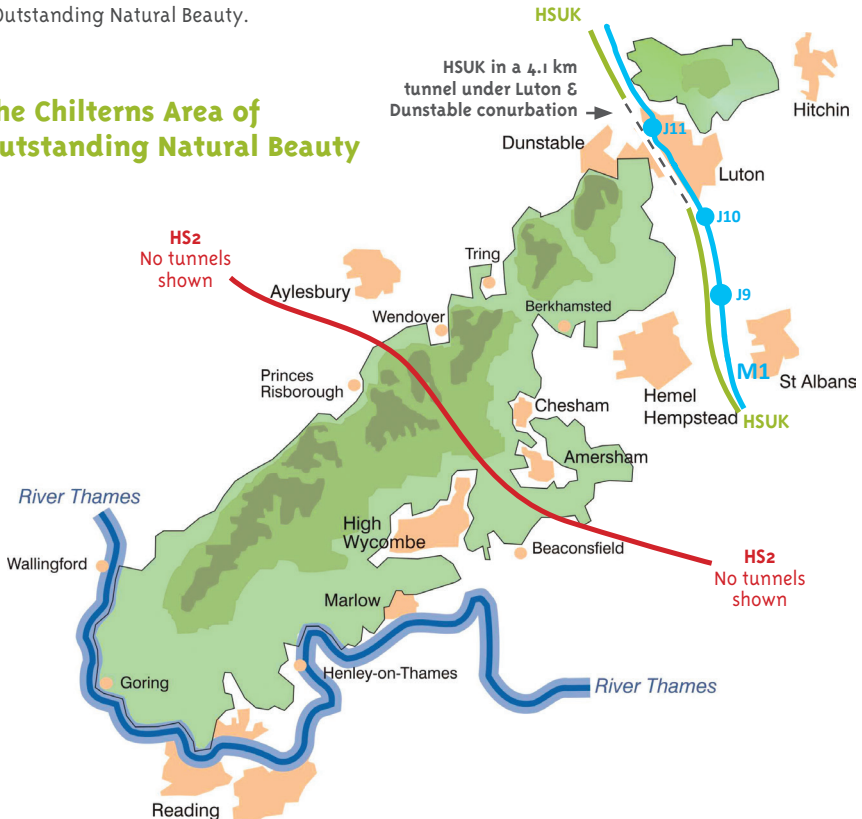
# HSUK

## The Pursuit of Speed

- HSUK’s design will deliver a faster network.
- HS2 will reach Birmingham Curzon Street in 49 minutes from Euston – but passengers will have to walk 10 minutes to New Street for other West Midlands destinations.
- HSUK will reach Coventry in 38 minutes, Birmingham International in 46 minutes and Birmingham New Street in 55 minutes. That’s 4 minutes faster than HS2.
- HS2 Ltd’s assertion<sup>4</sup> that a route through the Chilterns is unavoidable is simply not correct. By following the M1 corridor, HSUK has designed a complete route that will not cut through the countryside and will preserve this Area of Outstanding Natural Beauty.



## The Chilterns Area of Outstanding Natural Beauty



<sup>4</sup> HL Paper 134, Page 70, Para 222, Statement by Lord Adonis

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