High Speed UK — Connecting the Nation

HSUK

HS2 – High Speed to Failure

22 Reasons why the Government's experts have got it wrong

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Introduction

In all the furore that has surrounded the HS2 project, it is easy to lose sight of what the building of HS2 is intended to achieve. We are indebted to Andrew McNaughton, Technical Director of HS2 Ltd, for providing the following succinct 'mission statement' for HS2. In evidence to the House of Commons HS2 Select Committee on 30th November 2015 he stated:

> **"The aim of the HS2 project is to deliver hugely enhanced capacity and connectivity between our major conurbations"**

This statement not only encapsulates the twin goals of enhanced capacity and enhanced connectivity; it also defines the primary function of high speed rail as an intercity railway, interlinking all of the UK's principal population centres.

We believe that high speed rail must achieve far more. Not only must it prove a worthwhile investment of more than £70 billion of public money, it must also fully exploit the once-in-two-centuries opportunity that the UK high speed rail project represents – to transform our existing railway system into a better-connected and higher-capacity network to meet the needs of the 21st Century. This new network must satisfy many key requirements, to:

- Be accessible to the greatest possible proportion of the UK population;
- Offer the greatest improvements in connectivity and capacity, and the greatest reductions in journey time for the least cost and environmental damage;
- Radically improve links to the UK's principal airports, not only to Heathrow but also to the next tier – Gatwick, Luton, Birmingham, Manchester and Edinburgh;
- Maximise the opportunity for more freight to be transported on the existing rail network, thereby reducing the congestion and pollution caused by HGV traffic;
- Enable the development of 'Powerhouse' economies in all UK regions;
- Obtain real value for money through maximised benefits and minimised cost with a Benefit to Cost Ratio (BCR) of at least 4.0 in accordance with the Treasury Green Book;
- Conform with all other aspects of Government policy, including CO_2 emission reductions in line with the 80% reduction target of the 2008 Climate Change Act.

These requirements closely mirror the many benefits that have been claimed for HS2, and latterly Northern Powerhouse Rail (NPR). Central to these claims has been the assertion that the intervention of HS2 (and NPR) will enhance the national rail network. However an inconvenient truth lurks beneath the hype. HS2 has only ever been designed as a high speed line, linking just 8 regional stations that are largely disconnected from the existing local rail services, and often remote from key population centres. No meaningful attempt has ever been made to integrate HS2 with the existing railway system, and this leaves it unable to form the enhanced network that the nation needs to interlink fully its many population centres.

This failure to integrate HS2 with the existing network will have disastrous consequences not just for the UK high speed rail project, but for the entire UK railway system. The extent of this failure only becomes clear when HS2's performance is compared with the superior High Speed UK alternative, designed from the outset as a fully integrated national network.

We hope that the comparisons set out on the following pages will demonstrate two key truths; firstly, how far HS2 Ltd has fallen short of its fundamental objective, to deliver "hugely enhanced capacity and connectivity" between the UK's major conurbations, and, secondly, the huge gains that could be realised if the UK high speed rail project were to be designed with the primary aim of creating an enhanced and fully integrated national network.

Contents

Glossary of Abbreviations used in text and diagrams

HSUK	High Speed UK	AB	Aberdeen	EH	Edinburgh	NN	Northampton
HSUK	High Speed North	BD	Bradford	EX	Exeter	OX	Oxford
HS2	High Speed 2	BI	Birmingham	GL	Glasgow	PE	Peterborough
ECML	East Coast Main Line	BP	Blackpool	HD	Huddersfield	PH	Perth
MML	Midland Main Line	BS	Bristol	HU	Hull	PL	Plymouth
WCML	West Coast Main Line	BX	Brent Cross	LE	Leicester	PR	Preston
GWML	Great Western Main Line	CF	Cardiff	LI	Liverpool	SA	Swansea
KX/StP	Kings Cross/St Pancras	CG	Cheltenham	LO	London	SH	Sheffield
OOC	Old Oak Common	CH	Chester	LS	Leeds	SK	Stockport
NPR	Northern Powerhouse Rail	CV	Coventry	LU	Luton	ST	Stoke
LHR	Heathrow Airport	CW	Crewe	MA	Manchester	WA	Warrington
LGW	Gatwick Airport	DD	Dundee	MK	Milton Keynes	WS	Walsall
BHX	Birmingham Airport	DE	Derby	NE	Newcastle	WV	Wolverhampton
EDI	Edinburgh Airport	DL	Darlington	NG	Nottingham	YO	York
MAN	Manchester Airport	DN	Doncaster				

1. HS2 fails the Connectivity test

HS2's primary objective is to deliver "hugely enhanced capacity and connectivity" between the UK's major conurbations, and this improved connectivity is crucial to HS2 Ltd's claims of multi-billion pound economic benefits.

To test this claim, we have assessed the performance of HS2 and Northern Powerhouse Rail (NPR) in interconnecting 20 major UK cities plus Heathrow Airport, and we have compared this with our own High Speed UK (HSUK) proposals.

The cities that we have considered are:

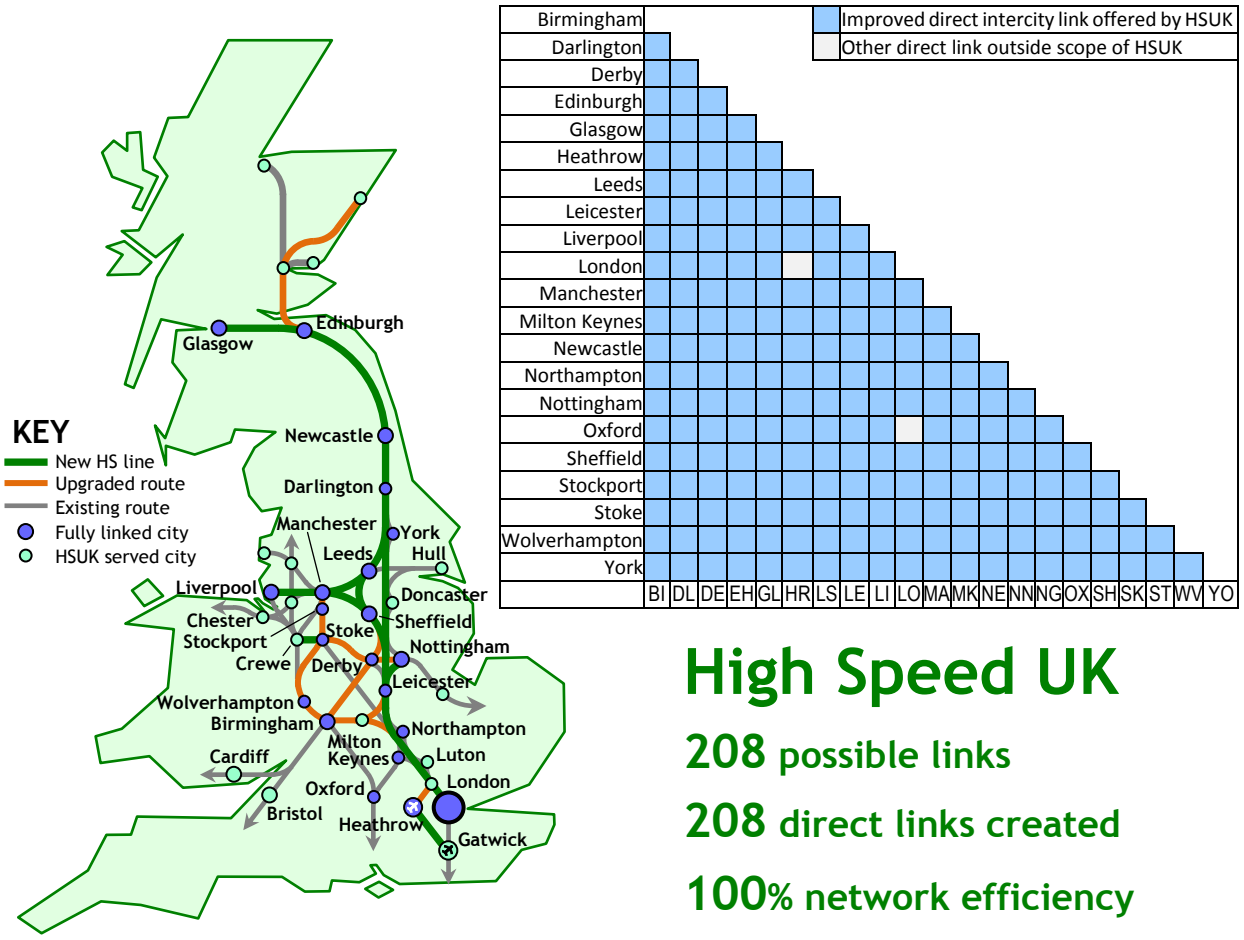
- London, Oxford, Milton Keynes, Northampton, Birmingham, Wolverhampton, Leicester, Nottingham, Derby, Stoke, Stockport, Sheffield, Manchester, Liverpool, Leeds, York, Darlington, Newcastle, Edinburgh, Glasgow, plus Heathrow Airport.

For HS2, predicted services are taken from Table 23 of *HS2 Regional Economic Impacts* (report by KPMG for HS2 Ltd, 2013). These predictions cover both high speed services on the new HS2 lines, and also reduced intercity services on the existing main line network. Predicted Northern Powerhouse Rail services are taken from the HS3 Journey Time Specification (see pages 29-30), with the assumption made that these services can be delivered.

HSUK's predicted services are taken from the HSUK 'Demonstrator Timetable', itself based on detailed route design of over 1,000km of new railway and more than 50 connections to the existing network.

The comparisons on the opposite page show that HSUK achieves full interconnectivity between all 21 centres, and improves frequency or journey time (or both) on 208 of the 210 journeys between these 21 centres.

By contrast HS2 only improves 42 journeys, makes 60 worse, and leaves 10 of the 21 centres entirely bypassed. This is clearly not the "hugely enhanced connectivity" that has been claimed for HS2.

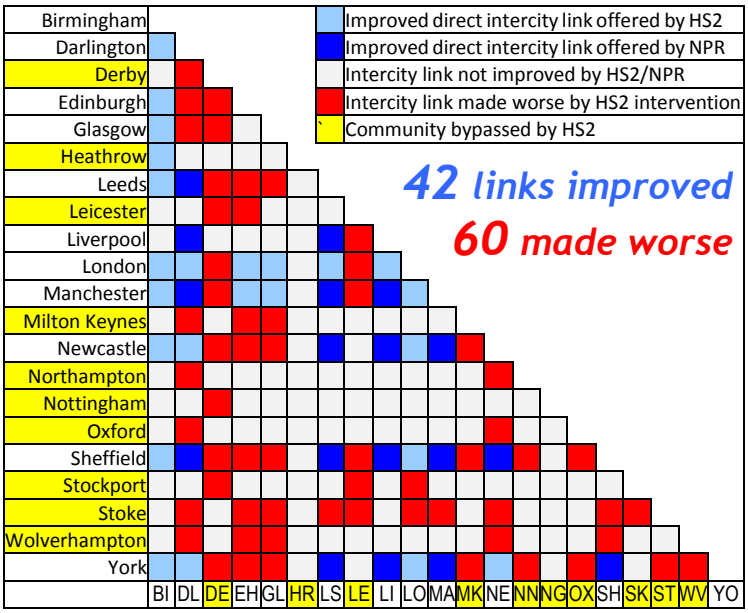


High Speed UK

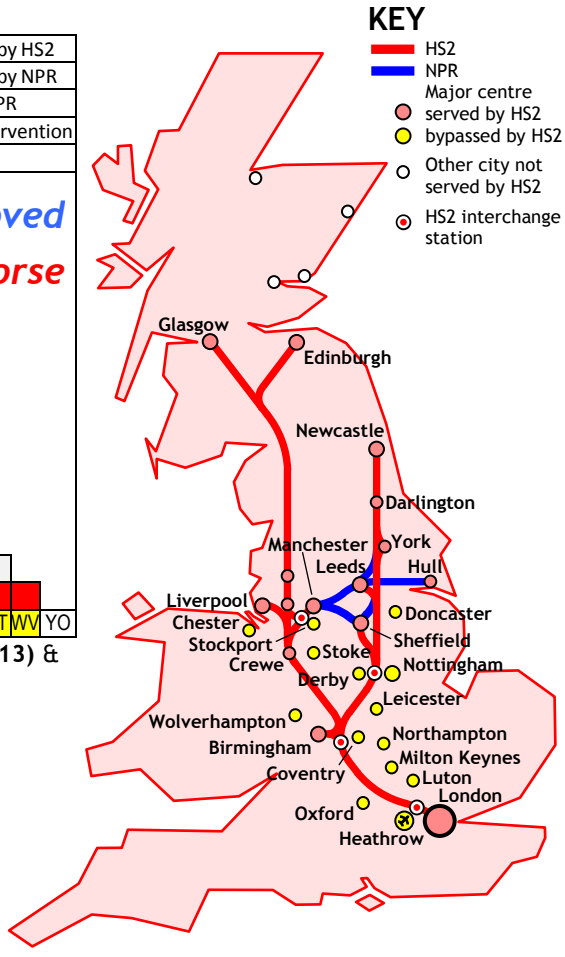
208 possible links

208 direct links created

100% network efficiency



Source info: **Table 23, HS2 Regional Economic Impacts (2013)** & Northern Powerhouse Rail route & journey time specification



HS2 + NPR

208 possible links

42 direct links created

20% network efficiency

2. HS2 fails the Capacity test

Claims that HS2 will add capacity to the national rail network tend to conceal a more fundamental truth. HS2's 2-track route from London to the West Midlands has neither sufficient capacity nor the correct routeing nor the necessary links to the existing rail system to serve all the major cities of the Midlands, the North and Scotland that are served by the present intercity network.

This will lead to a highly divisive situation whereby a few primary cities will benefit from direct links to HS2; but a greater number of second-tier cities, such as Milton Keynes, Coventry, Leicester, Derby and Stoke (total city population 1.4 million, or 3.3 million in their Larger Urban Zones) will be bypassed by HS2, and will have no effective links to HS2 services. Instead, these cities will remain reliant on existing main lines on which intercity services are projected to be reduced. This loss of connectivity seems certain to have major adverse economic impacts.

HS2's winners and losers are shown on the diagram opposite.

HS2's failure to provide sufficient new capacity can be likened to building a motorway with a single lane in each direction, and no interchanges. As a motorway, this would be an obvious nonsense, and exactly the same judgment should apply for new railways.

HSUK's superior design resolves all of HS2's capacity and inclusivity deficiencies, and at the same time it offers far greater operational resilience with its much greater interconnectivity to the existing network. The following features – all diametrically opposed to HS2's philosophy – are key to HSUK's superior performance:

- 4-track capacity in HSUK trunk route, double that of HS2;
- Adherence to existing road and rail transport corridors, thereby accessing far more major population centres than HS2 can;
- Provision of more than 50 links to existing main lines.

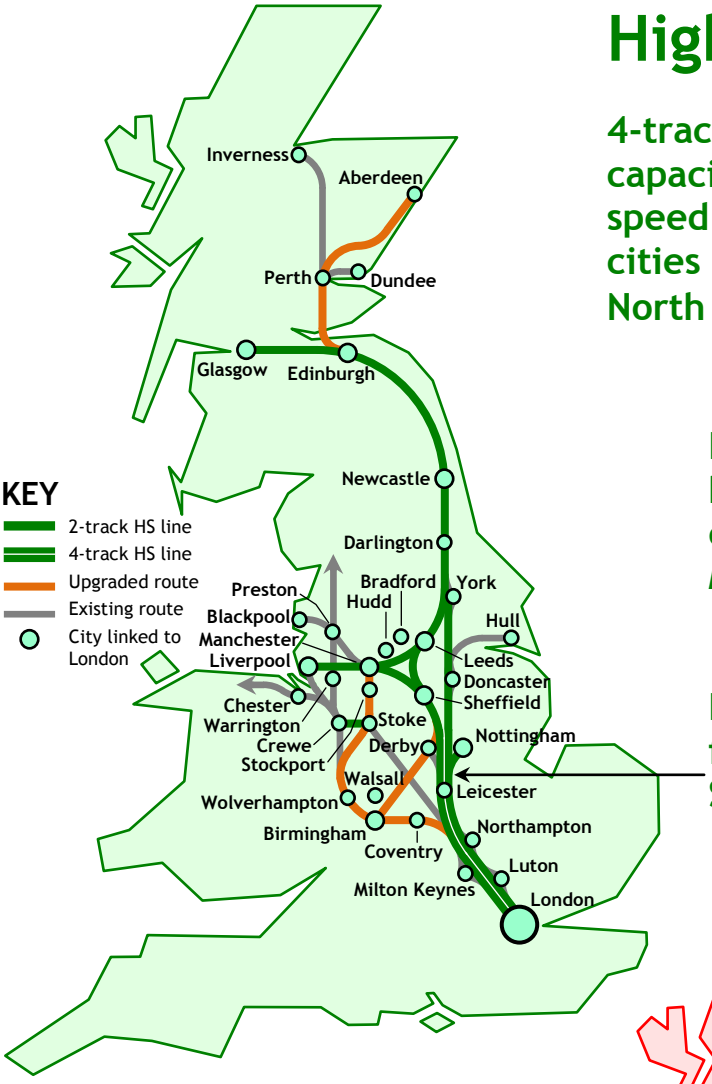
Under the HSUK proposals, all major cities of the Midlands, the North and Scotland will enjoy improved intercity services, and in these cities there will be much greater capacity for local services.

High Speed UK

4-track spine route has the capacity to bring high speed services to all major cities of the Midlands, the North and Scotland

HSUK's full integration hugely increases local capacity in Birmingham, Manchester and Leeds

HSUK 4-track spine from London to South Yorkshire

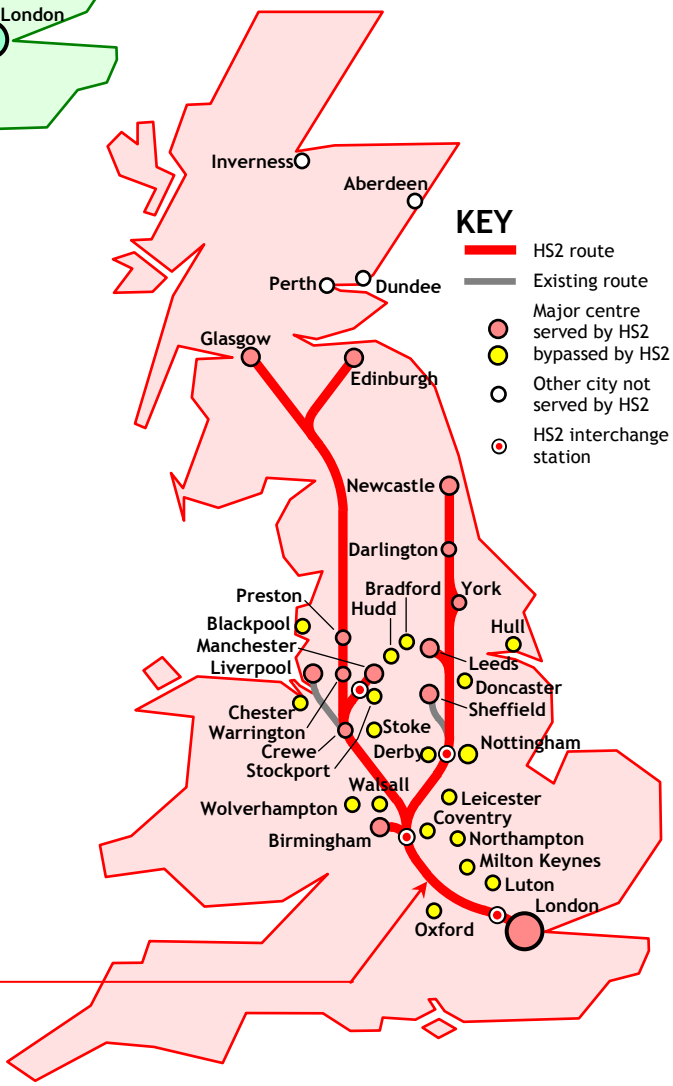


High Speed 2

2-track spine route lacks the capacity to serve all communities & bypasses more major cities of the Midlands, the North & Scotland than it serves

With no effective integration, HS2 offers no significant capacity increase in any regional city

HS2 2-track spine from London to West Midlands forming stem of 'Y-network'



3. HS2 fails the City Centre Station test

The enhancements in capacity and connectivity anticipated with the advent of new high speed lines will only prove worthwhile if the trains operating on these lines can be filled with passengers. To achieve this necessary commercial objective, it is vital that the trains operate from stations that are well connected to local rail services and other public transport, and are located close to the central business districts of the UK's principal cities. In inland cities, these stations should be 'through' stations rather than termini, to enable efficient operation of longer cross-country routes.

HS2's proposed stations perform poorly against these requirements. Its stations will either be a peripheral parkway (for Nottingham), termini (Birmingham, Manchester and Leeds) or existing central stations (Sheffield and Liverpool) on long spurs, remote from the high speed line. All these types are unsuitable for modern high-frequency, high-volume intercity operations.

HS2's proposed Curzon Street station in Birmingham offers an excellent example of poor station selection. This will be built on the site of the original terminus of the London & Birmingham Railway (precursor to the West Coast Main Line). Curzon Street *Mk1* opened in 1838, but it was found to be unsuitable for the operation of through services, both across the West Midlands, and nationwide. Curzon Street only survived until 1854, when it was superseded by a through station at New Street. A similar fate seems likely to befall HS2's Curzon Street *Mk2*.

HSUK's network has been designed to a radically different philosophy. Its trains will operate from central stations in all the primary cities, and the capacity of local routes will be enhanced to ensure conflict-free approaches for high speed services. This will also bring huge capacity benefits for local services.

The diagram opposite evaluates HS2's and HSUK's proposed station solutions in all primary cities. In all cases, HSUK offers the superior solution, and avoids the huge costs of developing (and disrupting) local networks to be 'HS2 ready'.

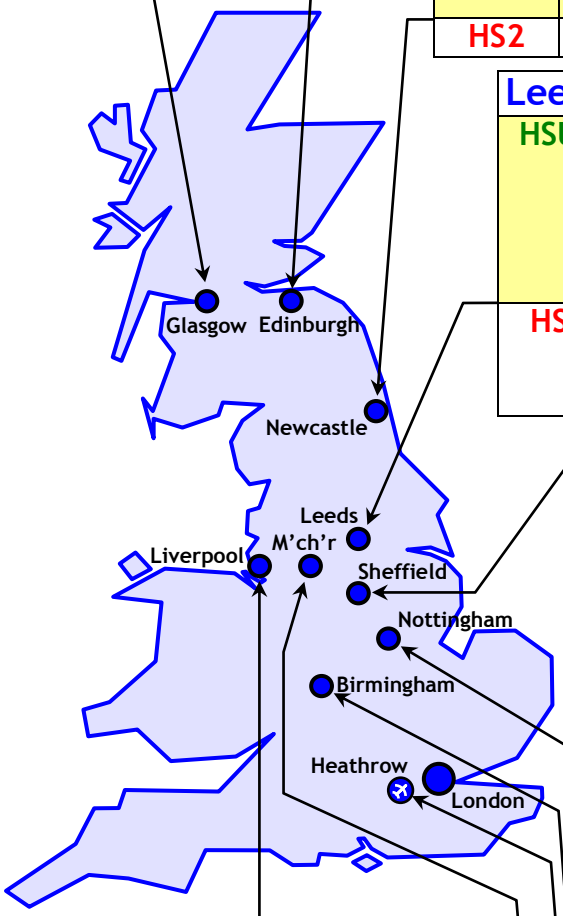
Glasgow	
HSUK	Glasgow Central to be developed as HSUK station
HS2	No proposal currently defined, viability of dedicated link to Scotland now in doubt

Key	
HSUK	Yellow infill denotes optimised central station proposal
HS2	

Edinburgh	
HSUK	Edinburgh Waverley to be developed as HSUK station
HS2	No proposal currently defined, viability of dedicated link to Scotland now in doubt

Newcastle	
HSUK	HS platforms on new Northumbria Bridge, fully integrated with Newcastle Central
HS2	No proposal currently defined

Leeds	
HSUK	Leeds City Station developed as HSUK station with dedicated reserved route for through flows; approach routes to be reoriented to reduce platform congestion & double local capacity
HS2	Latest proposals show new terminus platforms for HS2 at Leeds City Station No significant local capacity increase



Sheffield	
HSUK	Sheffield Victoria reopened as HSUK city centre station fully integrated with existing local services to Sheffield Midland
HS2	Existing Sheffield Midland now proposed as HS2 station on long spur from HS2 trunk route

Nottingham	
HSUK	HSUK services to existing Nottingham Midland station
HS2	Toton, 9km from city centre, proposed as HS2 station

Birmingham	
HSUK	HSUK services to existing New St station to maintain integrity of UK intercity network. Major upgrades to existing approaches to enhance capacity
HS2	Curzon Street terminus isolated from existing network

Liverpool	
HSUK	HSUK services to existing Liverpool Lime St station
HS2	HS2 services to existing Liverpool Lime St station

Manchester (M'ch'r)	
HSUK	Underground through station at Piccadilly to allow E-W high speed & local services. Major increase in local capacity
HS2	New terminus platforms at Piccadilly, no significant increase in local capacity

Heathrow (LHR)	
HSUK	HSUK services to existing Heathrow Express stations, transformed into through system
HS2	Dedicated airport spur cancelled, no prospect of direct HS2 services

4. HS2 fails the ‘Six Principles’ test

HS2 can only deliver its primary objective, of “hugely enhanced capacity and connectivity” between the UK’s major conurbations, if it operates in harmony with existing main lines, to create a network. However, HS2 is to be built and operated largely segregated from the existing network and this will make efficient network operation difficult if not impossible to achieve.

This critical contradiction has gone entirely unrecognised by HS2’s supporters, who continue to describe the proposals as the ‘Y network’. There is no indication, in any of the detailed reports that have been published in support of HS2, of any structured attempt to design HS2 as a national network or to optimise its performance as the core element of any national network.

Instead, it seems simply to have been assumed that the addition of new high speed lines will bring about an efficient network. This assumption is entirely mistaken. A better and more efficient network will not happen by accident; it will only come about if the new high speed lines are designed from the outset to form a network in conjunction with the existing railway system.

HS2’s inability to perform as a network is exposed by High Speed UK’s massive superiority in every test set out in this document. HSUK’s superior network performance is only possible through designing to a structured set of principles and tests, and these ‘Six Principles’ are set out on the opposite page.

In view of HS2 Ltd’s failure to give any meaningful attention to issues of network performance (as documented on pages 47-48), it is hardly surprising that HS2 fails every test as a national network.

The High Speed Rail 'Six Principles' Tests

A high speed railway cannot be an end itself. It can only be worth the investment of more than £70bn of public money if it performs as a network, delivering the greatest possible benefit to the greatest possible population. The 'Six Principles' tests set out below enable the relative merits of competing proposals to be objectively assessed.

1. The Intercity Test : Do the HSR proposals perform well as an intercity network?			
1.1	12 UK primary cities *(incl Bristol & Cardiff)* fully interlinked?	HSUK *PASS*	HS2 *FAIL*
1.2	Frequent interconnections with existing network?	HSUK *PASS*	HS2 *FAIL*
1.3	Inclusion of second-tier cities?	HSUK *PASS*	HS2 *FAIL*
1.4	10 further second-tier cities fully interlinked?	HSUK *PASS*	HS2 *FAIL*
1.5	Hourly (or better) frequencies on all routes?	HSUK *PASS*	HS2 *FAIL*
2. The Local Interchange Test : Efficient interchange with local networks?			
2.1	HS rail services to central stations in all major cities?	HSUK *PASS*	HS2 *FAIL*
2.2	Efficient harmonisation with local networks?	HSUK *PASS*	HS2 *FAIL*
2.3	Capacity increase to local networks in all primary cities?	HSUK *PASS*	HS2 *FAIL*
3. The International Connections Test : Efficient connections to airports and HS1?			
3.1	Direct links to Heathrow from all UK primary cities?	HSUK *PASS*	HS2 *FAIL*
3.2	Comprehensive direct links to principal regional airports?	HSUK *PASS*	HS2 *FAIL*
3.3	Direct link to HS1 with minimal community impact?	HSUK *PASS*	HS2 *FAIL*
4. The Freight Test : Potential for development of a parallel National Freight Network?			
4.1	Associated strategy for parallel National Freight Network?	HSUK *PASS*	HS2 *FAIL*
4.2	Continental gauge (UIC-C) for 'piggyback' lorry traffic?	HSUK *PASS*	HS2 *FAIL*
4.3	Transpennine lorry shuttles to address road congestion?	HSUK *PASS*	HS2 *FAIL*
5. The Performance Test : Efficient construction, and future-proofed operation?			
5.1	Buildability *(ie accessibility, sensitivity & easiest topography?)*	HSUK *BEST PERFORMER*	
5.2	Construction sequence *(can system be built in regions first?)*	HSUK *BEST PERFORMER*	
5.3	Capacity *(does system improve intercity, local & freight capacity?)*	HSUK *BEST PERFORMER*	
5.4	New journey opportunities *(to airports, & new regional links)*	HSUK *BEST PERFORMER*	
5.5	Operational viability *(has timetable been developed?)*	HSUK *BEST PERFORMER*	
5.6	Journey time reductions *(assessed between 32 key centres)*	HSUK *BEST PERFORMER*	
5.7	Resilience *(can system cope with planned/unplanned disruption?)*	HSUK *BEST PERFORMER*	
5.8	Network efficiency *(max no. of cities linked for fewest trains)*	HSUK *BEST PERFORMER*	
5.9	Future-proofing against demographic changes etc	HSUK *BEST PERFORMER*	
6. The Public Policy Test : Compliance with all relevant aspects of public policy?			
6.1	CO_2 emissions *(conformance with 2008 Climate Change Act?)*	HSUK *BEST PERFORMER*	
6.2	Minimised Environmental Impact	HSUK *BEST PERFORMER*	
6.3	Inclusivity *(accessibility/usefulness to greatest population?)*	HSUK *BEST PERFORMER*	
6.4	Value for money/BCR *(greatest economic benefit/least cost?)*	HSUK *BEST PERFORMER*	
6.5	Rebalanced economy *(regional 'Powerhouses' created?)*	HSUK *BEST PERFORMER*	
6.6	Profitable railway *(considering entire national network)*	HSUK *BEST PERFORMER*	
6.7	Minimised public expenditure *(lowest construction cost?)*	HSUK *BEST PERFORMER*	

5. HS2 fails the Timetable test

It is only possible to evaluate the performance of a railway system through the development of a timetable; but so far, HS2 Ltd has failed to publish any detailed timetable to show how the national rail network will operate with HS2 and NPR in place.

The disconnection of HS2 from the existing network is of course so great that it is probably not possible to develop a meaningful timetable. This supposition is generally supported by the best information currently available i.e. Table 23 from *HS2 Regional Economic Impacts* (report by KPMG for HS2 Ltd, 2013), which lists both new high speed services between the primary cities, and the reduced intercity services on existing main lines.

High Speed UK's route design of over 1,000km of new-build and upgraded railway, including over 50 connections to the existing network, has allowed development of a Demonstrator Timetable that describes most primary UK intercity services.

This timetable demonstrates HSUK's following key benefits:

- Average 46% journey time reductions;
- Existing CrossCountry and TransPennine intercity routes greatly improved, with a new South Coast to Scotland route via Milton Keynes, the East Midlands and Yorkshire;
- Direct high speed services from all UK primary cities to Heathrow, using existing Heathrow Express platforms;
- All 'Top 20' cities directly interlinked with high speed services operating at hourly or better frequencies;
- Service levels across network maintained or enhanced. Considering 32 key centres, 455 out of 496 possible intercity journeys are improved, and none are made worse;
- Capacity requirements on all routes defined, and the need for a 4-track high speed line from London to South Yorkshire has been conclusively established;
- All intercity journey time targets met for Northern Powerhouse.

HSUK's comprehensively superior network performance is demonstrated on the diagram opposite.

High Speed UK

The HSUK timetable is based on 496 possible journeys between 32 principal stations.

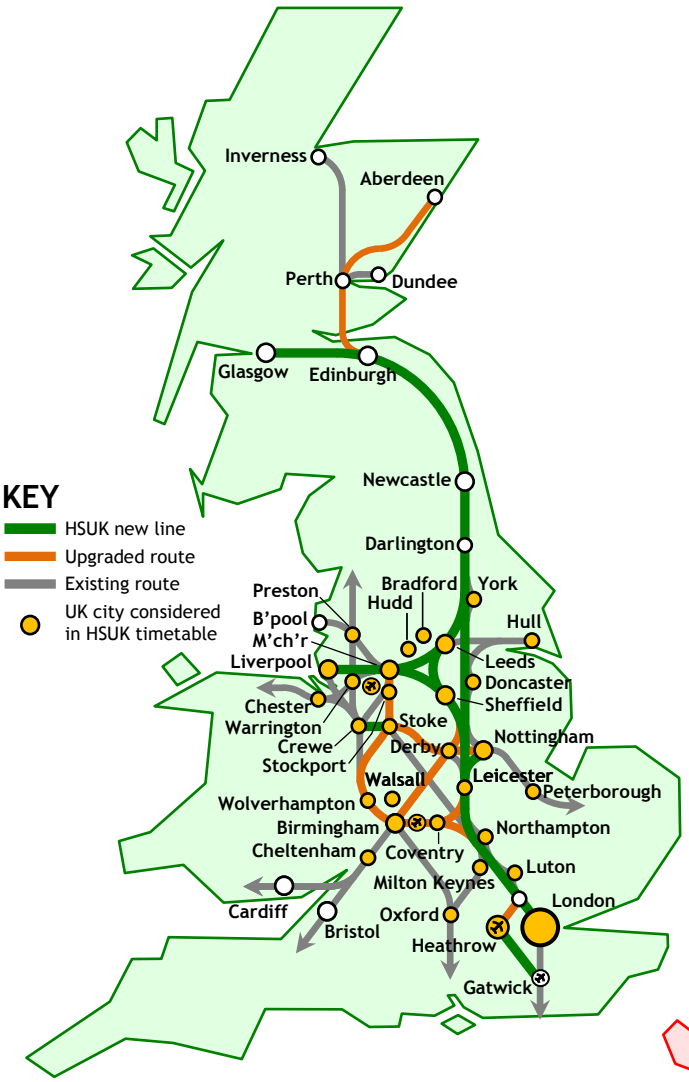
This timetable shows:

455 improved by HSUK

41 unimproved

0 made worse

46% average journey time reduction



HS2 and NPR

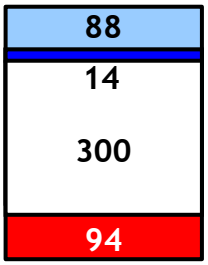
HS2 Ltd has developed no timetable. Our assessment of 496 possible journeys between 32 principal stations shows:

88 improved by HS2

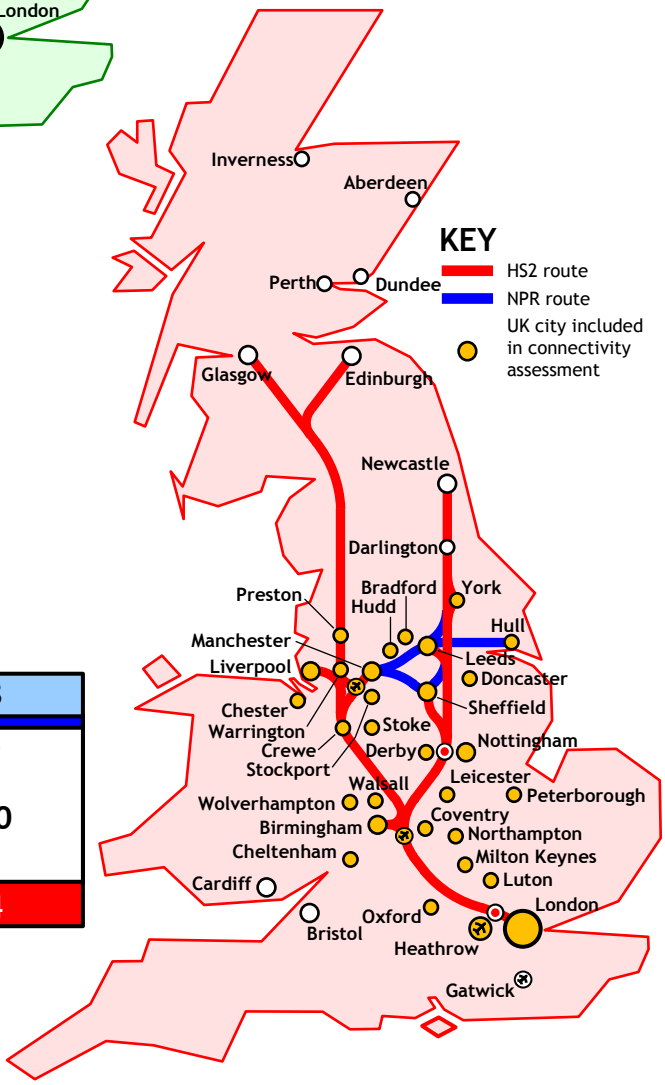
14 improved by NPR

300 unimproved

94 made worse



9% average journey time reduction*



** Effect of journeys improved by NPR and made worse by HS2 not assessed*

6. HS2 fails the London Hub Airport test

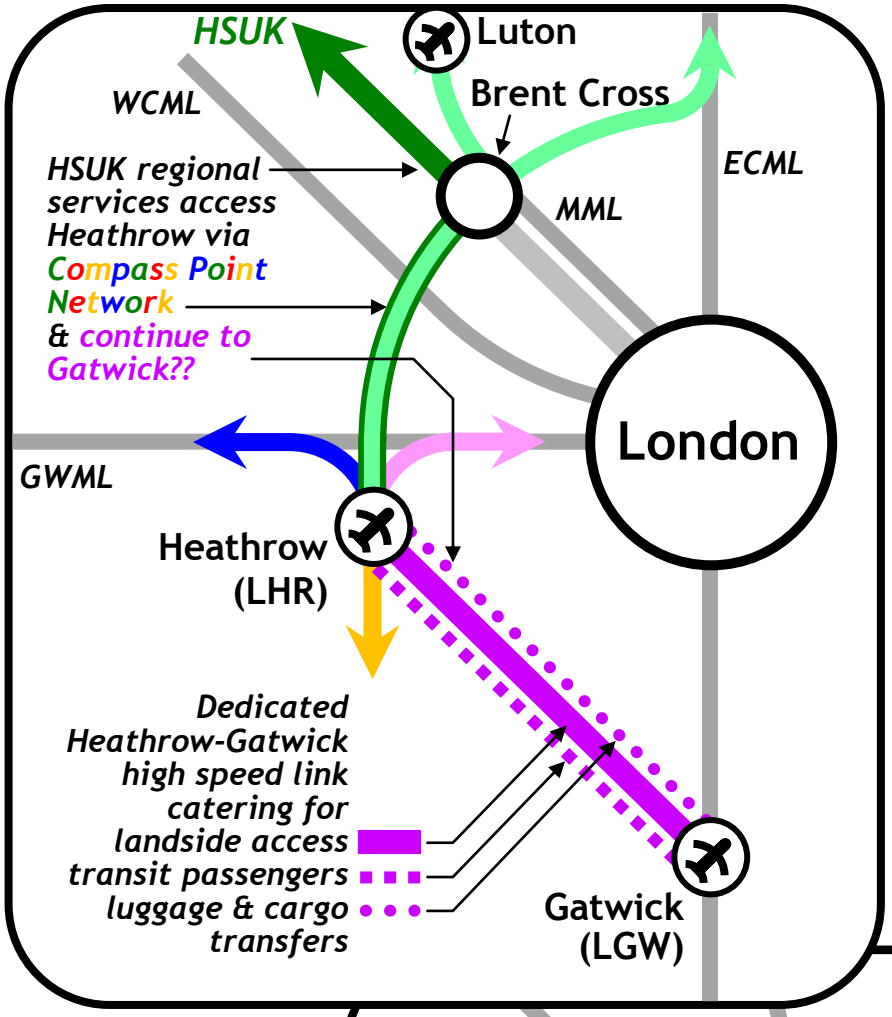
The recommendation of the Davies Commission to increase London's airport capacity with a new runway at Heathrow Airport has placed the Government in an impossible quandary. It is pulled in one direction by the strong desire of the business community and the aviation industry to expand Heathrow, and it is pulled in the opposite direction by the implacable opposition of the local community to any form of expansion.

Although HS2 was once seen as an alternative to building a third runway at Heathrow, HS2 Ltd has failed to develop viable proposals for direct rail links to the UK regions, that might reduce the pressure to expand. With HS2's planned spur to Heathrow cancelled, HS2 is now largely irrelevant to whatever decision Parliament might ultimately take on airport expansion.

High Speed UK has the potential to transform the Heathrow debate through the radically improved surface access that it can offer. Direct high speed services, operating at hourly frequency, will extend from Heathrow to all principal mainland UK cities. This will bring about the following key benefits:

- Transformed 'hub & spoke' airport operation, with fast and comprehensive rail services forming the spokes;
- Elimination of most domestic flights, thereby freeing up 'slots' for new routes to emerging economies.

The establishment of national high speed rail access to Heathrow opens up the possibility of an onward extension to Gatwick. HSUK has already undertaken the design of a high speed link between the two airports, with a length of 46km and a journey time of around 15 minutes. This would be a dedicated route, capable of handling not just 'landside' surface access but also all 'airside' activities i.e. transfer of luggage, cargo and transit passengers. With such a link in place, operation of the two airports could be integrated; and any expansion of London's airport capacity can be achieved with a new runway at Gatwick, for which detailed plans are already in place.



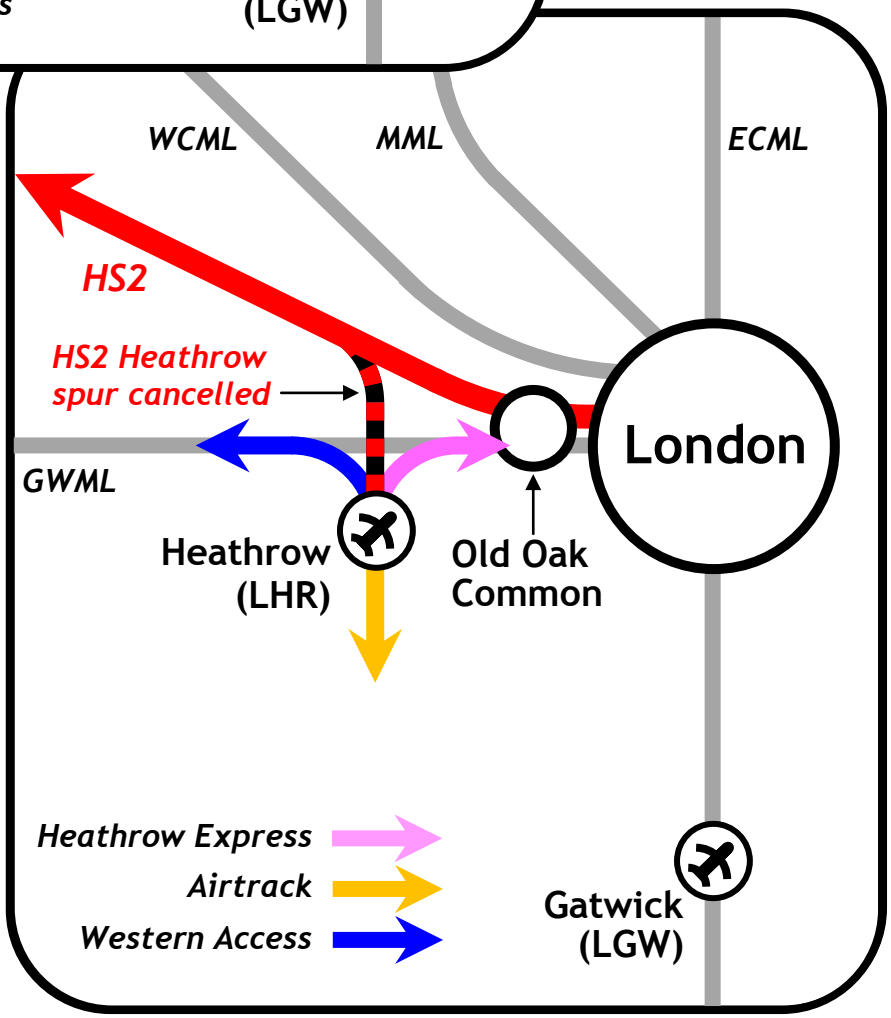
HSUK direct regional services from Heathrow to:

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 direct regional services from Heathrow to:

No other UK city

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



7. HS2 fails the Heathrow test

Improved links to Heathrow Airport are seen as vital for the economic development of the UK regions, and the prospect of direct HS2 services to Heathrow has been crucial in securing support for the project from UK regional communities.

However, despite many hopeful lines drawn on maps, HS2 Ltd has failed to fulfil the aspiration for improved and direct international connectivity to the UK regions. This has happened for a combination of reasons:

- Lack of capacity on HS2's 2-track stem. *It only has capacity for 18 trains per hour, and with all this capacity already allocated to London-bound services, there is no capacity for additional services to Heathrow*;
- Inefficiency of HS2's 'Y' configuration. *All primary cities are located on separate spurs, and it will be impossible to meet the demand of each city for direct services to Heathrow*;
- High cost of long tunnelled spur from HS2 to Heathrow.

These problems have ultimately led to the cancellation of the Heathrow spur, and no direct HS2 services are now proposed to link Heathrow to UK regional cities. Instead, passengers will be forced to change trains at Old Oak Common.

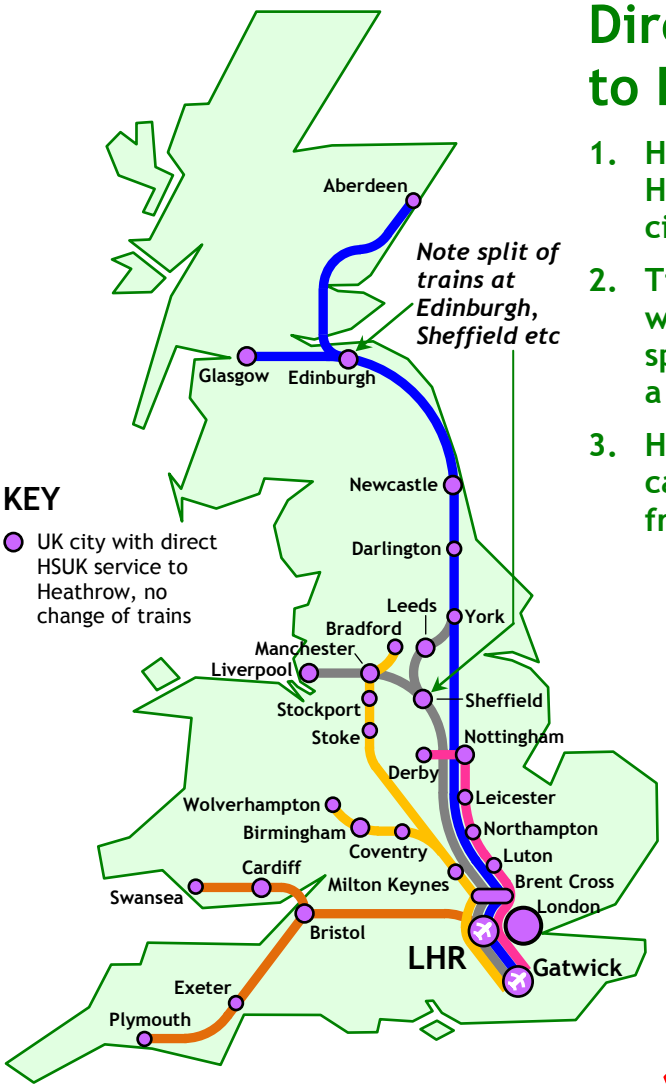
As shown on the diagram opposite, all these problems are avoided under the alternative High Speed UK proposals, which include the following design features:

- A 4-track HSUK stem from London to South Yorkshire;
- An efficient HSUK national network, with multiple cities on single lines of route;
- Full integration with the existing Heathrow Express system.

With these features, HSUK is able to offer direct services from Heathrow to most principal regional cities. This will hugely improve the international connectivity of the UK regions, and it is expected to have a greatly beneficial effect in stimulating regional development.

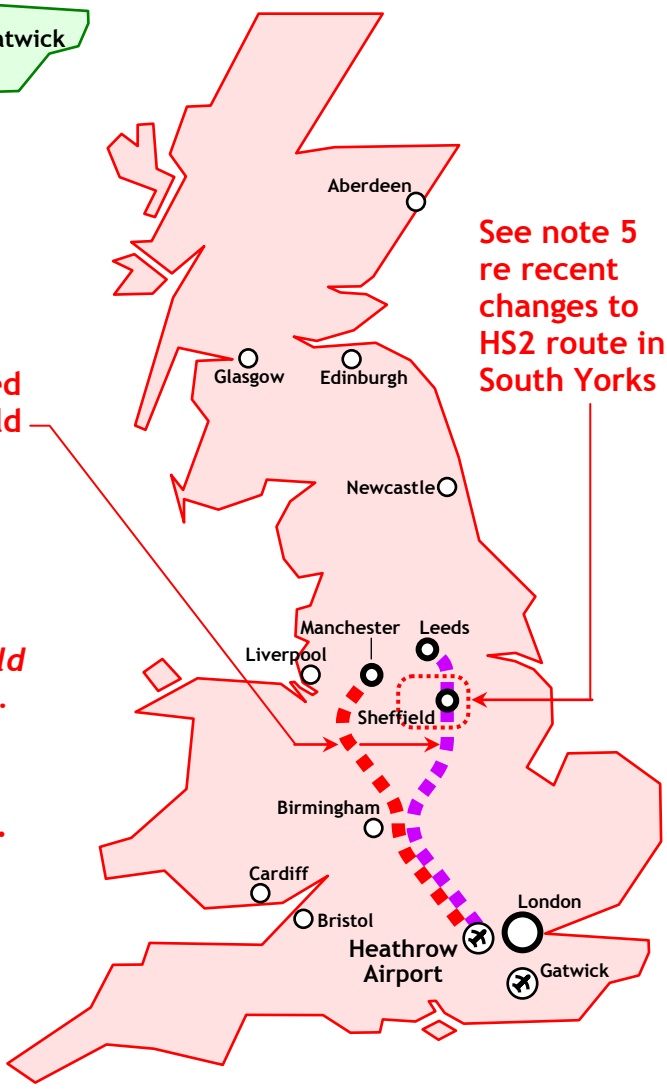
Direct HSUK services to Heathrow

1. HSUK direct services proposed from Heathrow to all primary regional cities, with single split of train.
2. Timetabled direct services possible with the efficiency of HSUK's 'spine & spur' network, with multiple cities on a single line of route.
3. HSUK 4-track spine has sufficient capacity for services to UK regions from Heathrow *and* from London.
4. HSUK Heathrow services to run from existing Heathrow Express platforms, with capacity hugely increased by transformation of Heathrow Express into through system.
5. Note onward link to Gatwick.



No Direct HS2 services to Heathrow

1. Direct services originally proposed from Heathrow to Leeds, Sheffield & Manchester - *but not to other regional cities*.
2. Comprehensive regional services never practicable given the inefficiency of HS2's 'network' - *note that each primary city would be located on a separate branch*.
3. HS2's 2-track stem also lacks the capacity to accommodate direct Heathrow services from all cities.
4. No prospect of regional high speed services to Heathrow with cancellation of dedicated spur.
5. Sheffield to LHR service not practicable with recent route changes.



8. HS2 fails the European test

A requirement for a direct link from HS2 to HS1 was written into HS2 Ltd's core remit (pages 37-38); but in 2014, after costs had risen to over £700 million, the HS2 to HS1 link was cancelled.

The problems of the HS2-HS1 link can be traced back to another requirement in HS2's core remit to provide an interchange with Crossrail and Heathrow services at Old Oak Common. This has dictated HS2's westerly approach route into Euston which in turn means that the only practicable route for the HS2-HS1 link is a very controversial one through the highly sensitive environment around Camden Lock and Camden Market.

Regrettably, no-one within HS2 Ltd appears to have realised that the requirement for an interchange at Old Oak Common is in direct conflict with the requirement for a link to HS1. Routeing via Old Oak Common effectively means that HS2 can never be physically linked to HS1 and the prospect of improved rail links from the UK regions to Europe will be lost forever.

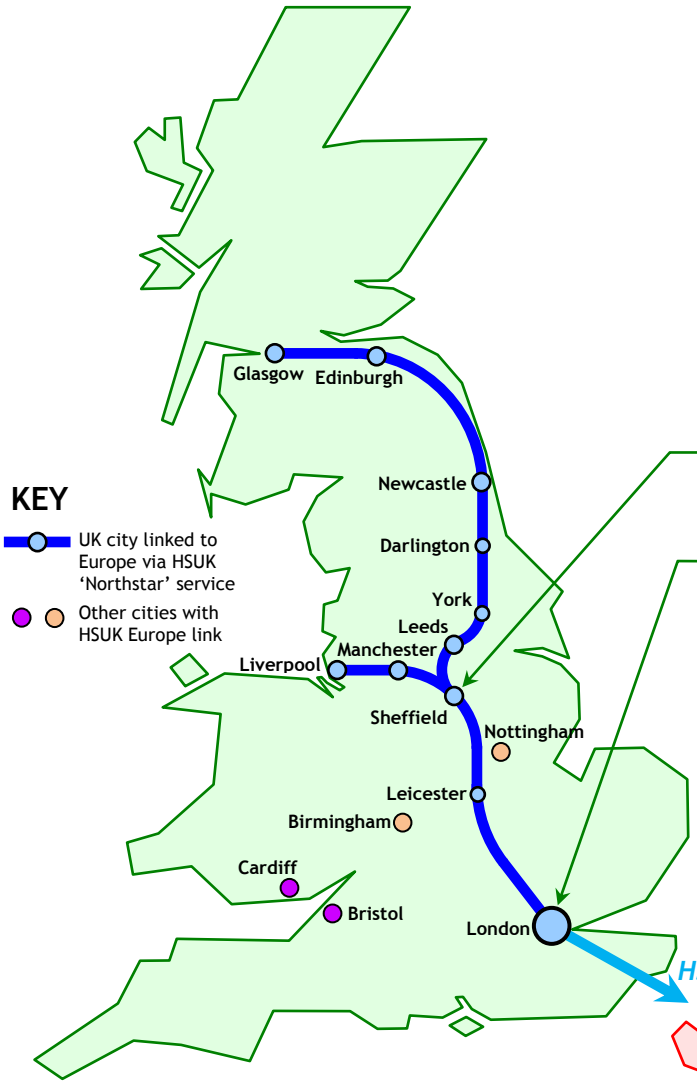
The problem of the HS2-HS1 link is solved by High Speed UK's better-engineered route to central London. HSUK follows the M1 and the Midland Main Line (MML), thus approaching Euston from a different, more northerly direction. At West Hampstead on the MML, HSUK domestic and European services will take different routes. The domestic services will access Euston through a new 3.4km long tunnel whilst the European services will simply follow the MML into the international platforms at St Pancras. HSUK's European services will reverse at St Pancras and continue to Europe via HS1 and the Channel Tunnel.

The diagram opposite shows a scheme for a direct service from Europe to all Northern and Scottish primary cities, possibly operating at a 2-hourly frequency.

The cost of HSUK's link to HS1 is estimated at about £2 million. Only minor works in the St Pancras 'throat' are required with no land take and minimal disturbance caused to local residents.

Direct HSUK services to Europe via HS1

1. Vital for connectivity of UK regions to Europe.
2. Practicable with efficiency of HSUK network - one train can serve all Northern & Scottish cities, with single split at Sheffield.
3. Possible with direct HSUK-HS1 link via Midland Main Line requiring no new-build infrastructure.
4. Separate trains required for Bristol/Cardiff and Birmingham/Nottingham



No Direct HS2 services to Europe via HS1

1. Link to HS1 key element of original HS2 remit.
2. Not practicable given the inefficiency of HS2's 'network', with each primary city on separate branch.
3. Not possible with cancellation of HS2-HS1 link.
4. No prospect of regional high speed services to Europe.

9. HS2 fails the Freight test

One of HS2's principal selling points has been the extra capacity that should be released for freight traffic, as intercity passenger flows transfer to the new high speed line. But this 'trickledown' strategy is compromised by:

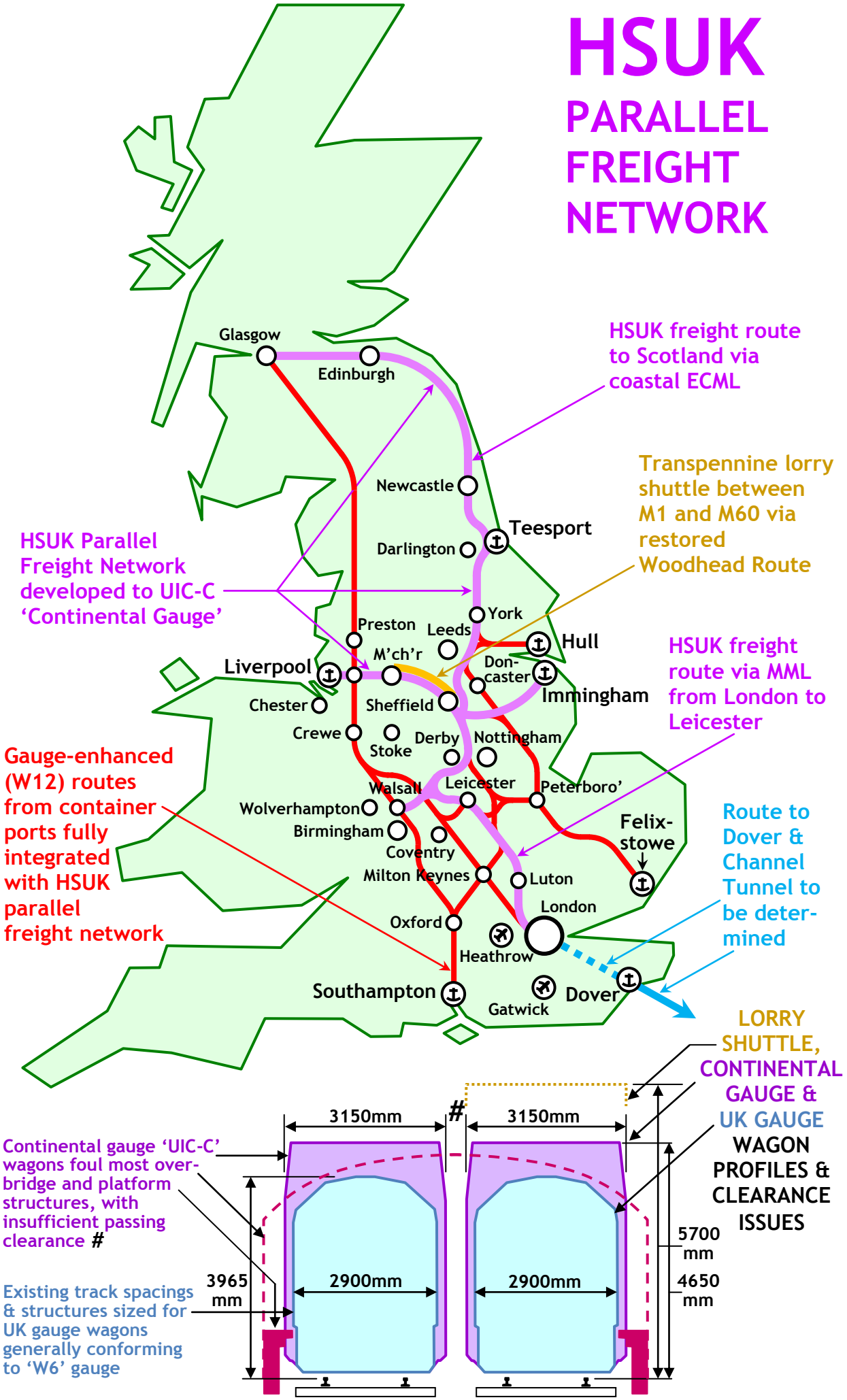
- HS2's own lack of capacity, and its flawed routeing strategy. *This will leave key routes such as the West Coast Main Line and the Midland Main Line still congested.*
- The lack of any wider vision for a national freight strategy, with freight capacity issues addressed on a nationwide basis and a network of routes created on which freight is 'prime user'. *This requires transfer of express passenger traffic to other lines but slower-speed local/regional passenger traffic would be generally retained.*
- The lack of any vision for an upgraded freight network capable of accommodating larger 'continental' sized rail wagons and 'piggyback' HGV trailers on rail wagons.

The High Speed UK concept for a complementary national freight strategy is illustrated on the opposite page. This shows the existing routes that must be upgraded to achieve a 'continental gauge' freight network extending to all the key conurbations that will be interlinked by HSUK's new high speed lines. These routes generally comprise either:

- underused existing freight lines; or
- main lines (such as the MML from London to Leicester, and the ECML from Newcastle to Edinburgh) that will be paralleled and superseded by HSUK's new high speed lines.

HSUK's establishment of a national continental gauge freight network capable of operating 'piggyback' services will be particularly valuable given its potential to transfer huge volumes of road freight to rail. This should dramatically reduce road congestion and assist in the achievement of step-change road to rail modal shift essential for CO_2 reductions in line with the 80% reduction target of the 2008 Climate Change Act.

HSUK
PARALLEL FREIGHT NETWORK



10. HS2 fails the Chilterns test

The proposed HS2 route through the widest part of the Chilterns Area of Outstanding Natural Beauty and through much unspoilt countryside further north has caused huge controversy. So far, HS2 has been justified by the twin assertions, that the chosen route represents the best routeing option for HS2, and that the obvious alternative of the M1 corridor is not a practicable proposition.

However, the detailed route design undertaken for the emerging High Speed UK proposals demonstrates conclusively that a high speed line closely following the M1 is both feasible, and far less damaging than the proposed HS2 route through the Chilterns AONB. It offers the following key advantages:

- Complete avoidance of the Chilterns AONB;
- Minimal additional environmental intrusion through close adherence to existing M1 route;
- Minimal requirement for property demolition, due to the M1's historic noise and atmospheric pollution discouraging adjacent residential development;
- A feasible 4-track route from London to the UK regions, providing sufficient capacity to serve all regional cities;
- Hugely enhanced connectivity for M1 Corridor communities i.e. Luton, Milton Keynes, Northampton, Coventry and Leicester;
- Shorter journey times from London to most West Midlands communities, due to HSUK serving the existing primary West Midlands rail hub at Birmingham New Street;
- A London-Birmingham route **£8 billion** cheaper to construct than HS2's route via the Chilterns AONB;
- A London-Birmingham route requiring only 12km of tunnel as opposed to HS2's 50km – *an unprecedented total for a UK intercity railway, comprising 28% of the route length*;
- Massively reduced impact on Ancient Woodlands and SSSIs.

These many advantages must call into question every aspect of the process by which the HS2 scheme has been developed. It is also highly concerning that all route options following the M1 corridor were dismissed very early in the sifting process, despite the acknowledged fact that these were the only options to avoid the Chilterns AONB (pages 43-46).

HS2

London-B'ham Phase1 cost **£22bn**

Route length **175km**

Tunnel length **50km**

HSUK

London-B'ham Phase1 cost **£14bn**

Route length **180km**

Tunnel length **12km**

HS2

Journey time from London Euston to Birmingham Curzon St: **49mins**

Walking transfer to New Street for onward West Midlands connections: **10mins**

TOTAL: **59mins**

HSUK

Avoids the Chilterns AONB by following M1

Requires 11km of tunnel to reach north scarp of Chilterns from Euston

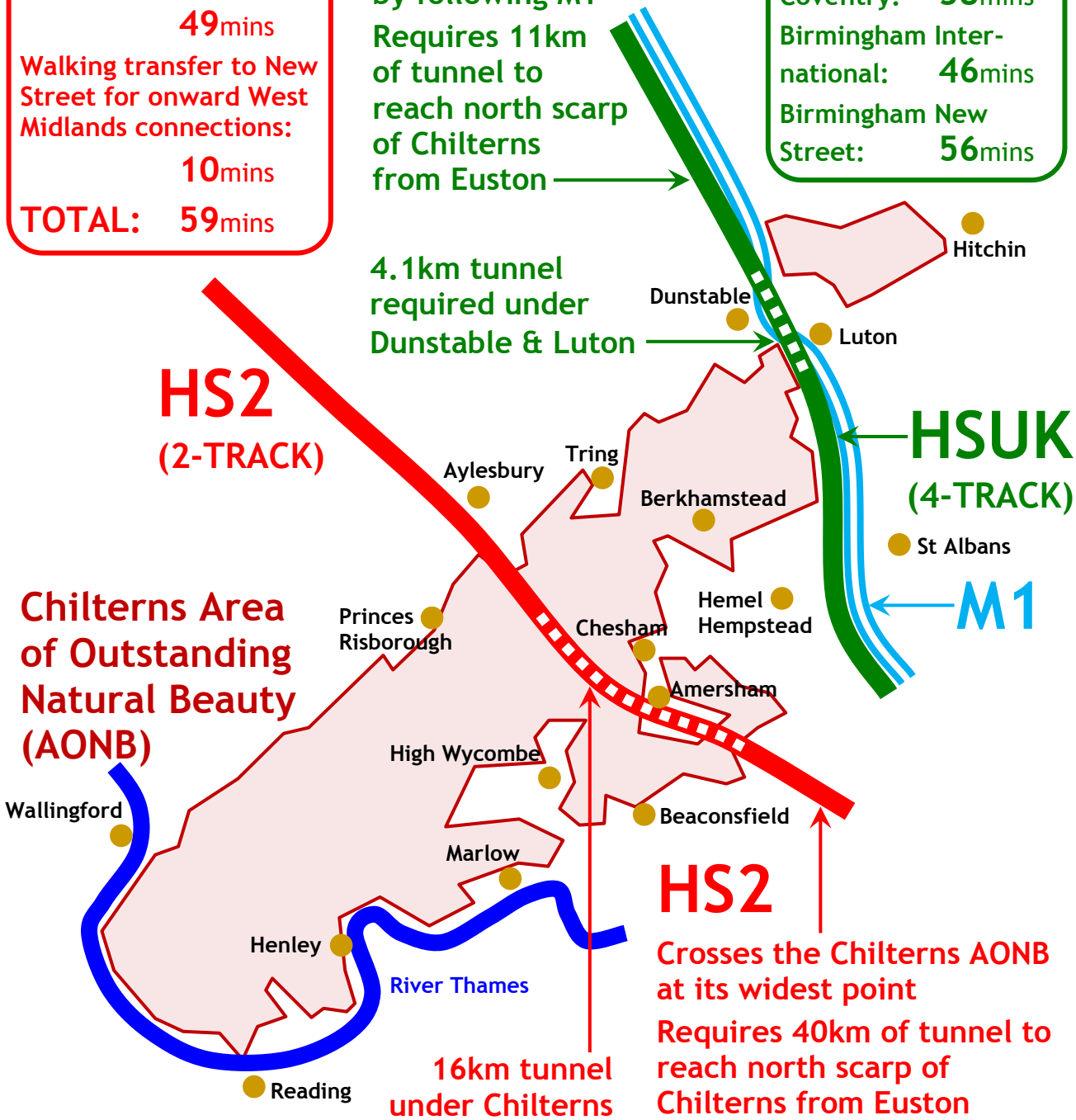
HSUK

Journey time from London Euston to:

Coventry: **38mins**

Birmingham Inter-national: **46mins**

Birmingham New Street: **56mins**



HS2

Crosses the Chilterns AONB at its widest point

Requires 40km of tunnel to reach north scarp of Chilterns from Euston

11. HS2 fails the Euston test

HS2 Ltd has correctly selected Euston as the London terminus for its new high speed line. However, its proposals will cause huge devastation and disruption to the local Camden community. The station is projected to be expanded into surrounding residential property, with over 200 homes lost. Reconstruction of all of Euston Station is estimated to take over 20 years to complete.

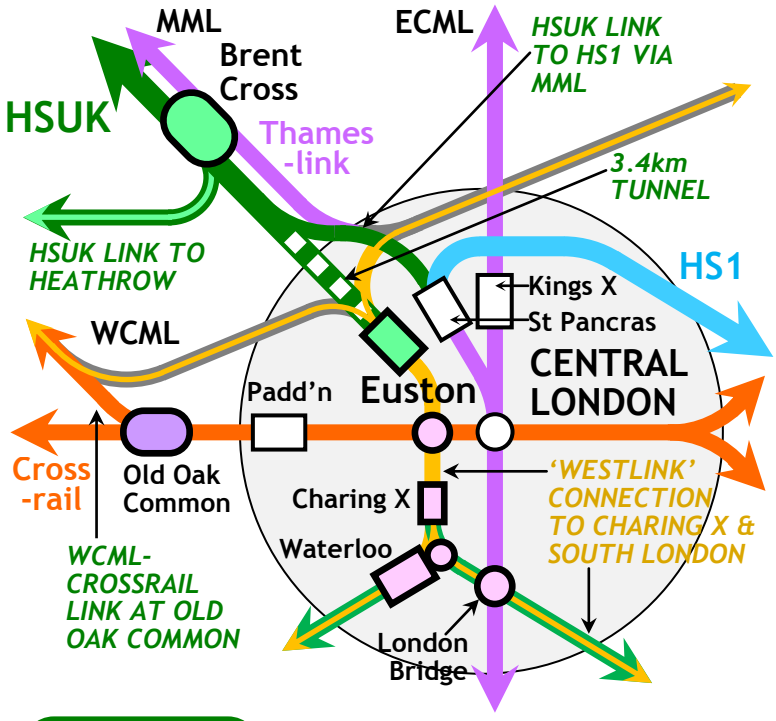
The destructive impact of the HS2 scheme is hugely increased by HS2 Ltd's failure to consider the obvious mitigation – the diversion of Euston's commuter flows onto Crossrail. This would reduce demand for platform space at Euston both during reconstruction and during future operation of HS2.

Only 2km of new railway, constructed on the surface, and estimated to cost about £100M, is required to connect Crossrail at Old Oak Common to the West Coast Main Line at Harlesden. With this link in place, the 10 Crossrail trains per hour currently planned to terminate at Old Oak Common can instead extend onto the West Coast Main Line. This will enable over one third of current peak-hour train and passenger flows to be diverted clear of Euston.

This diversion of commuter flows is central to High Speed UK's plans for Euston. Reduction of train and passenger flows by 36% allows the station to be reconstructed within its own footprint, in a greatly simplified and expeditious 2-stage process which can be completed in around 6-8 years, saving around **£2 billion**. With most commuter traffic permanently transferred to Crossrail, there is no need to expand the station. Euston has sufficient space to terminate up to 24 high speed services per hour in 12 platforms 400m long, with 6 platforms devoted to residual local services.

Further expansion of commuter services, to fully exploit capacity released on the West Coast Main Line, can be accommodated through the construction of 'Westlink'. This scheme would require a new 2.5km long cross-London tunnel to create a through link between Euston's and Charing Cross's commuter services and thereby avoid the need to terminate at Euston (and Charing Cross).

HSUK Strategy for Euston Station redevelopment



1. Link Crossrail to WCML at Old Oak Common.
2. Extend Crossrail services onto WCML, to divert LM commuter flows away from Euston - *reducing train/ passenger flows by ~36%.*
3. Fully rebuild Euston in simple 2-stage sequence - *minimising project costs & local community disruption*
4. Operate Euston as 18 platform high speed terminus with greatly reduced commuter flows.
5. Future Westlink project to divert increased WCML commuter flows.

MINIMISED COMMUNITY DISRUPTION DURING REBUILD

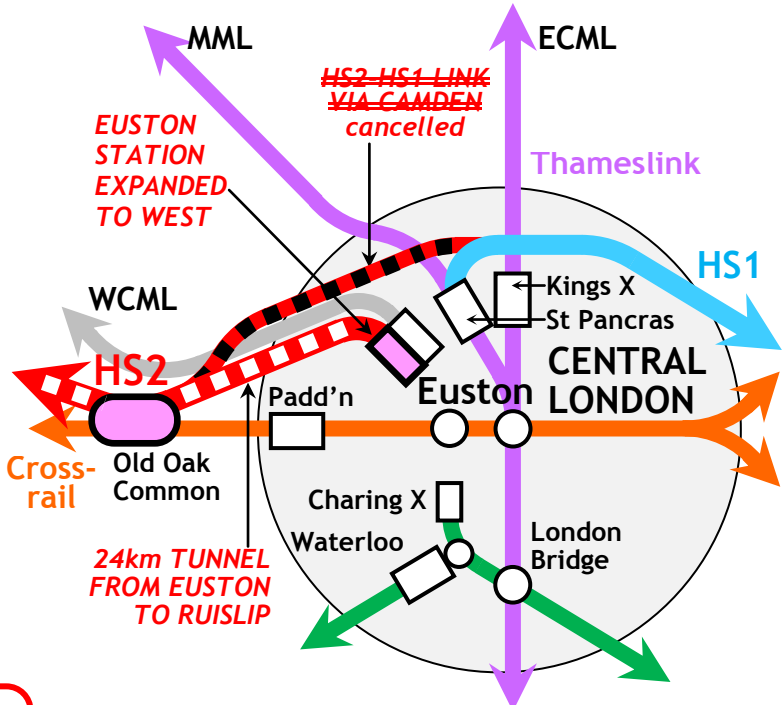
IMPROVED COMMUTER JOURNEYS VIA CROSSRAIL

NO NEED TO EXPAND EUSTON INTO CAMDEN COMMUNITY

REDUCED TUBE CONGESTION AT EUSTON

HS2 Strategy for Euston Station redevelopment

1. Fail to develop a strategy to divert existing train flows away from Euston - *all construction activities alongside busy railway operating at full capacity*
2. Build new station alongside existing to avoid disrupting commuter & intercity services - *215 adjacent homes demolished*
3. Continue rebuild for over 20 years - *causing huge community disruption*



MASSIVE COMMUNITY DISRUPTION DURING REBUILD

NO IMPROVE-MENT TO LOCAL RAIL NETWORK

HS2 STRATEGY FORCES EXPANSION INTO CAMDEN COMMUNITY

INCREASED TUBE CONGESTION AT EUSTON

12. HS2 fails to start the 'Midlands Engine'

The 'Midlands Engine' concept is based upon a political desire to derive a 'local connectivity dividend' from the HS2 proposals for both the East and West Midlands. However, any such dividend is fatally compromised by the astonishingly poor connectivity that HS2 will achieve within the Midlands region – see opposite.

HS2 will only serve 4 stations in the region i.e. the Curzon Street terminus in central Birmingham, Birmingham 'Interchange', Toton near Nottingham, and Crewe. Of these, only Crewe is directly linked to the existing rail network. Of equal concern is the fact that every major population centre of the East and West Midlands, with the single exception of Birmingham, is bypassed by HS2, and will suffer reduced intercity services along existing main lines (pages 3-4). It should not be forgotten that HS2's remit was to serve the entire West Midlands conurbation, not just central Birmingham.

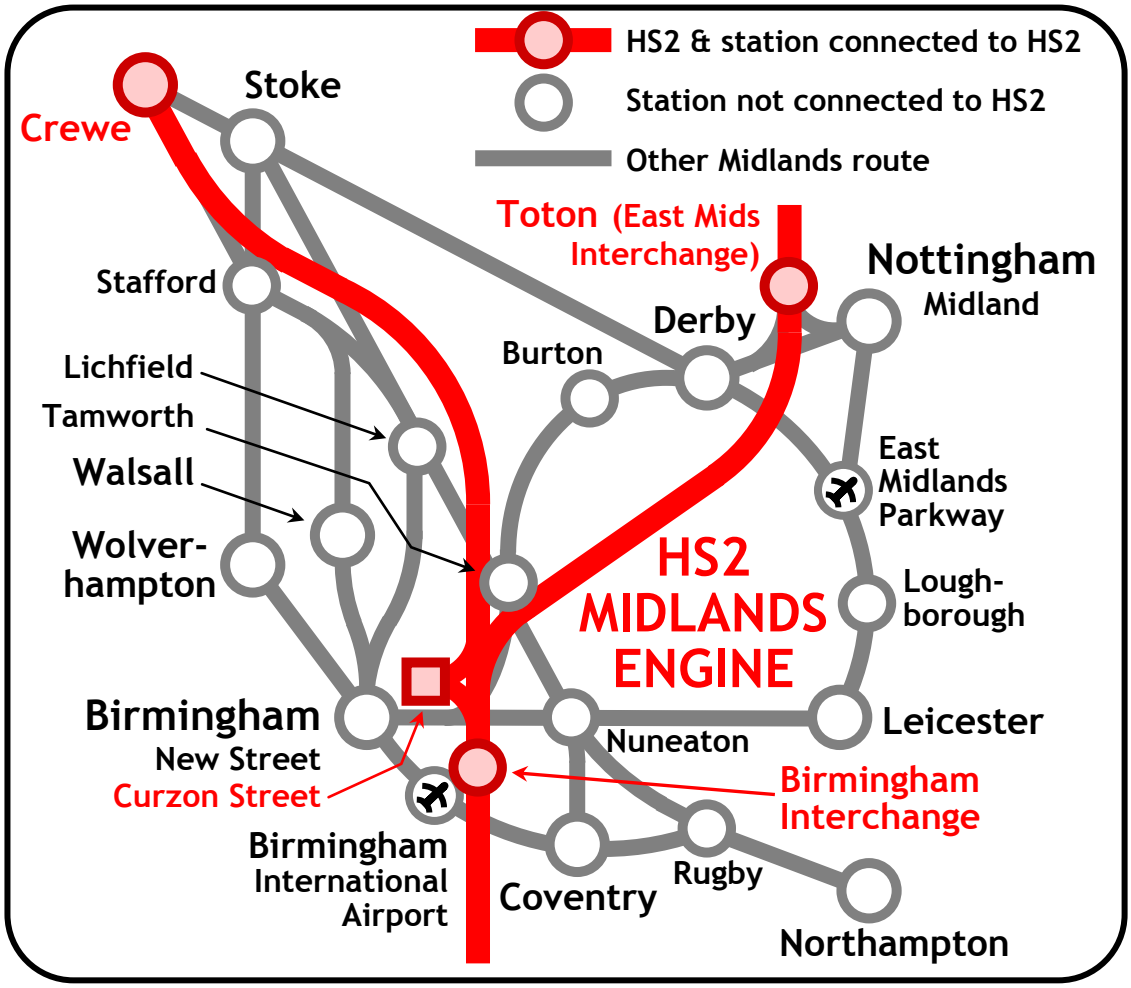
Given these failings, it is difficult to see how a Midlands Engine based upon HS2 will deliver any benefit for the region.

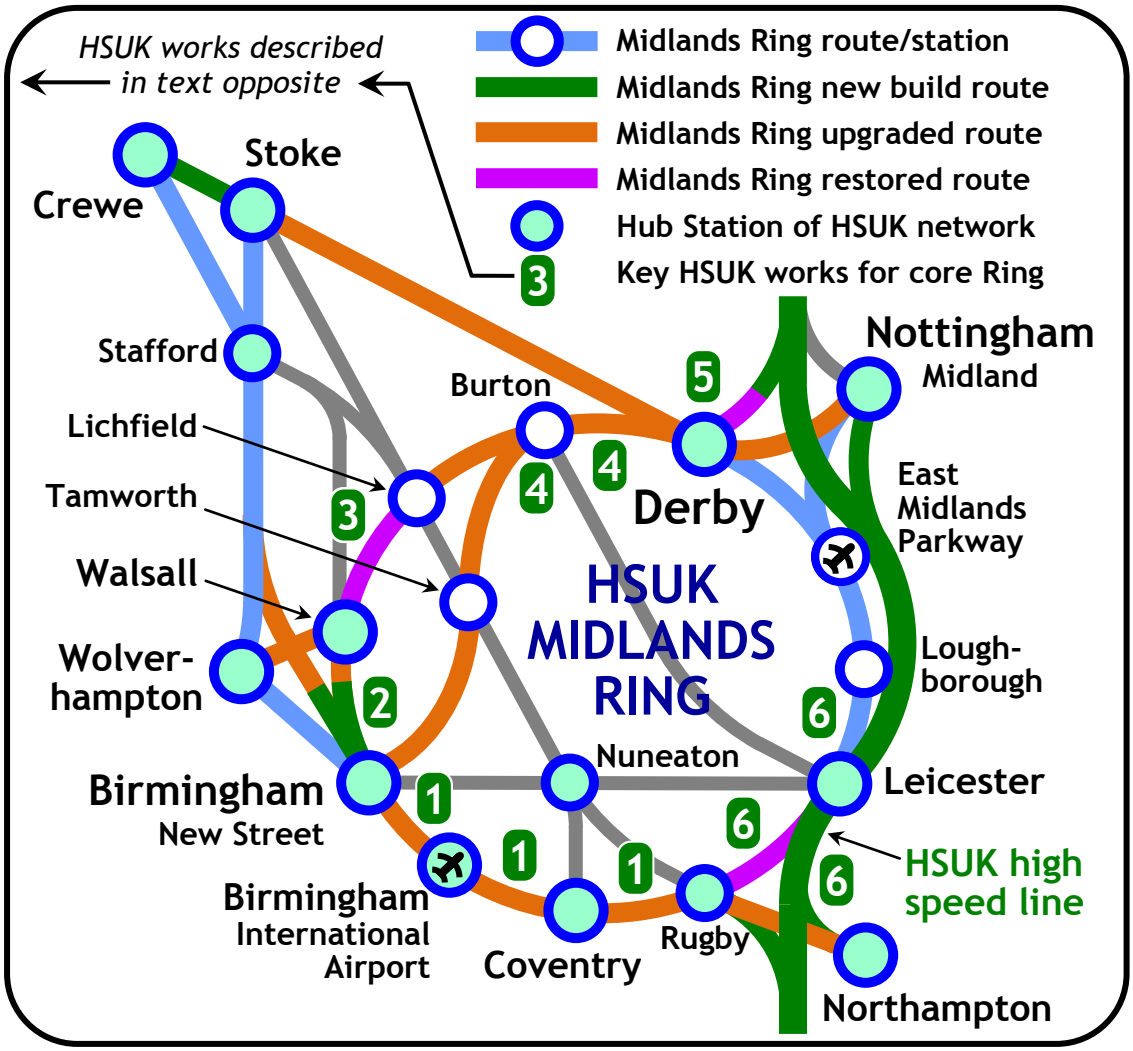
All these problems can be avoided through full integration with the local rail network. High Speed UK will bring high speed intercity services to all major cities of the East and West Midlands, and the necessary upgrades to the local networks and connections to the high speed line will provide both the capacity and the opportunity to create a 'Midlands Ring' that will interlink all the cities of the region. The Midlands Ring is illustrated in the diagram opposite.

The Midlands Ring is reliant upon the following infrastructure works, all necessary for a well-balanced national intercity network:

- 4-tracking of the existing Rugby-Birmingham main line. 1
- New Soho Junction-Tame Bridge link. 2
- Restoration of Walsall-Lichfield route. 3
- 4-tracking of CrossCountry main line through Burton. 4
- Restoration of north side of Derby 'teardrop'. 5
- 4-track HSUK HS line in Leicester area, and Rugby spur. 6

The superior connectivity and capacity of HSUK's Midlands Ring will create far greater economic benefit for the Midlands Region.


HS2 & station connected to HS2
Station not connected to HS2
Other Midlands route
Crewe
Stoke
Stafford
Lichfield
Tamworth
Walsall
Wolver-
hampton
Toton (East Mids
Interchange)
Derby
Burton
Nottingham
Midland
East
Midlands
Parkway
Lough-
borough
HS2
MIDLANDS
ENGINE
Birmingham
New Street
Curzon Street
Birmingham
International
Airport
Nuneaton
Leicester
Birmingham
Interchange
Coventry
Rugby
Northampton


HSUK works described
in text opposite
Midlands Ring route/station
Midlands Ring new build route
Midlands Ring upgraded route
Midlands Ring restored route
Hub Station of HSUK network
Key HSUK works for core Ring
3
Crewe
Stoke
Stafford
Lichfield
Tamworth
Walsall
Wolver-
hampton
Burton
Derby
Nottingham
Midland
East
Midlands
Parkway
Lough-
borough
HSUK
MIDLANDS
RING
Nuneaton
Leicester
Birmingham
New Street
Birmingham
International
Airport
Coventry
Rugby
Northampton
HSUK high
speed line

HSUK

PROJECTED COSTS

HS2/NPR

PROJECTED COSTS

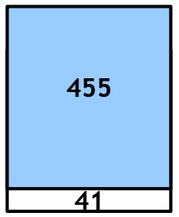
HSUK's timetable, based on 496 possible journeys between 32 principal stations, shows:

455 improved by HSUK

41 unimproved

0 made worse

46% average journey time reduction



See pp 11-12

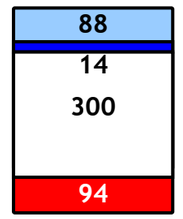
Assessment of HS2, based on 496 possible journeys between 32 principal stations, shows:

88 improved by HS2

14 improved by NPR

300 unimproved

94 made worse



See pp 11-12

Further infrastructure enhancements essential for HSUK's timetabled network & 46% average journey time reductions

£24 bn difference

£95.7 bn

See pp 31-32

Separate HS Routes to Scotland and to North-East

£72.0 bn

See pp 31-32

HS Route to North-East & Scotland

£12 bn difference

£65.2 bn

See pp 29-30

NPR Infra-structure

£52.9 bn

Full Network

£50.7 bn

Local Connectivity

£48.0 bn

Direct Connectivity

£46.7 bn

£43.6 bn

4-track spine

£4bn budget to address local connectivity deficiencies

See pp 33-34

£21 bn difference

See pp 33-34

£38.7 bn

4-track spine gives capacity for enhanced national HSUK network

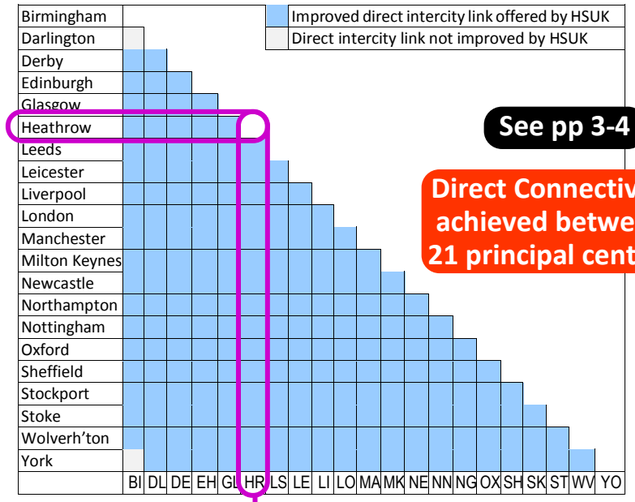
See pp 5-6

NPR required to address connectivity deficiencies of 'Y'

Phase 1/2 Infra-structure c/w 2-track spine

Rolling stock costs excluded from comparisons

Phase 1/2 Infra-structure ie HS2 'Y' c/w 2-track stem

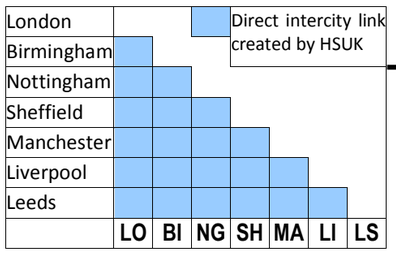


See pp 3-4

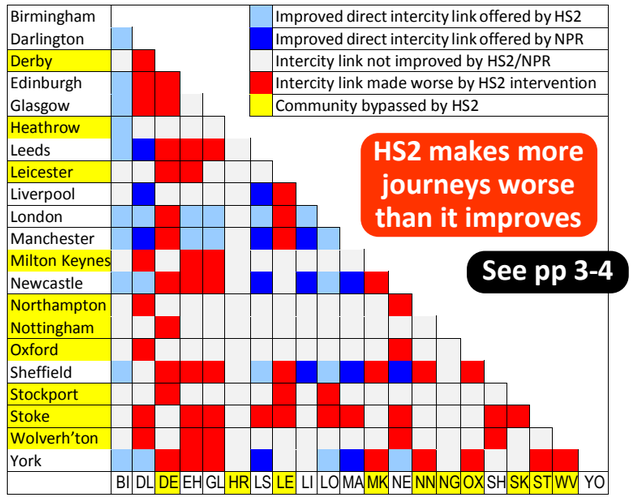
Direct Connectivity achieved between 21 principal centres

HSUK provides direct links to Heathrow from most principal UK cities

See pp 13-16

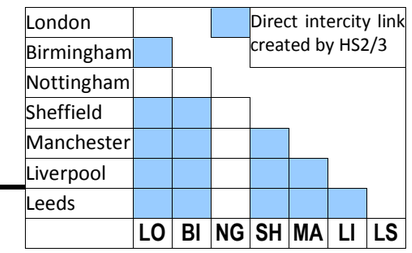


HSUK Phase 1/2 Infrastructure to match geographic extent of HS2 'Y'

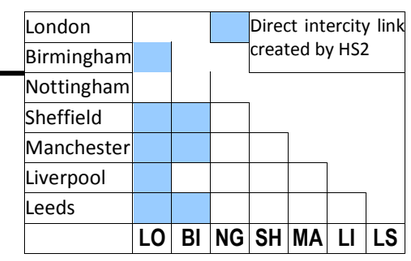


HS2 makes more journeys worse than it improves

See pp 3-4



HS2 'Y' system extending to 7 UK primary cities of Midlands & North



High Speed UK : Low Cost & High Connectivity

£0 bn

HS2 & NPR : High Cost & Low Connectivity

13. HS2 fails the Northern Powerhouse test

The Northern Powerhouse is the Government's programme to transform the economic performance of the North, and the development of 'HS3' transpennine high speed rail links is crucial to improve connectivity between the region's principal cities.

Leeds, Sheffield and Manchester lie at the heart of the Northern Powerhouse, and it is the improvement of rail links between these 3 cities that will determine the fundamental shape and performance of Northern Powerhouse Rail (NPR).

The HS3/NPR concept arose from the failure of the original HS2 proposals to provide improved transpennine links or even to recognise the need for such links; yet the routes and stations proposed for HS2 in the Northern Powerhouse region are to be adopted as basic building blocks in the development of NPR.

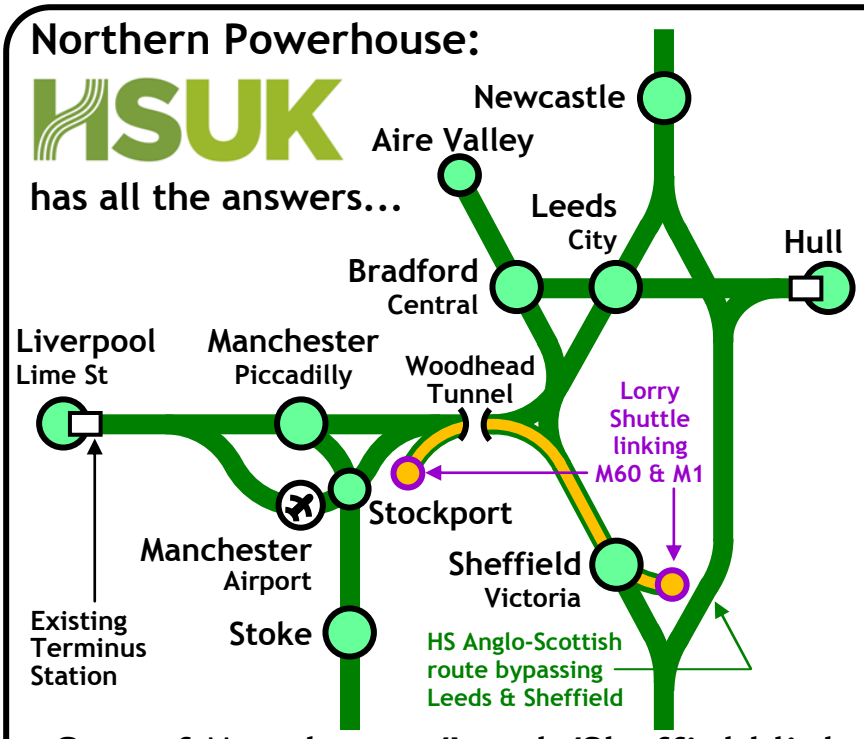
The folly of this disjointed approach is exemplified by HS2's proposed terminus stations in Leeds and Manchester. These would not allow the running of through services e.g. from Hull to Liverpool, vital for efficient links between Northern cities. Also, the easterly alignment of HS2 through Yorkshire is incompatible with any single 'HS3' transpennine high speed line, which might link Manchester to Leeds *and* Sheffield. This leads to a general failure to meet the full Northern Powerhouse journey time specification – see opposite – and a requirement for 2 separate new transpennine routes, each with a tunnel over 30km long.

In complete contrast, HSUK's transpennine high speed route via Woodhead achieves all of the journey times and the capacity and connectivity gains specified for the Northern Powerhouse, including direct links from all major cities to Manchester Airport.

HSUK's detailed cost comparisons indicate that its proposals to interlink Manchester, Leeds and Sheffield will cost around **£7 billion** less than the disjointed and uncoordinated HS2 and NPR schemes. This applies either to the previous proposals serving Sheffield Meadowhall or to the latest serving Sheffield Midland.

Northern Powerhouse:

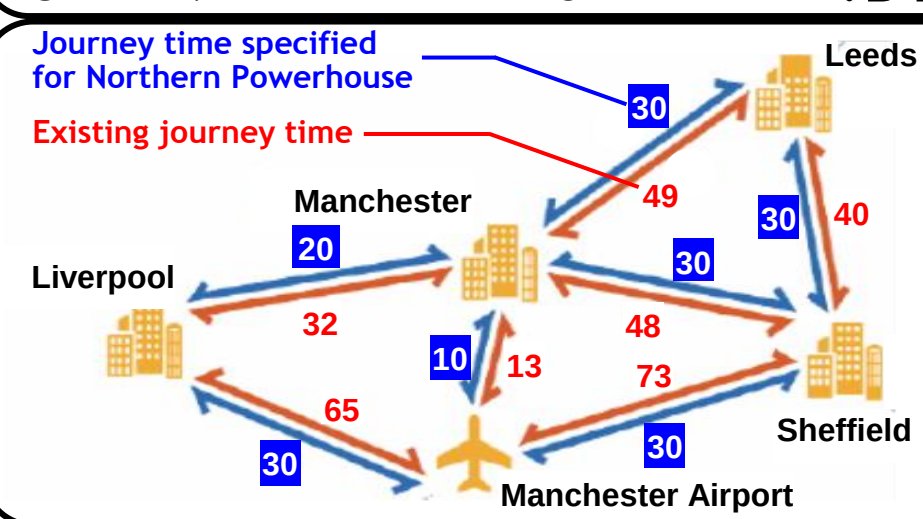
HSUK has all the answers...



HSUK journey times (in minutes) vs 'HS3' specification

Between:	HS3	HSUK
Manchester - Leeds	30	26
Manchester - Sheffield	30	23
Manchester - Liverpool	20	19
Sheffield - Leeds	30	19
Leeds - M'ch'r Airport	40	37
Sheffield - M'ch'r Airport	30	34
Liverpool - M'ch'r Airport	30	26
Leeds - Newcastle	60	51
Bradford - Sheffield	N/A	26
Bradford - Manchester	N/A	33

Cost of Manchester/Leeds/Sheffield links: £10.0 billion



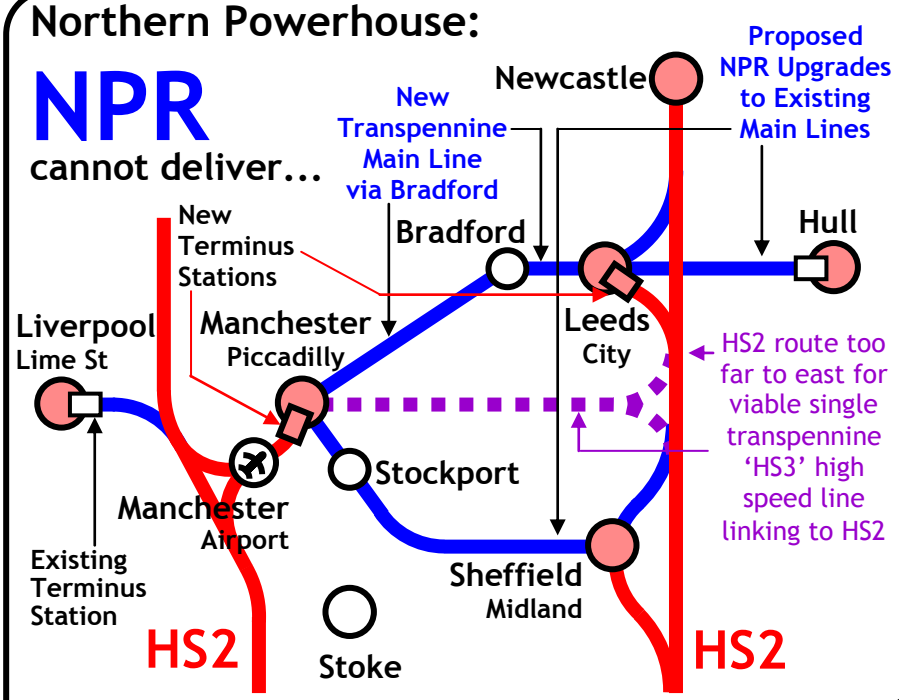
HS3/Northern Powerhouse Journey Time Specification -

now abandoned by Transport for the North

(Sketch developed from figure, P19, *The Northern Powerhouse: One Agenda, One Economy, One North*, DfT, 2015)

Northern Powerhouse:

NPR cannot deliver...



HS2/NPR journey times (in minutes) vs 'HS3' specification

Between:	HS3	NPR
Manchester - Leeds	30	30
Manchester - Sheffield	30	40
Manchester - Liverpool	20	28
Sheffield - Leeds	30	30
Leeds - MAN Airport	40	47
Sheffield - MAN Airport	30	60
Liverpool - MAN Airport	30	28
Leeds - Newcastle	60	70

Cost of Manchester/Leeds/Sheffield links: £16.7 billion

14. HS2 fails the Scottish test

Whilst the official scheme for the HS2 'Y' reaches no further north than Manchester and Leeds, outline plans exist to extend HS2 along the corridor of the West Coast Main Line (WCML) into Scotland, with the route splitting near Carstairs into 2 branches, for Glasgow and Edinburgh.

The projected link to Scotland has been presented as a long-term aim to realise a truly national high speed network; but closer examination reveals yet more flaws in the HS2 vision:

- HS2 will only link Edinburgh and Glasgow to London, Birmingham and Manchester;
- The 'Carstairs split' will dictate 2-hourly frequencies on all HS2 services from Edinburgh and Glasgow to English regional cities;
- No HS2 services are proposed to northern Scottish cities;
- A west-sided HS2 route, passing through the sensitive landscapes of the Lake District and Yorkshire Dales National Parks, will cause major controversy and will require extreme lengths of tunnel.

With all these intractable problems, it is unsurprising that HS2's proposed west-sided route to Scotland has been deemed to have "no business case". All these problems are avoided through High Speed UK's adoption of an east-sided route:

- Edinburgh & Glasgow will be directly linked to all principal UK cities;
- Hourly or better frequencies will be achieved on all intercity routes;
- A direct Edinburgh – Glasgow high speed link is created with a 20 minute journey time and 6 trains per hour;
- HSUK high speed services will extend to northern Scottish cities;
- HSUK's route is located in easier & less sensitive topography.

In addition to all these connectivity advantages, HSUK's cost projections indicate that its proposed east-sided route to Scotland will cost around **£11 billion** less to construct.

HS2 Ltd is now examining options to upgrade sections of the existing WCML, rather than construct a dedicated high speed line. This will leave HS2 journey times to Scotland significantly greater than those of HSUK, and detailed analysis of the latest proposals indicates major environmental controversy and only very small cost savings.

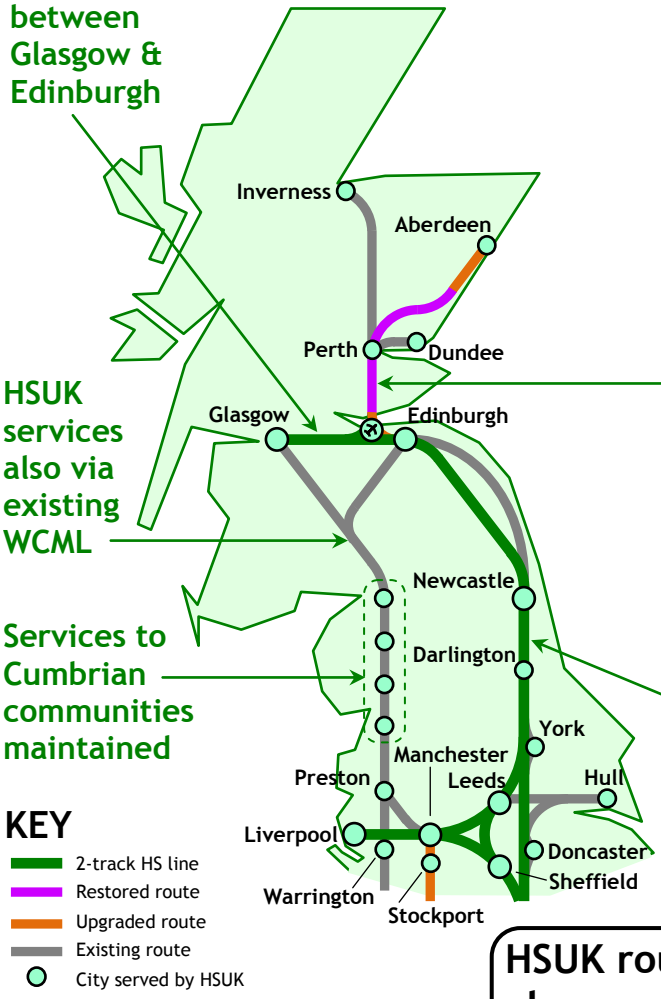
High Speed UK

East-sided spine route links Edinburgh and Glasgow to all principal English cities with direct hourly (or more frequent) services

Direct HS link between Glasgow & Edinburgh

HSUK services also via existing WCML

Services to Cumbrian communities maintained



HSUK services extend via Forth Bridge to Aberdeen, Inverness, Perth & Dundee: Edinburgh Airport at fulcrum of new Scottish network *(works not included in cost comparisons)*

East-sided spine route designed for 360km/h, also serves North-East of England and requires few tunnels

HSUK route to NE & Scotland cheaper than HS2 routes by £11bn

High Speed 2

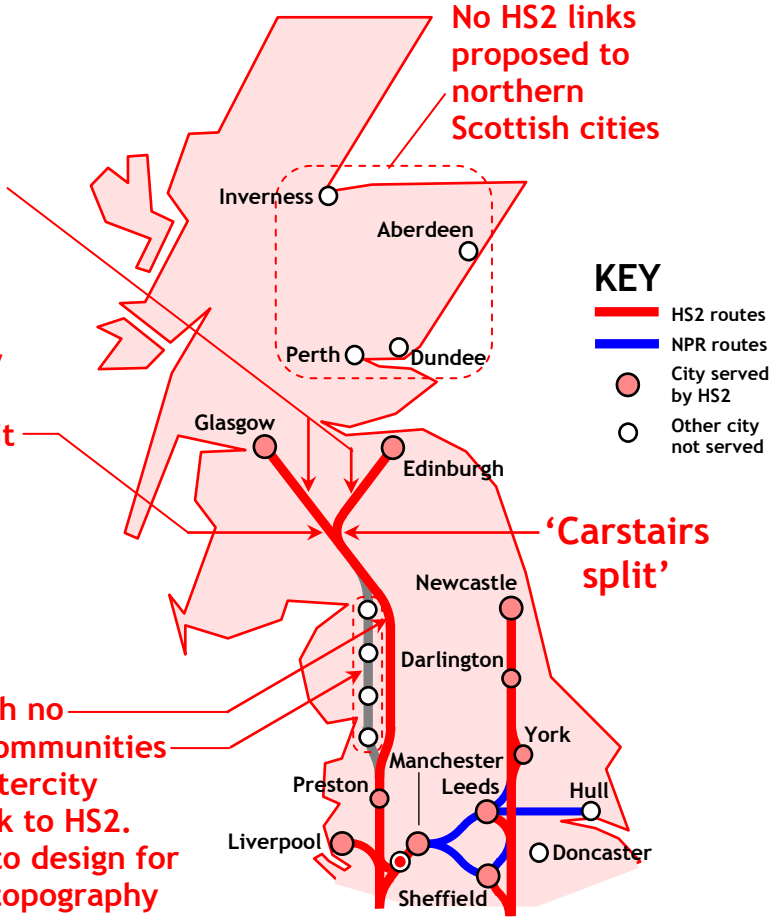
West-sided spine route links Edinburgh & Glasgow with direct hourly services only to London

Services to Birmingham (& possibly Manchester) at 2-hourly frequency due to inefficiency of Carstairs split

No HS2 services from Scotland to other principal English cities - instead, existing intercity services projected to be reduced

West-sided HS2 route probably with no intermediate stations. Cumbrian communities on WCML likely to lose premium intercity services, with little prospect of link to HS2. Major environmental damage due to design for high speed in difficult & sensitive topography

No HS2 links proposed to northern Scottish cities



'Carstairs split'

15. HS2 fails the Cost test

The cost of constructing the HS2 'Y', extending as far north as Leeds and Manchester, is currently estimated at around £56 billion. With Northern Powerhouse Rail (NPR) and the putative Scottish extension taken into account, the cost of the entire national high speed rail project seems likely to rise to around £100 billion.

The HS2 proposals have come under sustained criticism for their excessive costs – much higher per mile than comparable projects in France. So far it has proved impossible to determine whether these costs stem from natural differences between France and the UK, or from fundamental inefficiencies in the HS2 design.

The emergence of High Speed UK now allows this issue to be resolved. HSUK's detailed route design – with horizontal and vertical alignments defined for over 1,000km of new railway – enables the size of structures and earthworks to be determined, and this allows detailed cost comparisons to be drawn with HS2.

The calculated comparative costs indicate that HSUK's baseline cost is around **£21 billion** (or 30%) less than the equivalent cost of the HS2 'Y' and NPR combined. This huge cost difference can be simply explained through the following 5 key comparisons:

- HSUK requires 227km less new railway than HS2 and NPR combined;
- HSUK requires 74km less tunnel than HS2 and NPR combined;
- HSUK requires 6 fewer new stations than HS2;
- HSUK is generally built in more accessible, less sensitive and easier terrain, with less costly earthworks and structures;
- HSUK needs no further development to achieve full integration with local networks.

HSUK is of course not just cheaper to construct than HS2; it also delivers significantly greater benefit, which might conservatively be estimated to be 50% more. Together, these two gains will transform HS2's very questionable Benefit to Cost Ratio (BCR) of 2.2 into a much more bankable figure of 4.6.

High Speed UK

Infrastructure required to fully interlink London and 6 primary cities of the Midlands and the North:

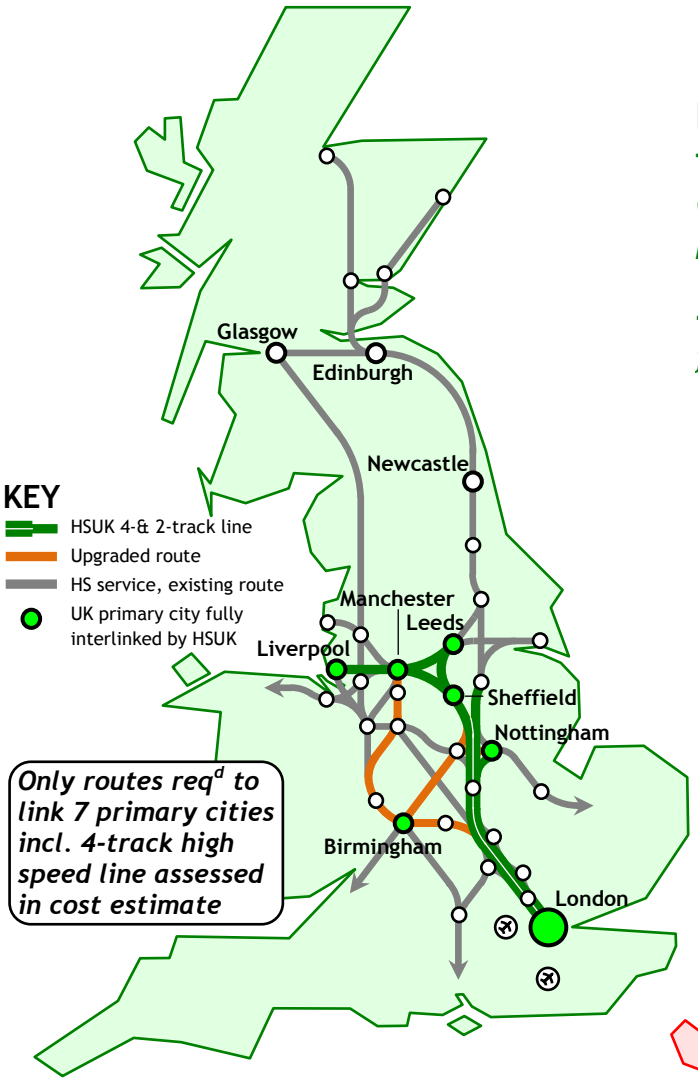
462km new railway - *mostly following existing transport corridors*

202km upgraded/restored

60km tunnel

3 new stations

Cost estimate £52bn



ALL COSTS INCLUDE ROLLING STOCK

HS2 and NPR

Infrastructure required to interlink London and 6 primary cities of the Midlands and the North:

699km new railway - *mostly clear of existing transport corridors*

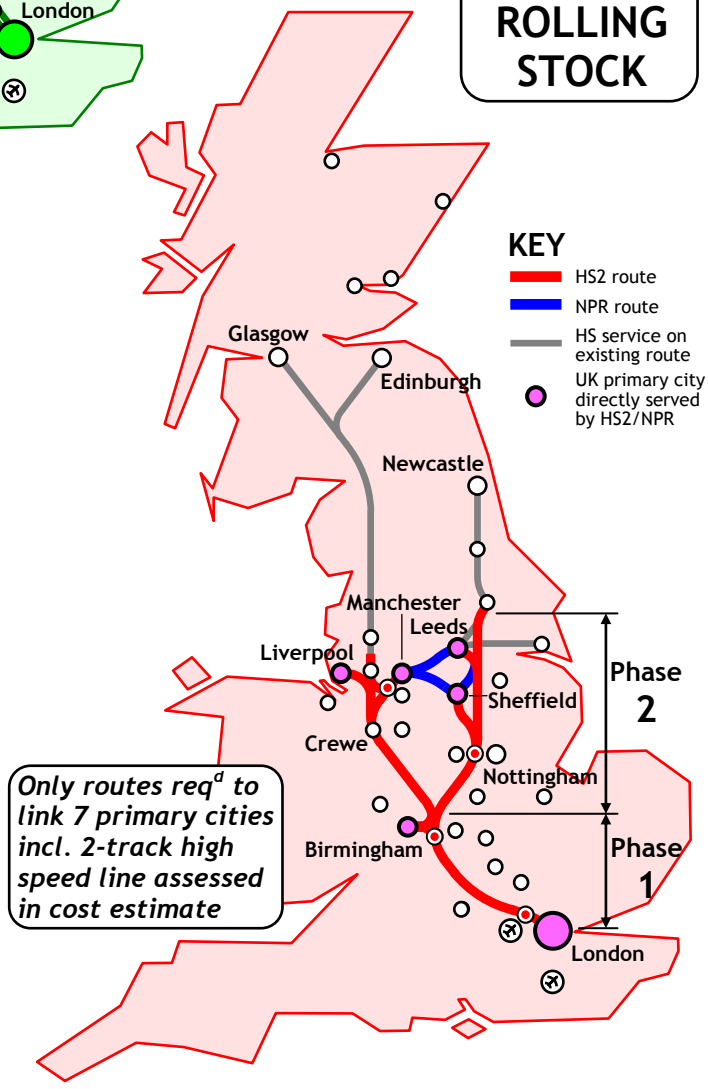
54km upgraded/restored

134km tunnel

9 new HS2 stations

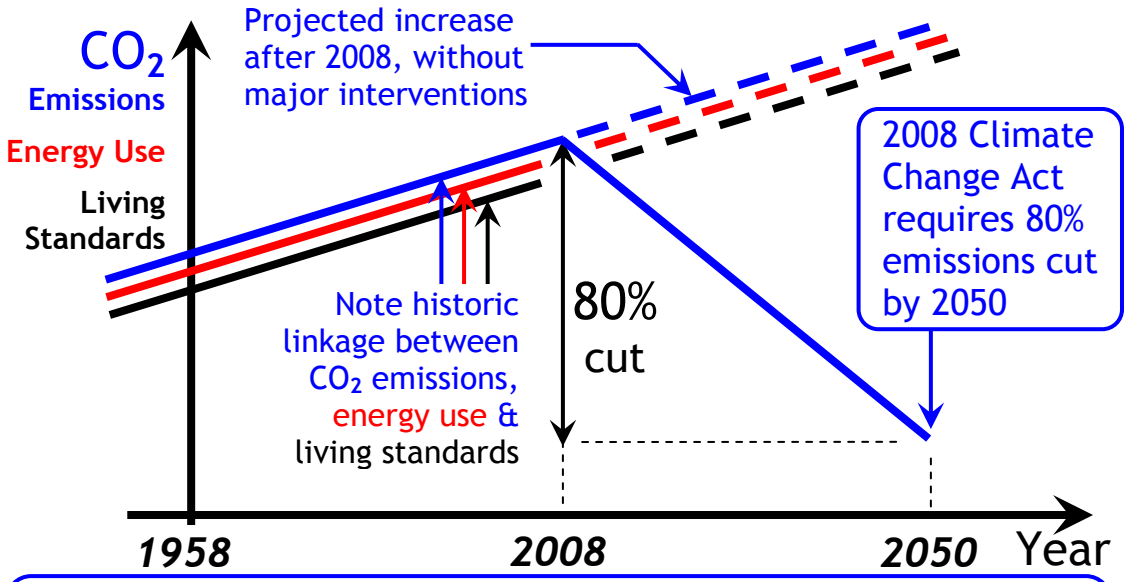
Local integration projects at disconnected HS2 stations

Cost estimate £73bn

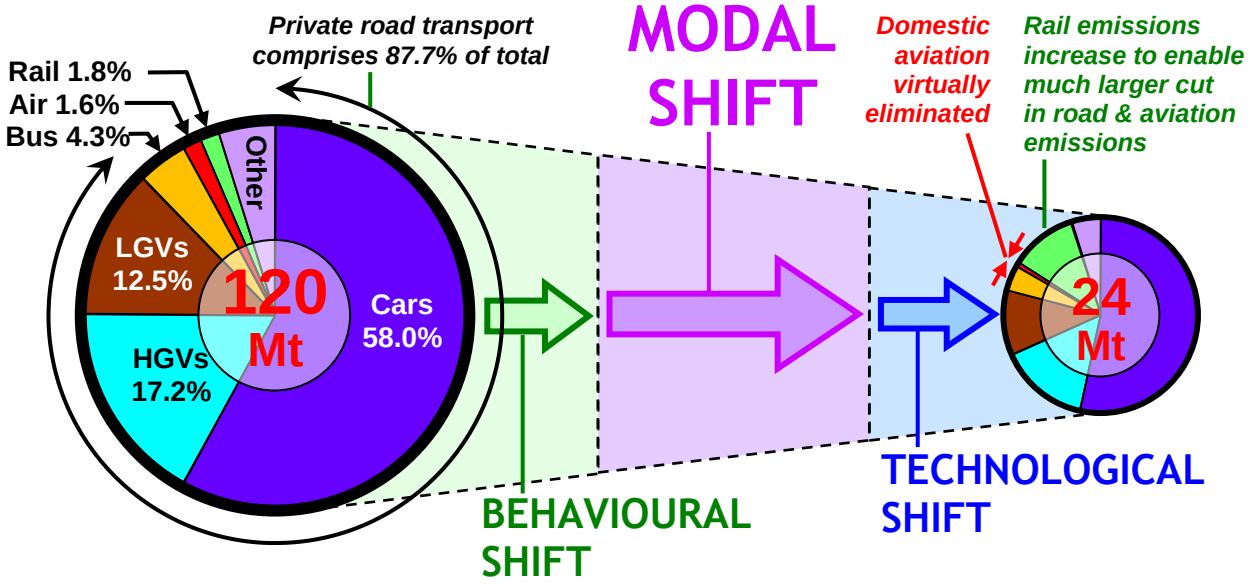


16. HS2 fails the CO_2 test

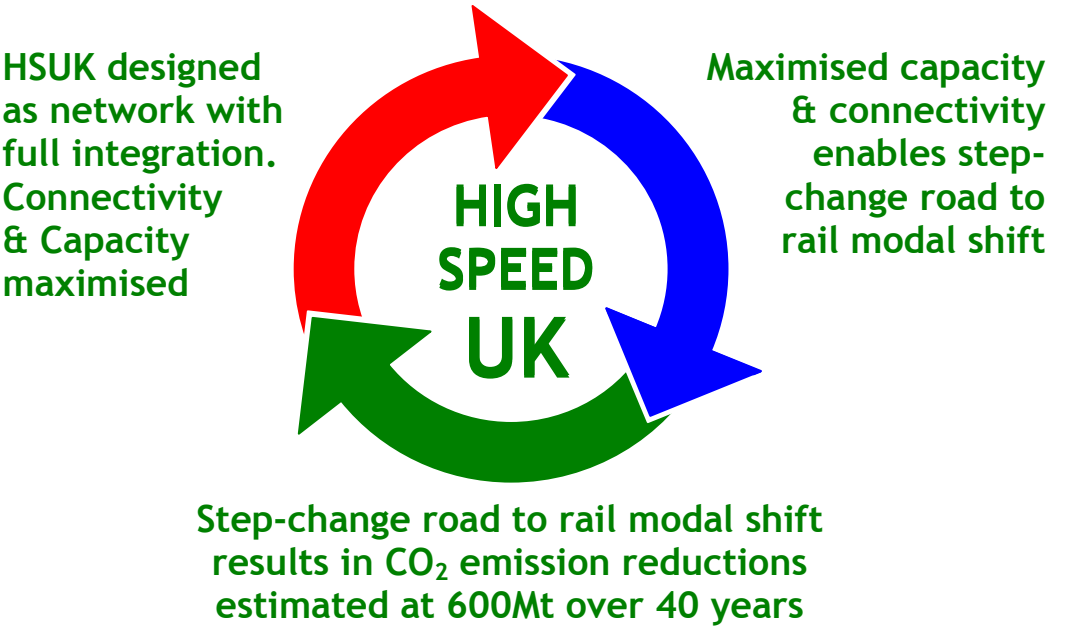
HS2 is planned to be the most significant intervention in UK surface transport during the first half of the 21st Century. This is exactly the period in which the UK Government is legally committed by the 2008 Climate Change Act to achieve an 80% reduction in national CO_2 emissions by 2050. It would therefore seem eminently reasonable to expect the Government to ensure that HS2 would be designed to make the maximum possible contribution to meeting this radical target. However, HS2 achieves no significant reductions in transport sector CO_2 emissions.



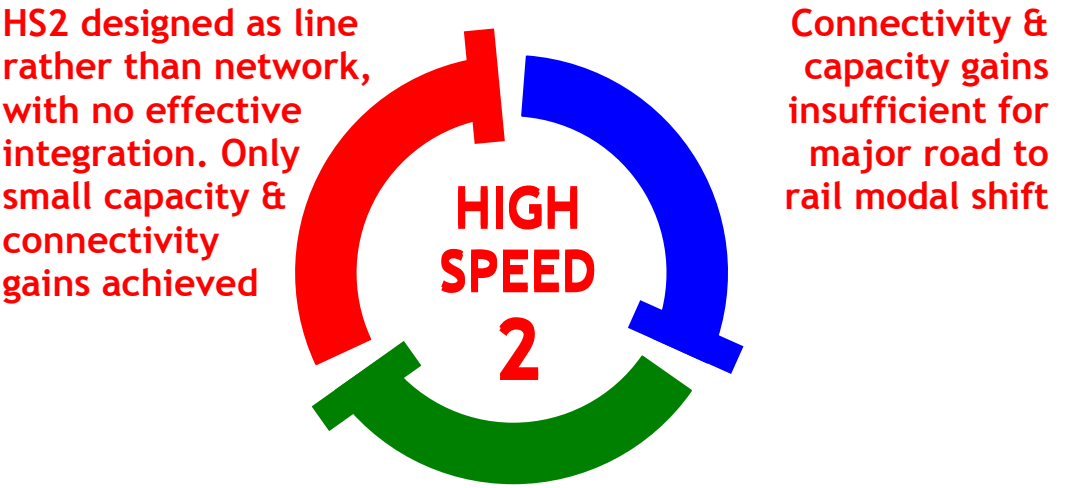
Historical context of targets of 2008 Climate Change Act



3 'Shifts' must occur to deliver 80% emission reductions by 2050



HSUK & HS2 : Relative Environmental Performance



By HS2 Ltd's own predictions, HS2 will only be 'carbon neutral' i.e. it will deliver no worthwhile reduction of overall transport CO_2 emissions. This failure is directly attributable to HS2's inability to significantly enhance either connectivity or capacity.

Together these deficiencies make it impossible for HS2 to bring about the step-change road to rail modal shift that is essential for CO_2 reductions in line with the requirements of the 2008 Climate Change Act.

By contrast HSUK's far superior connectivity and capacity are forecast to avoid the emission of 600Mt of CO_2 over 40 years.

17. HS2 fails the Remit test

HS2 must operate in harmony with existing main lines, to create an integrated national network, if it is to deliver its primary objective, of "hugely enhanced capacity and connectivity" between the UK's major conurbations.

However, HS2 Ltd's project remit – see opposite – makes no attempt to specify either the ultimate goal of an improved national network, or to define how "hugely enhanced capacity and connectivity" might be measured. Instead, the remit appears to define:

- HS2's route – via an interchange at Old Oak Common, the only possible outcome of Item 5, leading inevitably to its damaging route through the Chilterns AONB;
- HS2's national configuration – i.e. a new high speed line from London to the West Midlands (Item 1), with further northward development from the West Midlands (Item 2) on both sides of the Pennines, to form the 'Y'.

It is significant to note that the HS2 remit does not specify either the speed for which HS2 should be designed, or whether HS2 should be integrated with, or segregated from the existing rail network.

It is not a logical impossibility, that an optimised national rail network delivering "hugely enhanced capacity and connectivity" between the UK's major conurbations might develop from the London to West Midlands high speed line specified in the HS2 project remit.

However, this fortuitous outcome has not happened for the HS2 project. This is proved by the conscious design of High Speed UK as a network, and its vastly superior performance in terms of capacity, connectivity and indeed any reasonable comparator.

High Speed UK's superiority also underlines the huge financial and environmental costs that will accrue from the fundamental mismatch between HS2's localised remit and its national objective of "hugely enhanced capacity and connectivity". This mismatch exposes the folly of predicating HS2's development upon a first phase designed to a narrow, corridor-specific remit, and it represents a monumental technical failure on the part of HS2 Ltd's leadership.

HS2 REMIT – KEY POINTS

1. **Build a high speed line from London to the West Midlands.**

2. **Consider development of HS2 further north.**

3. **Select a London terminal.**

4. **Consider intermediate parkway between London and the West Midlands.**

5. **Build an inter-change station with GWML/ Heathrow/ Crossrail services.**

6. **Connect to HS1 and the existing network.**

SUMMARY OF THE REMIT AND OBJECTIVES OF HIGH SPEED TWO

On 15 January 2009 the Secretary of State for Transport announced in 'Britain's Transport Infrastructure: High Speed Two', the setting up of a new company to look at a possible new railway line between London and the West Midlands.

HS2 was set up shortly after as a private company limited by guarantee. It is chaired by Sir David Rowlands, and Alison Munro was seconded from the Department of Transport as Chief Executive. The rest of the HS2 team comprises further secondees from the DfT and from Network Rail.

HS2's remit is to develop proposals for a new railway line from London to the West Midlands taking account of environmental, social and economic assessments. It will also provide advice to Ministers on the potential development of a high speed line beyond the West Midlands on the level of broad corridors, considering in particular the potent to extend to Greater Manchester, West Yorkshire, the North-East and Scotland.

HS2 will make recommendations on options for a terminus station or stations serving London and possible options for an intermediate parkway station between London and the West Midlands. It will also provide a proposal for an interchange station between HS2, the Great Western Main Line and Crossrail with convenient access to Heathrow Airport. HS2 will also provide suggested means of linking to HS1 and the existing rail network.

HS2 will produce a confidential report to Ministers by the end of 2009 that should be sufficiently developed to form the basis for public consultation in 2010 should Ministers decide to take the project forward. The advice will also include financing and construction proposals as well as a proposition for how best to move through the planning process within an indicative outline timetable.

Extract from July 2009 HS2 Newsletter.
Colouring by CSE

17. HS2 fails the Remit test *(continued)*

Perhaps the greatest fault of HS2's remit is that it specifies what is to be built i.e. a new high speed line, rather than how it must perform to deliver the project's objective, of "hugely enhanced capacity and connectivity" between the UK's major conurbations.

As noted previously, there is no fundamental reason why a high speed line built to a localised remit could not deliver that objective. However, a far more certain and reliable way forward is to specify the performance of the new high speed line, together with other associated infrastructure, to comprise the integrated system that will collectively achieve the project's objective.

High Speed UK was developed from its inception in 2008 (as High Speed North) with a controlling specification aimed at optimising its performance as a national network[1]. The latest iteration of this specification, which is set out in the table below, aligns closely with the 'Six Principles' of network design set out on pages 9-10.

HIGH SPEED UK REMIT (2016)

Starting with the existing rail network and existing service patterns, use the opportunity offered by the intervention of new-build high speed railway lines, linking London and the primary cities of the East and West Midlands, the North-West, Yorkshire, the North-East and Scotland) to create an enhanced and fully integrated national rail network. This network should be capable of performing as follows:

1. Provide direct services of intercity quality between all principal cities / major conurbations in the regions listed above;
2. Provide enhanced service levels to intermediate secondary cities, with frequent links from high speed lines to the existing network, and upgrades to existing routes, where necessary;
3. Integrate all existing intercity routes extending to other parts of the network with the new high speed (or upgraded) lines;
4. Maintain or enhance existing service levels;

[1] The original HSUK specification was summarised in Colin Elliff's article *High Speed Rail : Where are the Engineers?* published in the October 2008 edition of the Journal of the Permanent Way Institution.

5. Operate all intercity routes at hourly or better frequency;
6. Optimise network capacity through maximised segregation between high speed intercity services and local/freight services;
7. Achieve major journey time reductions on all routes;
8. Achieve step-change transport CO_2 reductions through road to rail modal shift enabled by enhanced capacity & connectivity;
9. Offer 'easy transfer' between national (high speed) rail and local transport services (train, metro, tram, underground, buses and taxis) at existing city centre hub railway stations;
10. Develop proposals for a London terminus;
11. Optimise connections to London suburban rail services;
12. Offer direct services to Heathrow from all principal regional UK cities, and direct services to all major regional airports from within their own respective regions, with upgrades and/or new local connections to achieve this;
13. Provide a link to HS1 without using the already overcrowded North London Line;
14. Develop supplementary proposals for a dedicated national freight network, linked to the Channel Tunnel, largely independent of major intercity passenger routes and capable of carrying trains of UIC-C loading gauge (in order to carry HGV trailers by rail and to allow larger 'Continental Gauge' wagons to enter the UK);
15. Be a 'Good Neighbour' to local communities by following existing transport corridors i.e. motorways, trunk roads and railways where there is already significant noise pollution and avoiding, as far as possible, all environmentally sensitive areas;
16. Develop a new national intercity 'Demonstrator Timetable' to identify capacity constraints and demonstrate exactly what connectivity benefits the HSUK design can deliver;
17. Design the new high speed line as a series of independent sections, each capable of being built as a separate stage to provide significant benefit to the local and national rail network. This would respond to local economic priorities, and not require high speed line construction to start in London.

18. HS2 fails the Speed test

HS2 has been designed to operate at 360km/h (225mph), with allowance for a future maximum speed of 400km/h (250mph). This would make HS2 the fastest railway in the world. Whilst there is much public scepticism as to the true value of extreme speed on a small island, HS2 Ltd continues to insist that design for future 400km/h operation represents necessary future-proofing against anticipated advances in technology.

There appears to be little or no recognition of the many drawbacks of extreme speed, including:

1. Excessive energy use and CO_2 emissions, rising roughly proportional to the square of speed (i.e. energy use at 400km/h is approximately 4 times the energy use at 200km/h);
2. Excessive power demand, rising proportional to the cube of speed;
3. Maintenance costs and technical risk, rising at a similar exponential;
4. Increased vulnerability to ground movement;
5. Increased engineering cost and environmental impact resulting from
    - constructing larger earthworks and longer tunnels and viaducts, necessary to fit the near-straight track alignments (both vertical and horizontal) onto an undulating landscape.
    - forcing the route away from established transport corridors (e.g. that of the M1, which cannot accommodate HS2's large radius curves), and into relatively unspoilt rural landscapes.

The overriding folly of HS2 Ltd's design for 400km/h operation is exposed by the much greater overall journey time reductions achieved by High Speed UK. Design for the lower maximum speed of 360km/h allows HSUK's new lines to follow existing transport corridors, particularly that of the M1 and the West Coast Main Line. This in turn allows the connections to be made to existing main lines necessary for full integration with the existing network.

The benefits of this full integration are proved by the 46% average journey time reductions which HSUK can achieve across the entire intercity network, and which are verified by the HSUK 'Demonstrator Timetable' (pages 11-12). This is far in excess of anything that the segregated and disconnected HS2 can achieve.

Comparison of HS2 and HSUK performance between London and the West Midlands			
Comparison		**HS2**	**HSUK**
Maximum operational speed		**360km/h**	**360km/h**
Design speed		**400km/h**	**360km/h**
Track type		**Ballasted**	**Slab**
Minimum curve radius		**7800m**	**5700m**
Route		**Via Chilterns AONB**	**Via M1 corridor**
Intrusion into Chilterns AONB?		**Yes**	**No**
No of Ancient Woodlands directly affected (between London & Birmingham)		**34**	**0**
No of tracks in London-Midlands spine		**2**	**4 ¤**
Tunnel length from London to Birmingham		**50km**	**12km**
Estimated first phase cost		**£21.7 billion**	**£14.2 billion**
Intercity Journey times via:	**Existing network**	**HS2**	**HSUK**
London-Birmingham	**84 mins #**	**59 mins ##**	**56 mins #**
London-Coventry	**59 mins #**	**68 mins §**	**38 mins #**
London-Walsall	**122 mins §**	**92 mins ***	**67 mins #**
London-Wolverhampton	**114 mins #**	**86 mins ***	**74 mins #**
Average journey time reductions across national intercity network		**9%**	**46%**

Note # = Direct journey, no change of trains

= 10 minute addition needs to be made to journey times to Curzon Street to account for greater average walking time to central Birmingham locations

§ = Indirect journey, change of trains required

***** = Indirect journey, change of trains required plus 10 minute walking connection between Birmingham Curzon Street and Birmingham New Street

¤ = HSUK 4-track spine extends from London to South Yorkshire

19. HS2 fails the Option Selection test

With a multiplicity of possible high speed routes from London to the West Midlands, a process was required to progressively narrow down options to arrive at the chosen HS2 route. HS2 Ltd adopted a sifting process by which a 'long list' of possible options was reduced to a 'short list' through a series of stages, with more detailed study being applied at each successive stage. This process is described in Section 3.5 of HS2 Ltd's *Report to Government* (March 2010).

Such a process should be aimed at developing the option that represents the best balance of capacity and connectivity benefits against financial costs and environmental impacts. Whilst there is no reason why HS2's highly damaging ultra-direct Chiltern route should not be developed for further consideration, it is equally important that other options are also examined in detail. This is necessary not only to ensure that the best route is selected, but also to maintain public confidence that the correct decision has been taken.

In the case of a high speed line between London and the West Midlands, HS2's controversial route through the Chilterns AONB can only be justified if the apparently less damaging alternative of the M1 corridor is not feasible. Since Roman times this corridor has been the primary route from London to the Midlands and the North, for Telford's Turnpike (the A5), the Grand Union Canal, the London & Birmingham Railway and the M1, and it would be reasonable to expect HS2 Ltd to have given detailed consideration to such a route. However, all options for a route following the M1 were dismissed very early in the process, despite the acknowledged fact that this was the only option that could avoid damaging the Chilterns AONB.

With no detailed technical analysis applied, the option of an M1 corridor route was instead rejected through a series of baseless assertions made in various HS2 Ltd reports. One glaring example was the statement that an M1-aligned route to Birmingham would be "insufficiently direct"; in fact, it is 4.3km longer, equivalent to 52 seconds at 300km/h. All of HS2 Ltd's assertions are shown to be either false or spurious (pages 45 & 46) by HSUK's detailed design work undertaken in support of its own M1-aligned proposals.

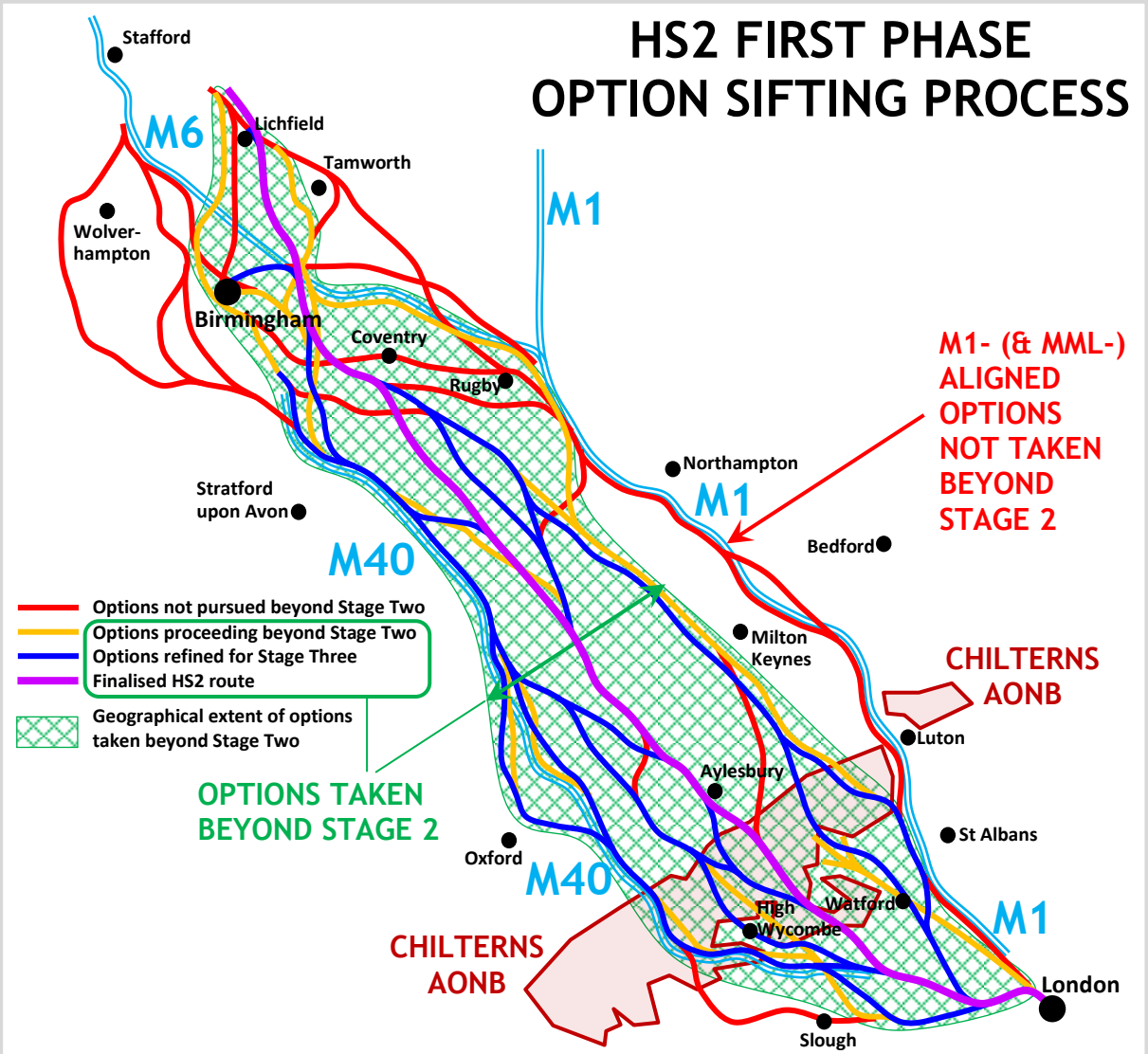


Diagram developed from Figure 3.5a : *Long list of routes considered between London and the West Midlands* : HS2 Ltd *Report to Government* (March 2010)

Info re Chilterns AONB, selected motorway routes and finalised HS2 route added by CSE

Options aligned with the Midland Main Line (MML) not illustrated (CSE)

HS2 Ltd's dismissal of M1 corridor routes also seems highly suspect, in view of the much greater consideration given to a multiplicity of far less feasible routes generally following the M40 corridor.

Accordingly, it is fair to conclude that HS2 Ltd's option selection process has failed in its basic purpose. It has not developed the best possible option, best serving the national interest by delivering the required step-change improvements in connectivity and capacity for the least cost and the least environmental damage. This failure is proved by HSUK's comprehensively superior performance. Instead, the HS2 option selection process appears to have been subverted to the baser purpose, of justifying the flawed idea that the 'experts' at HS2 Ltd first thought of.

20. HS2 fails the Impartial Assessment test

Although it is clearly unacceptable for a route with the self-evident advantages of the M1 corridor to have been dismissed so early in HS2 Ltd's option sifting process, it is still instructive to examine the various reasons put forward to justify this rejection. HS2 Ltd's rationale is set out in the following 3 reports:

- HS2 Ltd *Report to Government* (March 2010) (RTG);
- DfT Command Paper *High Speed Rail* (March 2010) (CMD);
- HS2 Ltd *Review of Route & Speed Selection* (January 2012) (RRSS).

Every justification offered by HS2 Ltd to dismiss the M1 corridor is shown to be either false or spurious by the detailed design work undertaken in the development of High Speed UK. HS2 Ltd's rationale and HSUK's rebuttals are summarised in the table below.

Reasons offered by HS2 Ltd to dismiss high speed route via M1 corridor, *with HSUK rebuttals in italics*		Reference to HS2 report
1	The M1 corridor offers an insufficiently direct route from London to Birmingham. *The HSUK route from London to Birmingham via the M1 corridor and Coventry is 4.3km longer than the HS2 route, equivalent to 52 seconds extra at 300km/h.*	RTG Item 3.5.6, CMD Item 6.33, RRSS Items 3.1.16 & 3.1.22
2	A high speed line closely aligned with the M1 cannot sustain the desired 400km/h design speed specified for HS2. *The HSUK high speed line is designed for a maximum speed of 360km/h to enable it to closely follow the M1 and thus avoid the Chilterns AONB and other unspoilt areas.*	CMD Item 6.33
3	London-Birmingham journey times via M1 corridor compare poorly with the 49 mins timing via the preferred Chilterns route. *HSUK's journey time to Birmingham New St is 56 mins, but this gives access to entire West Mids conurbation - effectively faster than HS2's 49 mins to isolated Curzon St.*	RTG Item 3.5.6, CMD Item 6.33, RRSS Items 3.1.16 & 3.1.22
4	Any deviation from the alignment of the M1 would create unacceptable 'islands' of blighted land. *HSUK's route following the M1 will cause far less environmental damage than the HS2 route via the Chilterns AONB.*	CMD Item 6.33
5	Excessive lengths of tunnel are needed to avoid unacceptable demolition of property (if new line located on the surface). *HSUK's route to Birmingham following the M1 and the existing Rugby-Birmingham line requires 12km of tunnel. HS2's route via the Chilterns to Birmingham requires 50km.*	RTG Item 3.5.6, CMD Item 6.33, RRSS Item 3.1.16
6	An M1-aligned route would be too far from Heathrow to allow any regional high speed connection to the airport. *HSUK has the 4-track capacity to offer direct high speed services to Heathrow from all regional cities. HS2 lacks this capacity and its Heathrow spur is now cancelled.*	RTG Item 3.5.24, CMD Item 6.33, RRSS Item 3.1.15
7	Motorway junctions will block the route of an M1-aligned high speed line, with modifications too expensive and disruptive. *HSUK has undertaken a detailed study of all affected junctions. This demonstrates that all technical issues are relatively minor, and manageable at reasonable cost.*	RRSS Items 3.1.22 & 3.2.5

Table 20.1 : HS2 Ltd rationale to dismiss M1 corridor and HSUK rebuttals

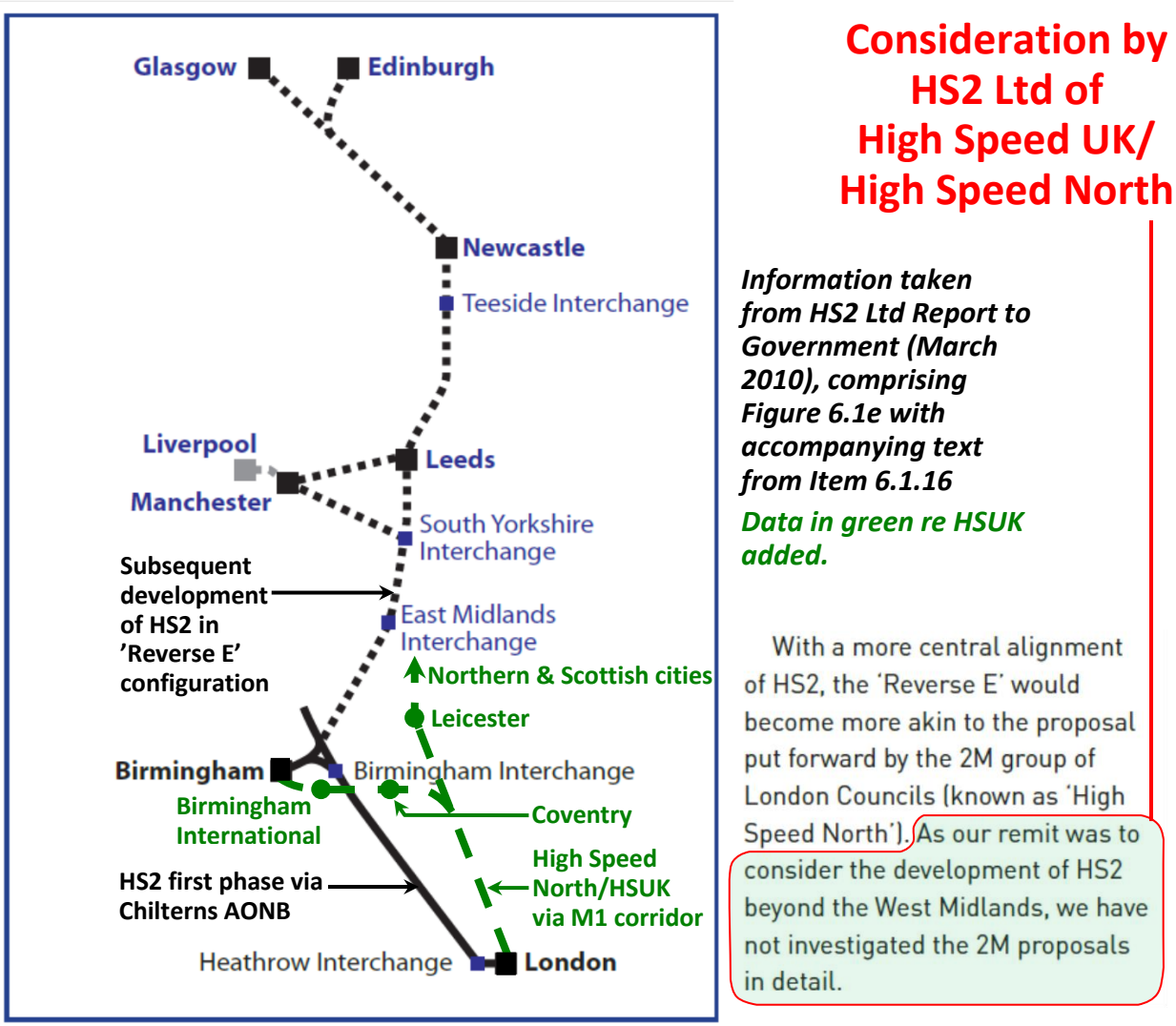


Figure 20.2 : Reference to High Speed North in HS2 Ltd *Report to Government* (March 2010)

HS2 Ltd's dismissal of High Speed UK (in its previous guise of High Speed North) raises particular concerns. Figure 20.2 shows the specific text from HS2 Ltd's *Report to Government* which details how HSUK was rejected on account of its 'failure' to pass through the West Midlands en route to conurbations further north. This was despite HSUK being personally presented in May 2009 to senior figures at HS2 Ltd, and its benefits as an intercity network, far outperforming HS2 (in whatever variant), being fully explained.

The text of Section 6.1 of HS2 Ltd's *Report to Government* (2010) makes it clear that HS2 Ltd never analysed HSUK in any detail. Instead, it was dismissed by a crude and inappropriate analogy with an entirely different proposal for a 'Reverse E' configuration. All of the configurations examined by HS2 Ltd (i.e. 'Inverse A', 'Reverse S' or 'Reverse E') were built upon HS2's London-West Midlands first phase – but none came close to HSUK in its ability to provide comprehensive interconnection between regional UK conurbations.

21. HS2 fails the Network Design test

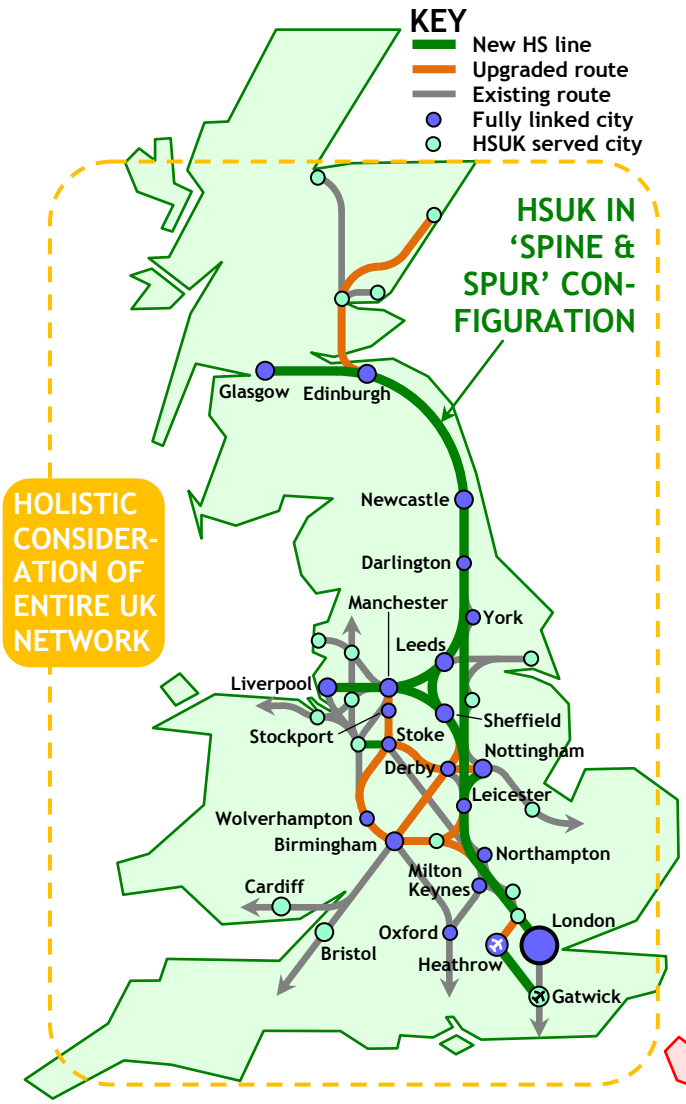
HS2 Ltd's proposals for new high speed lines from London to Birmingham, Manchester and Leeds are frequently described as the 'Y network'. But nowhere in HS2 Ltd's many reports can any structured consideration be found, of how such a 'network' might be developed to deliver the "hugely enhanced capacity and connectivity" between the UK's major conurbations, which of course is the fundamental self-imposed aim of the HS2 project. Instead, HS2's routes have been set with no apparent concept of how they fit into, or might enhance, the overall national network.

HS2 Ltd's own reports confirm that the HS2 route from London to the West Midlands was determined ***with no consideration of how it might develop into an optimised national network*** – yet this first phase would become the stem of all options subsequently considered by HS2 Ltd as candidate schemes for a national network of high speed lines. The unstructured process by which the HS2 'Y' developed is summarised on the diagram opposite, and contrasted with the more holistic approach adopted by High Speed UK.

It would seem self-evident that a scheme (such as HSUK) which fully interconnects all major conurbations with high speed services operating at hourly or better frequencies is better than one that does not; yet this most basic analysis – or even ambition – is conspicuous by its absence. Instead, any option (such as HSUK) that failed to comply with HS2's London-West Midlands first phase route was excluded from consideration.

All this represents a massive technical and intellectual failure on the part of those leading the HS2 project, with no recognition that:

- The true objective of the UK high speed rail project must be an optimised national network that delivers the greatest possible enhancement in capacity and connectivity to the greatest possible proportion of the population;
- A railway network is just another design output that is capable of optimisation by those with the necessary competence who should, at the very least, be able to distinguish an efficient network from an inefficient network.

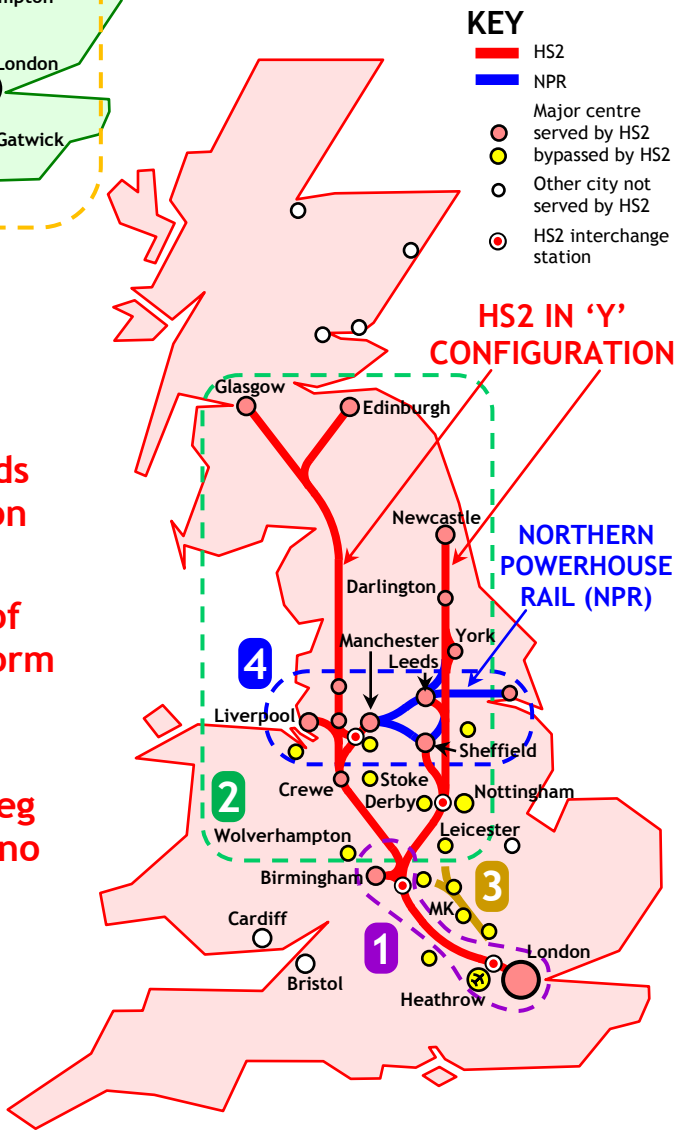


HSUK Network Design Process

1. Start with aim of using high speed rail to create enhanced national network directly inter-linking 10 primary cities ● plus Heathrow Airport. ✈
2. Develop national time-table of high speed services fully integrated with existing network.
3. Succeed by achieving full interconnectivity for 20 cities ● plus Heathrow. ✈

HS2 (& NPR) Network Design 'Process'

1. Design London-West Midlands HS line with no consideration of national network. 1
2. Predicate all development of further route sections (to form 'Y') on HS2 London-West Midlands first phase. 2
3. Reject alternative options (eg HSUK) via M1 corridor with no detailed study. 3
4. Partly remedy lack of connectivity of the 'Y' with transpennine NPR. 4
5. Call it all a network!!



22. HS2 fails the Democracy test

The development of HS2 at all stages has been accompanied by extensive official consultations, in which members of the public have been invited to comment upon HS2 Ltd's proposals.

These consultations are an essential democratic process, intended to ensure that a public project remains true to its fundamental goal of serving the public interest – and intended also to guard against the risk (for example) of a technocratic elite subverting a transport project's proper objective of "hugely enhanced capacity and connectivity" into an extremely questionable mission, to build the fastest railway in the world.

High Speed UK has fully engaged with the HS2 consultations, with detailed responses explaining how HS2 Ltd's 'need for speed' and flawed routeing strategy will have a huge negative effect on every aspect of HS2's performance, and on the performance of the wider UK rail network and transport system. HSUK's responses – see Table 22.3 – are published in *HS2 : High Speed Trains, Slow Speed Brains*.

HSUK's response to the questions of the 2011 HS2 consultation – see opposite – provides an excellent example of the input that HS2 Ltd and the Government have received and, apparently, completely ignored. In summary, the HSUK response explained that:

- although new high speed lines were essential for improved capacity and connectivity between the UK's major conurbations, (Q1)
- the HS2 'Y' was not the right way to deliver this improvement, because it lacked any transpennine connection, (Q2)
- the proposed HS2 links to Heathrow and HS1 were not viable, (Q3)
- HS2 Ltd's design principles – in particular stand-alone operation and design for the extreme speed of 400km/h – would fail to deliver the desired improvements in capacity and connectivity; its option selection process was fatally flawed (Q4); and
- a far superior route via the M1 corridor was available. (Q5)
- HS2's deficiencies as a network and its flawed routeing would hugely increase its environmental impact, in terms of both CO_2 emissions and damage to sensitive landscapes, (Q6) and also greatly increase the need for compensation payments. (Q7)

2011 HS2 PHASE 1 CONSULTATION		
	GUIDELINE QUESTIONS FOR PUBLIC RESPONSE	HIGH SPEED UK RESPONSE
Q1	Do you agree that there is a strong case for enhancing the capacity & performance of Britain's inter-city rail network to support economic growth over the coming decades?	New high speed lines, fully integrated with the existing network, are essential for improved capacity and connectivity between the UK's major regional conurbations.
Q2	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?	The HS2 'Y' is not the right way to deliver this improvement. It lacks any transpennine connection and more generally it performs poorly in interlinking the UK's many conurbations. In both respects HSUK's spine & spur configuration far outperforms the HS2 'Y'.
Q3	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?	HS2's isolated route gives no opportunity for phased roll-out; whereas HSUK's M1-corridor route can be built in much smaller stages. Proposed HS2 links to Heathrow and HS1 are not viable.
Q4	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?	HS2 Ltd's design principles, in particular stand-alone operation and design for the extreme speed of 400km/h, will fail to deliver the desired gains in capacity and connectivity, and its route selection process is fatally flawed.
Q5	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?	HSUK's route via the M1 corridor offers a far superior route, requiring far less tunnel than HS2, causing much reduced environmental damage and costing much less to construct.
Q6	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?	HS2's network deficiencies and its flawed routeing will hugely increase its environmental damage, in terms of both impact on the landscape and failure to reduce transport CO_2 emissions.
Q7	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?	Whilst compensation packages are essential, HS2's inappropriate route will greatly increase the sums to be paid in compensation.

Table 22.1 : Guideline questions for public response to July 2011 official consultation on HS2 Phase 1 proposals, with summarised responses taken from Christopher Quayle's submission on behalf of High Speed North (predecessor proposal to High Speed UK). For the full text of this response, see *HS2 : High Speed Trains, Slow Speed Brains*.

Issue raised in **HS2 : High Speed to Failure**		Official HS2 Consultation		
		HS2 Phase 1	**Draft Env Statement**	**HS2 Phase 2**
		July 2011	July 2013	Jan 2014
		Page/clause reference in HSUK response		
1	Intercity Connectivity	p7/2.2	p4/10.2	p11/A.1-A.3
2	High Speed Line Capacity	p5/1.7	p2/3.1	throughout
3	Primary City Station Proposals	p4/1.3	N/A	p4/5.1-5.5
4	Network Performance	p9/2.3 p25/4.2.9	p3/6.2	p4/5.1 p6/5.5
5	Quantified Journey Time Reductions	N/A	p2/3.2	p11/A.1-A.3
6	London Airport Development	p11/3.3	N/A	N/A
7	Regional HS links to Heathrow	p10/3.2	p6/12.7	p10/9.3
8	HS2-HS1 Link	p13/3.5	N/A	N/A
9	Strategy for National Freight Network	N/A	N/A	N/A
10	Environmental Impact in Chilterns etc	p30/5.3-5.4	P6/12.6	p8/7.2
11	Euston Terminal Proposals	p28/5.2	p6/12.8	N/A
12	Midlands Connectivity	p15/4.1.1 p27/4.2.10	N/A	p6/5.5
13	Transpennine Connectivity	p7/2.2 p25/4.2.9	p4/10.2	p2/2.1-2.2 p4/5.1-5.2
14	High speed links to Scotland	p25/4.2.9	p4/11.1	N/A
15	HSUK & HS2/NPR Construction Cost	throughout	p2/3.3	p12/Q.3
16	CO_2 reductions/Climate Change Act	p9/2.4 p35/6.1	p3/5.1 p3/5.2	p8/7.4
17	HS2 Remit	p17/4.2.1	p1/1.1	N/A
18	Adoption of 400km/h Design Speed	p16/4.1.2	p5/12.2	p12/Q.1
19	HS2 Ltd Option Sifting Process	p20/4.2.4	p5/11.3	N/A
20	HS2 Ltd reasons for dismissing HSUK	p18/4.2.2	p5/11.2	N/A
21	National high speed network design	p7/2.2	p4/10.2	p4/5.1 p6/5.5
22	Official HS2 Consultations 2011-2014	N/A	N/A	p8/7.6

Table 22.2 : Issues raised in *HS2 : High Speed to Failure* cross-referenced against High Speed North/High Speed UK responses to official HS2 consultations.

Consultation	*Date*	*Respondent*	*Author(s) of response*
HS2 Phase 1	2011	High Speed North	Christopher Quayle
Draft Environ-mental Statement	2013	High Speed North	Christopher Quayle & Quentin Macdonald
HS2 Phase 2	2014	High Speed UK	Colin Elliff & Quentin Macdonald

Table 22.3 : HSUK Responses to official HS2 Public Consultations

Note that 'Christopher Quayle' was a pseudonym adopted by Colin Elliff to avoid accusations of conflict of interest from his then railway industry employers.

Conclusion

The 22 tests presented in this document paint a damning picture of the multiple failings of the HS2 project. Not only does HS2 fail to meet its core objective of "hugely enhanced capacity and connectivity between our major conurbations[2]", these fundamental deficiencies also prevent HS2 from achieving wider goals of improving connections to local transport systems, and of improving travel to international destinations, both European and global.

HS2's failures are primarily technical and they arise out of the intellectual failure on the part of those leading the HS2 project to understand that HS2's stand-alone high speed line should not be the end in itself, but merely the means of attaining the true goal of a transformed national rail network that could realise the central ambition of enhanced capacity and connectivity.

However, HS2's shortcomings go far beyond a simple technical failure. They also represent a major political failure in that HS2 is clearly not the 'railway that works for everyone'. The implementation of HS2 will prevent Government from realising its many public policy goals of:

- Inclusive and integrated transport (i.e. a 'railway that works for everyone');
- Enhancing interregional connectivity to stimulate regional growth;
- Protecting cherished rural landscapes, SSSI's and Ancient Woodlands;
- Achieving reductions in transport CO_2 emissions in line with the 80% target of the 2008 Climate Change Act.

For HS2 to fail even on one of the comparisons presented in this paper should demand a far-reaching review of every aspect of the HS2 project. But HS2's failure on all 22 tests, and its comprehensive outperformance by the superior High Speed UK proposals, must illustrate its total inadequacy and unfitness for purpose as a UK intercity railway. It also raises huge concerns about the proper conduct of the HS2 project.

Perhaps the gravest concern lies with the final 6 tests, that focus on the process by which HS2 has been developed. This process started with remit formulation and continued to option selection and design development, accompanied by multiple stages of public consultation. This process should have been unambiguously aimed at securing for the people of the United Kingdom the best possible intercity railway system, delivering the greatest capacity and connectivity benefits for the least cost and environmental impact. But it is evident that this has not happened. Moreover, there are strong indications that, in the selection of the HS2 proposals, there may have been a systematic effort to suppress High Speed UK, an alternative to HS2 which is far more capable of meeting HS2's fundamental capacity and connectivity objectives.

The authors of this paper do not possess any detailed insight into the inner workings of HS2 Ltd; but the vastly superior performance of High Speed UK, compared with that of HS2, indicates that something very serious must have gone wrong. The many reports published by HS2 Ltd provide a huge volume of compelling evidence to support this conclusion. However, it is not for the authors of this paper to accuse individuals leading the HS2 project of specific misdeeds; rather it is for those individuals to explain the failure of their project to the UK public.

This is the basis of High Speed UK's challenge to HS2 Ltd. If the nation is to invest more than £70 billion in new high speed railways, the nation has a right to expect that those responsible for the development of HS2 and Northern Powerhouse Rail can demonstrate that their project is the best possible scheme, meeting all the requirements of public policy and developed in accordance with all necessary due process so that it can best serve the UK public.

If the HS2 and NPR proposals are to retain any legitimacy, the leaders of the HS2 project must answer this challenge.

[2] HS2 Ltd evidence submission to House of Commons HS2 Select Committee, 30th November 2015

Appendix 1 : High Speed UK Achievements

It is important to appreciate that High Speed UK is far more than just a collection of hopeful lines on a map. High Speed UK represents an unprecedented effort to design a better-connected, higher speed and higher capacity UK rail network as a single holistic system, and its scope far exceeds that of HS2. Every straight, transition and curve has been mapped and HSUK is ready to be taken to the next detailed design phase. With much simpler construction along existing transport corridors, HSUK can be completed far more quickly than HS2 and NPR, at lower cost and higher specification.

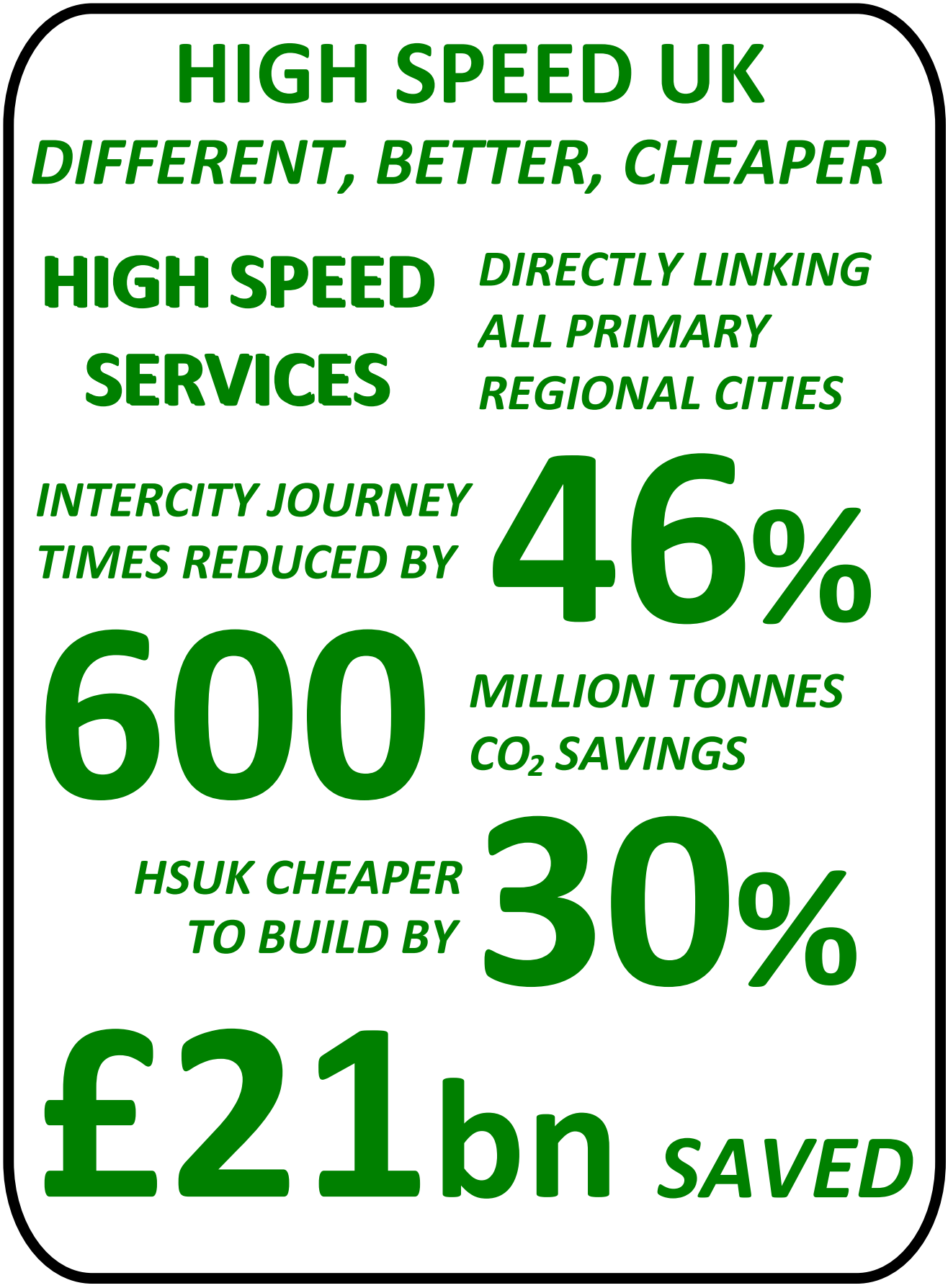
These are the key High Speed UK 'products':

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, with horizontal & vertical alignments designed – *comprising over 1,000km of new and upgraded railway from London to Glasgow.*
3. Complementary national mapping – *21 A3 maps summarise the HSUK design.*
4. 'Demonstrator Timetable' developed confirming:
   a) 46% average journey time reductions across HSUK's national network;
   b) Capacity requirements for national network;
   c) Basic feasibility of full integration.

   – *'Demonstrator Timetable' based on 1:25,000 route design, Network Rail Sectional Appendix and over 50 connections between HSUK and the existing network, and validated against published HS2 journey times.*
5. City centre stations, upgraded as necessary, schemed for all major cities – *this includes a restored Sheffield Victoria station in lieu of HS2's Meadowhall (recently amended to Sheffield Midland on long and impracticable loop).*
6. Rigorous capital cost comparisons with HS2 and NPR – *comparisons based on detailed route designs for both HS2 and HSUK show £21 billion cost savings.*
7. Regional integration strategies – *compiled for all regions served by HS2/HSUK, these show how HSUK will be fully integrated with local rail services.*
8. High level 'carbon accountancy' undertaken – *this assesses HSUK's potential for 600 million tonnes of CO_2 reductions arising from step-change road to rail modal shift.*
9. Audit trail on HS2 development process – *this demonstrates comprehensive 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. These responses are published separately.*
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. Complementary freight strategy – *this uses the intervention of HSUK's new high speed lines to enable the creation of a gauge-enhanced 'prime user' freight network on existing lines, running parallel to HSUK.*

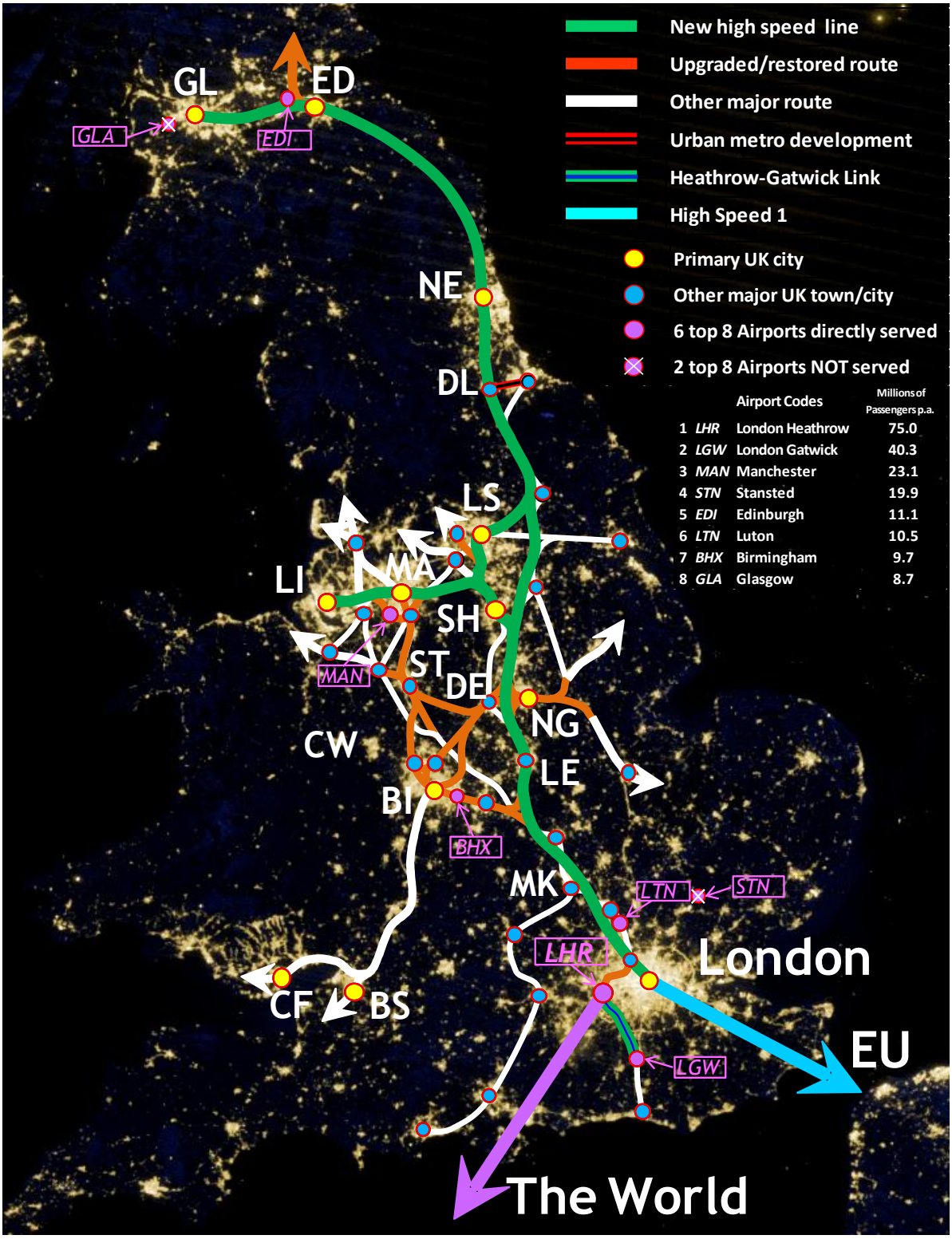
Appendix 2 :

High Speed UK : Advantages at a glance



Appendix 3 :

High Speed UK superimposed onto satellite view of island of Great Britain



HSUK

High Speed UK – the viable alternative to HS2

Cost

HSUK costs £21 billion less than HS2 + HS3

Connectivity

HSUK has seven times the connectivity of HS2 + HS3

Capacity

HSUK has twice the capacity of HS2 + HS3

CO2

HSUK saves 600 million tonnes of CO2 compared to carbon-neutral HS2 + HS3

Countryside

HSUK avoids the Chilterns AONB completely, while HS2 cuts through the AONB at its widest point

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