

HS2 Ltd NETWORK DESIGN - EPIC FAIL

At High Speed UK, we never tire of ridiculing HS2 Ltd, and especially its former Technical Director Andrew McNaughton, for the appalling standard of interregional connectivity that the HS2 proposals offer. Mr McNaughton may indeed be sincere in his claim¹, that: **“the aim of the HS2 project is to deliver hugely enhanced capacity and connectivity between our major conurbations.”** But the reality of HS2 is starkly different. As Figure 4 demonstrates, not only does HS2 fail to offer meaningful connectivity between UK regional cities, it is also massively outperformed by HSUK.

It's necessary to understand how someone as well qualified as Mr McNaughton could have developed a project that fails so badly in delivering its central objective of “hugely enhanced... connectivity.” One explanation might be that Mr McNaughton and the other boffins at HS2 Ltd were so obsessed with designing HS2 to be the fastest railway in the world, that they forgot to check whether it would work efficiently as a network, and thereby deliver its promise of “hugely enhanced... connectivity”. But in the context of a multi-billion national infrastructure project, this seems scarcely credible. Surely someone would have made some attempt to design HS2 as a network, to better connect the nation?

So, to shed some light on this crucial question, we've undertaken an exhaustive trawl through the many volumes of reports published over the last 10 years by HS2 Ltd.

Hugely Enhanced Capacity and Connectivity??

The aim of the HS2 project is beyond dispute; the questions that must be asked are:

- a) What has been done, to develop HS2 as a network to achieve the aim of “hugely enhanced capacity and connectivity”?
- b) How has HS2 Ltd measured the success of its proposals in achieving this aim?

But in all the reams of HS2 Ltd reports, answers to these questions are conspicuous by their absence. Instead, our review has uncovered the following pertinent and highly disturbing facts:

1. **HS2 Ltd's aim of “hugely enhanced capacity and connectivity” only emerged in 2012, 3 years into the project.** The first reference that we can find is in the January 2012 HS2 Ltd report *High Speed Rail: Investing in Britain's Future – Decisions and Next Steps* (see Figure 1). This appears to coincide with the belated realisation in the wider political sphere that HS2 could not be all about speed; capacity and connectivity had to be its primary aims.



Figure 1 : Extract from page 11 of *High Speed Rail: Investing in Britain's Future – Decisions and Next Steps* (HS2 Ltd report, published 2012)

¹ On 30th November 2015, Andrew McNaughton stated in evidence to the HS2 Select Committee that: “The aim of the HS2 project is to deliver hugely enhanced capacity and connectivity between our major conurbations.”

2. **Until 2012, development of HS2 was primarily governed by the project remit.** In terms of strategic development of the UK rail network, the remit (see Figure 2) set out 2 key requirements:
- Build HS2, a high speed line from London to the West Midlands.
 - Consider development of HS2 to conurbations further north.

There was no stipulation for HS2 to be designed as a national network, and no detailed performance requirements were given for capacity and connectivity.

<p>HS2 REMIT - KEY REQUIREMENTS</p> <ol style="list-style-type: none"> Build a high speed line from London to the West Midlands. Consider development of HS2 further north. Select a London terminal. Consider intermediate parkway between London and the West Midlands. Build an interchange station with GWML/ Heathrow/ Crossrail services. Connect to HS1 and the existing network. 	<p>SUMMARY OF THE REMIT AND OBJECTIVES OF HIGH SPEED TWO</p> <p>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.</p> <p>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.</p> <p>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 potential to extend to Greater Manchester, West Yorkshire, the North-East and Scotland.</p> <p>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.</p> <p>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.</p> <p><i>Extract from July 2009 HS2 Newsletter. Colouring and summarising of text by CSE</i></p>
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Figure 2 : HS2 Project Remit (2009)

3. ***The first phase of HS2, from London to the West Midlands, was designed with no consideration of its performance as the first stage of a new national network.*** This was confirmed in Section 3.5.24 of HS2 Ltd's *Report to Government*, published in March 2010. Instead, the primary design concerns were listed as cost, journey time and environmental impact.
4. ***3 options for national network development were assessed – the 'Inverse A', the 'Reverse S' and the 'Reverse E'.*** The relative performance of these 3 options was discussed in Section 6 of *Report to Government*. As can be seen in Figure 3, all 3 options were based upon HS2's London-West Midlands first stage, running via 'Heathrow Interchange' (now named Old Oak Common) and Birmingham Interchange.
5. ***There was no recognition of the illogicality of basing all options for HS2's national network of high speed lines upon the first phase of HS2, which was designed with no consideration of national network.***
6. ***Any alternative option (such as HSUK), which was not based upon the first phase of HS2, was dismissed without detailed assessment.*** Section 6.1.16 of *Report to Government* describes how High Speed UK (then entitled 'High Speed North', and at the time promoted by the 2M Group of London and South-East councils) was dismissed. The reasons offered were a) its alleged similarity with the 'Reverse E' option developed by HS2 Ltd, and b) its failure to meet the remitted requirement for HS2 to pass through the West Midlands en route to conurbations further north.
7. ***None of HS2 Ltd's rationale stands up to serious technical examination.*** HS2 Ltd, and in particular Andrew McNaughton², were already well aware of HSUK, and its potential to fully interlink the UK's major regional conurbations. On any simple analysis (see Figure 3) HSUK's 'spine and spur' configuration can be shown to significantly outperform any of the options considered by HS2 Ltd. The analogy with the 'Reverse E' is inaccurate and inappropriate, and the remitted requirement for high speed routes to the North having to pass through the West Midlands is utterly discredited by HSUK's massively superior performance as a national network (see Figure 4).
8. ***The extent of HS2 Ltd's failure is demonstrated by HS2's and HSUK's current abilities to connect the nation.*** Whereas the HS2 connectivity offer has now regressed to the point where HS2 will only provide direct links from a select group of regional cities to London and Birmingham, HSUK has developed to offer direct links between most principal UK cities.

All of this raises huge concerns as to the proper and professional development of the HS2 project. The processes employed in HS2's development should have been unambiguously aimed at providing for the people of the UK the best possible national high speed rail network, delivering the greatest connectivity and capacity for the least cost and environmental impact. That is the theory; the reality appears to be that the project's objectives are fundamentally misaligned with its remit, and its processes appear to have been subverted to the baser purpose of rubber-stamping the failed concept, for a segregated, superfast railway, that HS2's progenitors first thought of.

It is for HS2 Ltd, and for Mr McNaughton, to provide an alternative narrative.

² At a meeting in May 2009, senior figures at HS2 Ltd including Technical Director Andrew McNaughton were briefed upon the HSUK proposals (then entitled 'High Speed North'. Further details are given on pages 45-46 of High Speed Trains, Slow Speed Brains, available on www.highspeeduk.co.uk.



Figure 6.1c Possible configuration - Inverse A

HS2 Inverse A configuration:
30 links out of 54 possible

HS2 Reverse S configuration:
20 links out of 54 possible



Figure 6.1d Possible configuration - Reverse S

London	LO	BI	EM	SH	MA	LI	LS	NE	EH	GL	HR
Birmingham	Direct	Direct	No								
East Midlands	No	No	Direct	Direct	No						
Sheffield	No	No	No	Direct	Direct	No	No	No	No	No	No
Manchester	No	No	No	No	Direct	Direct	No	No	No	No	No
Liverpool	No	No	No	No	No	Direct	Direct	No	No	No	No
Leeds	No	No	No	No	No	No	Direct	Direct	No	No	No
Newcastle	No	Direct	Direct	No	No						
Edinburgh	No	Direct	Direct	No							
Glasgow	No	Direct	Direct								
Heathrow	No	Direct									

London	LO	BI	EM	SH	MA	LI	LS	NE	EH	GL	HR
Birmingham	Direct	Direct	No								
East Midlands	No	No	Direct	Direct	No						
Sheffield	No	No	No	Direct	Direct	No	No	No	No	No	No
Manchester	No	No	No	No	Direct	Direct	No	No	No	No	No
Liverpool	No	No	No	No	No	Direct	Direct	No	No	No	No
Leeds	No	No	No	No	No	No	Direct	Direct	No	No	No
Newcastle	No	Direct	Direct	No	No						
Edinburgh	No	Direct	Direct	No							
Glasgow	No	Direct	Direct								
Heathrow	No	Direct									

London	LO	BI	EM	SH	MA	LI	LS	NE	EH	GL	HR
Birmingham	Direct	Direct	No								
East Midlands	No	No	Direct	Direct	No						
Sheffield	No	No	No	Direct	Direct	No	No	No	No	No	No
Manchester	No	No	No	No	Direct	Direct	No	No	No	No	No
Liverpool	No	No	No	No	No	Direct	Direct	No	No	No	No
Leeds	No	No	No	No	No	No	Direct	Direct	No	No	No
Newcastle	No	Direct	Direct	No	No						
Edinburgh	No	Direct	Direct	No							
Glasgow	No	Direct	Direct								
Heathrow	No	Direct									

London	LO	BI	EM	SH	MA	LI	LS	NE	EH	GL	HR
Birmingham	Direct	Direct	No								
East Midlands	No	No	Direct	Direct	No						
Sheffield	No	No	No	Direct	Direct	No	No	No	No	No	No
Manchester	No	No	No	No	Direct	Direct	No	No	No	No	No
Liverpool	No	No	No	No	No	Direct	Direct	No	No	No	No
Leeds	No	No	No	No	No	No	Direct	Direct	No	No	No
Newcastle	No	Direct	Direct	No	No						
Edinburgh	No	Direct	Direct	No							
Glasgow	No	Direct	Direct								
Heathrow	No	Direct									



Figure 6.1e Possible configuration - Reverse E

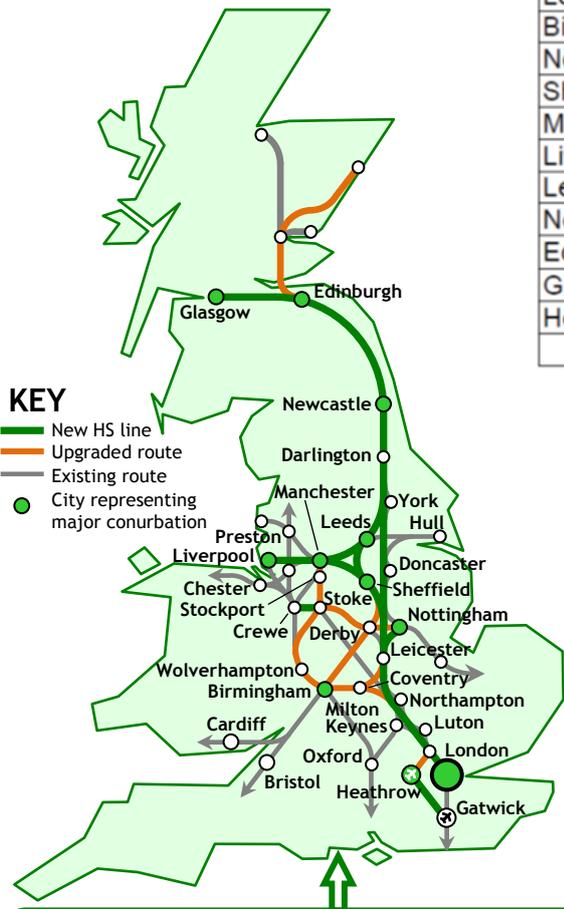
HS2 Reverse E configuration:
42 links out of 54 possible

HSUK Spine & Spur format:
52 links out of 54 possible



HSUK Concept (2009)

Figure 3 : Connectivity Performance of Alternative Network Configurations (2009)



KEY
 — New HS line
 — Upgraded route
 — Existing route
 ● City representing major conurbation

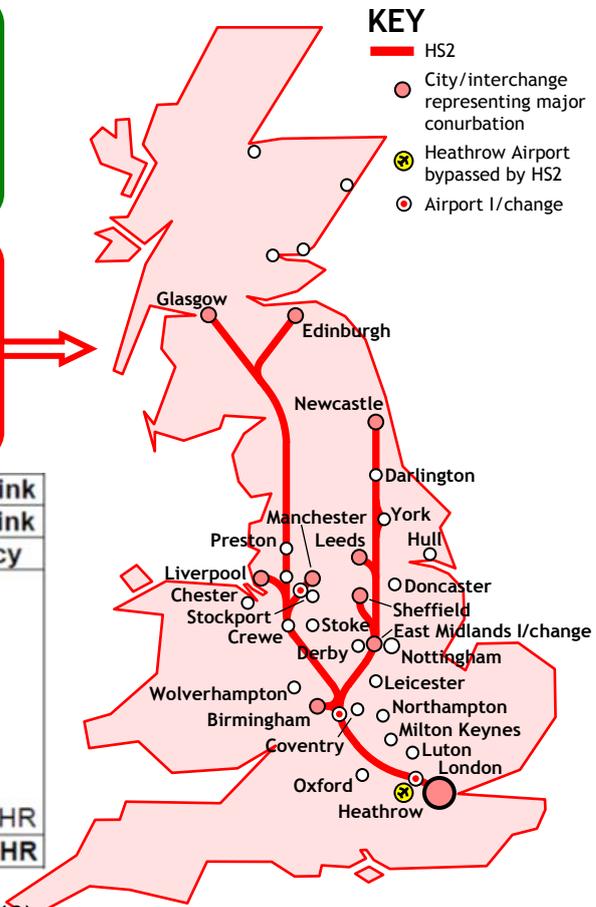
London	LO																					Direct hourly intercity link	
Birmingham		BI																					No direct intercity link
Nottingham			NG																				
Sheffield				SH																			
Manchester					MA																		
Liverpool						LI																	
Leeds							LS																
Newcastle								NE															
Edinburgh									EH														
Glasgow										GL													
Heathrow																							HR
	LO	BI	NG	SH	MA	LI	LS	NE	EH	GL													

Primary City	Major Conurbation
London	Greater London
Birmingham	West Midlands
Nottingham	East Midlands
Sheffield	South Yorkshire
Manchester	Greater Manchester
Liverpool	Merseyside
Leeds	West Yorkshire
Newcastle	North-East
Edinburgh	Lothian
Glasgow	Strathclyde

HSUK 54 possible links
 54 direct links created
 100% network efficiency

HS2 54 possible links
 14 direct links created
 26% network efficiency

London	LO																						Direct hourly intercity link
Birmingham		BI																					No direct intercity link
Nottingham			NG																				2 2-hour frequency
Sheffield				SH																			
Manchester					MA																		
Liverpool						LI																	
Leeds							LS																
Newcastle								NE															
Edinburgh									EH														
Glasgow										GL													
Heathrow																							HR
	LO	BI	NG	SH	MA	LI	LS	NE	EH	GL													



KEY
 — HS2
 ● City/interchange representing major conurbation
 ● Heathrow Airport bypassed by HS2
 ● Airport I/change

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

Figure 4 : Connectivity Performance of HSUK 'Spine & Spur' and HS2 'Y' (2018)