

HS2 and the railway network : the case for a review

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Summary

High Speed 2 [HS2] has been promoted as a means of improving rail capacity and connectivity between London and the North of England, rebalancing the UK economy and increasing sustainability. It remains controversial, with concerns over its opportunity cost, its independence from the classic rail network, its environmental damage and its wider economic impacts.

Assessed against its four objectives:

- **HS2 does add to rail capacity, but there are much less costly and environmentally damaging ways of doing so;**
- **HS2 provides only limited improvements to connectivity, and will worsen London services for several cities, as well as many cross-country journeys;**
- **HS2's wider economic benefits for the North are uncertain – investment in the North is a more certain way of providing them; and**
- **HS2 contributes nothing to the objective of reducing carbon emissions from transport.**

A much fuller range of policy options should have been considered to meet these objectives. These include improvements to reduce the adverse impacts of HS2, alternative high-speed routes better integrated with the classic network, lower-speed but better-connected rail enhancements, investments within the North of England, and other lower-cost interventions.

These policy options must now be reviewed objectively, transparently and dispassionately against a set of scenarios reflecting the inherent uncertainties in economic and technological developments. This will take time and will inevitably involve some delay to the implementation of HS2, should it be broadly endorsed by the review. The delay should be minimised as far as possible, but it should not be used as a reason for pressing ahead unquestioningly with a scheme that has attracted so much expert criticism.

This report summarises the conclusions of a workshop⁶ convened to discuss these issues. It was designed to involve experts with a wide range of views. The report is intended to reflect the majority view, but inevitably its conclusions are not equally endorsed by all participants.

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6 Further information on the workshop and its background papers can be found at www.passengertransportnetworks.co.uk.

I The background

High Speed 2 has been conceived as a “transformational” rail project linking London, Birmingham, Leeds and Manchester, and designed to provide 400km/h running on a dedicated twin track. It was originally costed at £30 billion, excluding trains, but is now estimated to cost £56bn. The first study was commissioned by the shadow Strategic Rail Authority in 2000; a manifesto was published by the advocacy group Greengauge 21 in 2006; the idea was adopted by the Conservative Party in 2008 (as a device to avoid building a new airport runway in south-east England); the Labour government established the company HS2 Ltd in 2009 to develop the concept, and studies were well under way by the end of that year; and the Liberal Democrats supported HS2 in the run-up to the General Election in 2010.

The project remains controversial. Criticisms have included the price tag, and the opportunity cost of devoting so large a sum to this one project; the independence of the line and its operation from the classic rail network, and hence its limited connectivity; damage to the natural and built environment; the failure to contribute to carbon reduction; the lack of clarity on planned services and unrealistic assumptions on fares; and the uncertainties surrounding the intended regeneration of the north of England.

Our involvement started with a letter from Professor Richard Allsop to *New Civil Engineer* in April 2015, noting the wide-ranging professional concerns and those of the House of Lords Economic Affairs Committee⁷ and arguing for a “thoroughgoing review of how best to bring our whole national rail system holistically into the 21st century”. As he put it: “[the] decisions we make in the next few years will have consequences lasting at least a century, so we should give the time it takes to look at the question with a clean sheet in front of us, setting aside the preconceptions that seem to have underlain the development of the HS2 project”. That letter in turn led some 30 expert engineers, economists, planners and railway strategists to write to the Prime Minister in May 2015, arguing for a pause while such a review was conducted.

The responses from Robert Goodwill, then junior transport minister, while detailed, were dismissive, arguing that “[the] case for HS2 is crystal clear”. The House of Commons HS2 Select Committee started its consideration of the Hybrid Bill for Phase I between London and Birmingham in July 2014, but it could only consider matters of detail and there has been no wider inquiry. With the Labour Party supporting it the Commons passed the third reading of the Bill by 399 votes to 42: a third of MPs did not vote and the Noes came from all parties. It is now before the House of Lords, which has referred it to a committee. This also has a restricted role, but the Lords' questioning may be more robust.

The failure to convene an independent inquiry is particularly concerning because of the stance taken by various organisations. The National Infrastructure Commission, chaired by Lord Adonis, one of the original enthusiasts for the project, is only concerned with investment in large projects. The civil engineering profession has increasingly focused on what it now sees as a “\$1 trillion global opportunity”⁸. Northern local authorities have been encouraged to believe that HS2 would bring them substantial regeneration benefits. And leading environmental NGOs decided not to oppose HS2 partly on the grounds that it is a rail project, and thus preferable to investment in road and air.

7 See <http://www.publications.parliament.uk/pa/ld201415/ldselect/ldeconaf/134/13402.htm>.

8 *New Civil Engineer* [April 2016]. Special Report : High Speed.

Against this background we convened a Workshop at which some 40 professionals with widely differing views debated the case for HS2 and its alternatives. While opinions inevitably differed, very few thought that there were not serious questions still to be answered. It was generally agreed that a review was needed. The review should be conducted in a way that would delay the implementation of HS2 as little as possible, were it to be concluded that HS2 should go ahead. Some delay is inevitable, however, and is a price well worth paying to ensure that the right solution is found.

This paper sets out the reasons for carrying out a review, considering in turn the case for HS2, the four objectives on which it is predicated, other ways of meeting those objectives, the appraisal process and factors which should be considered in a review. As lead authors we circulated an earlier version of the paper to all participants, and have done our best to reflect the wide range of comments received. It is important to note, however, that opinions among the invited group of informed professionals remain diverse; this further reinforces the need for a review, in which all of the options are assessed on a consistent basis.

2 The case for HS2

HS2 has four objectives: increasing rail capacity, achieving greater connectivity, rebalancing the economy and enhancing sustainability. The paper considers the arguments on whether HS2 is an effective contributor to each of these objectives in Sections 3-6 below.

As noted, it is currently estimated that the full project will cost at least £56 billion⁹, or roundly £105 million per route-km. By comparison, the TGV line from Tours to Bordeaux currently under construction is costing £20 million/km. The much higher unit cost of HS2 is explained in part by the need for extensive tunnelling through the Chilterns Area of Outstanding Natural Beauty and by the complex plan for London Euston. While the costs of environmental mitigation are included in this figure, no costs are presented for the many remaining unmitigated environmental impacts. These include irreparable damage to 98 ancient woodlands and seven SSSIs and a huge impact in the Euston area of Camden.

The 2013 appraisal¹⁰ gave a Benefit/Cost Ratio [BCR] of 1.8 for the whole project, or 2.3 after including £13.3bn in wider economic benefits. A BCR of 1.8 means that the project is of medium value for money while 2.3 only just enters the high range and many alternative transport schemes show higher scores. Underpinning the appraisal were a series of assumptions about continued growth in demand for rail travel, the levels of service and fares offered on HS2 and competing routes, and underlying trends in the economy over the 60 year appraisal period. In particular, the assumption that HS2's fares will be competitive with fares on the conventional network implies that those investing in HS2, including taxpayers, will subsidise the minority of the population who will benefit from this new facility. Given the likelihood of price cutting and marketing activity by competing services, HS2 revenue could be lower than forecast.

Conventional estimates were made of the value of time saved by business travellers; this element

9 Government estimates include a sizeable margin for contingencies. The revision announced in the 2015 Autumn Statement appears to have offset a significant increase in costs by reducing the contingency element. See <http://stophs2.org/news/15094-hs2-phase-2-construction-estimate-jumps-39>.

10 See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/286611/hs2-economic-case.pdf.

alone accounted for 44% out of the 84% of transport-user benefits¹¹. While a range of sensitivity tests were conducted, they were not necessarily the most searching ones (excluding for example a higher discount rate and a shorter appraisal period). There is in addition a case for assessing a project of this scale against a wider range of scenarios related to trends in global affairs, the economy, fuel prices, technology and other determinants of rail travel demand.

The BCR calculations take no account of the local, terrestrial impacts of HS2. A sound business case has to take account of these unmonetised effects as well as of those included in the BCR calculations. This point was emphasised by Atkins in its 2012 report which said, in notes to its tables showing benefit-cost ratios: “There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does not provide a good measure of value for money and should not be used as the sole basis for decisions”¹². Unfortunately, no such warning appears in the subsequent Atkins study¹³, or in HS2 Ltd’s report *The Economic Case for HS2*¹⁴. In both those documents benefit-cost ratios are indeed discussed as if they were a good measure of value for money, and they still are being used in this way.

It has recently been announced that the Cabinet Secretary is to review the detail of the scheme to reduce costs and avoid further cost escalation. The outcome of that review may well influence the scheme’s performance. The National Audit Office is also expected to report on HS2 in the summer of 2016, and the Major Projects Authority keeps its progress under review. Both have previously published warnings about the risks associated with such a large project.

3 Rail capacity

In the case for HS2 it is assumed that additional capacity is needed, particularly on the main routes north of London. However, Euston, King’s Cross and Marylebone are the three least crowded of all London termini, with a load factor on Virgin West Coast of less than 40%¹⁵. The need for additional capacity is thus based on predictions that passenger demand will continue to grow at rates similar to the recent past. Significant improvements to capacity could be achieved at a much lower cost and much more rapidly. Easing price restrictions would spread the load since Virgin’s most crowded trains are outside the peak. Increasing the proportion of standard-class seats and using 12 car trains could increase capacity by approximately 25%.

HS2 would undoubtedly add to capacity, but two tracks with limited provision for passing are not a resilient way of doing so. HS2 Ltd bases its prospectus on operating up to 18 trains/hour each way when the scheme is complete. This is four more than any other high-speed line has achieved, and given that it involves both “captive” trains and “classic-compatible” stock which will run from

11 HS2 Ltd [October 2013]. See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/365065/S_A_1_Economic_case_0.pdf, p.82.

12 Atkins [January 2012]. High Speed Rail Strategic Alternatives Study. Update following consultation. Report to DfT. See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/3664/hs2-strategic-alternatives-study-update.pdf.

13 Atkins [2013]. HS2: Strategic Alternatives. Final Report. Report to DfT. See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/253456/hs2-strategic-alternatives.pdf.

14 See footnote 11.

15 Calculations based on Office of Rail and Road data for 2014/15.

and to the existing rail network it assumes a degree of signalling sophistication and operational discipline that may be difficult to achieve. Moreover, if a future regulator allocated paths for competing services for the principal centres, some lesser centres could be left with unfulfilled promises. In both circumstances the business case would be weakened. Discussion of these issues has not been helped by the reluctance of HS2 Ltd to publish proposed timetables.

Finally it should be noted that publicity about capacity released on the West Coast Main Line [WCML] becoming available for freight is misleading. Many of the constraints on freight paths will remain, especially north of Preston, and maintaining good passenger services for places like Stoke-on-Trent and Coventry while simultaneously satisfying the outer-London commuter demand would in practice mean no increase in paths for freight south of Rugby.

4 Connectivity

Any addition to capacity should be achieved without reducing connectivity and ideally should enhance it. Yet completion of many journeys by HS2 to London Euston, Birmingham Curzon Street, Leeds or Manchester will require a change of train, often including a lengthy transfer on foot. In some cases this will be exacerbated by the size of the train (up to 400m), the scale of the station and the crowds of people circulating in it. The stations at Toton and Meadowhall will depend upon additional transport investment to connect with their intended catchments.

In his response to our letter the minister asserted that “HS2 will be fully integrated with the existing network” so that “HS2 will improve connectivity”. Because there is no committed timetable this cannot be verified, but it is noteworthy that a report by KPMG assumed that a wide range of existing services would be slowed by extra stops and/or reduced in frequency¹⁶. The 2013 HS2 business case included £8.3bn in savings from existing services, which implies substantial deteriorations in services to London from places such as Carlisle, Derby, Nottingham and Stockport¹⁷. Taking the 21 places most directly served by the high-speed corridor, 43 of their 210 connections would be enhanced by HS2 and the trans-Pennine HS3 together, while 48 would be made worse. One workshop presentation involved an alternative high speed proposal which offered the potential to improve journeys on virtually all of the links between principal centres¹⁸.

The poor planning of the scheme is also illustrated by the fact that east-west links were ignored when the 'Y' layout was adopted. Enthusiasm for the so-called HS3 is more recent, and there may prove to be incompatibilities between the separate plans for HS2 and HS3 that make the overall design less than optimal. Weak connectivity is likely to be aggravated by the plan to have an independent operator run the service, while adopting a different loading gauge renders through running more difficult. Lack of timetabling information makes it difficult to determine how journeys on parts of the route would be made: for example a journey from Leeds to Bristol would, it appears, either use conventional cross-country services or involve a change at Birmingham including a walk from Curzon Street to New Street.

16 See <https://www.kpmg.com/UK/en/IssuesAndInsights/ArticlesPublications/Documents/PDF/Market%20Sector/Building%20and%20Construction/hs2-regional-economic-impacts.pdf>. Table at pp. 91-92.

17 HS2 Action Alliance [2013]. The £8.3bn of service cuts assumed in the HS2 business case. See <http://www.hs2actionalliance.org/press-release/dozen-towns-cities-lose-train-services-result-hs2/>.

18 See <http://www.highspeeduk.co.uk/>. This scheme has been developed in great detail and makes a persuasive comparison with HS2. However, its cost and timetable calculations need to be independently evaluated.

The government has promised that investment in the existing railway will not be affected by the substantial budget allocated to HS2. However it would be unwise to assume that the promise would hold in the event of budgetary difficulties since it would be easier to cancel smaller projects than to abandon or even to slow construction of HS2 if it were well advanced. Schemes to enhance the East Coast Main Line might be particularly vulnerable.

5 Rebalancing the economy

In his letter to us, the junior transport minister argued that HS2 “will have a transformational effect, supporting growth in the north by improving connectivity”. The BCR included an estimate of £13.3bn for wider economic benefits, relating principally to extensions to commuting catchments. A report by KPMG¹⁹, whose methodology has since been questioned, suggested that the scheme would generate further spatial economic benefits of £15bn per annum. Different experts have produced estimates of between £2.5bn and £0.01bn per annum. This range indicates how poorly the likely impact of HS2 on the economy is understood.

Other research suggests that the impact is likely to be small. Despite a 40-year, 2000km programme, the claim that the French TGV network has changed the relative performance of France’s regions has never been substantiated. Where economic benefits have arisen, as in Lille and Lyon, they have been principally the result of local policies to focus development close to stations. Evidence to the House of Commons Transport Select Committee suggests more generally that, in those countries that have built high speed rail lines, any regional benefits were marginal and tended to benefit the capital²⁰.

Much of the analysis of HS2 focuses on agglomeration benefits, in which proximity to employees, markets and collaborators increases productivity. It is estimated that a doubling of economic mass can increase productivity by 3% to 8%, but this impact is specific to conurbations and declines rapidly with distance²¹. It is difficult to see that faster connections between northern cities and London will have agglomeration effects, except through opening up a market for more long-distance commuting. If agglomeration benefits are to be gained for the North, they will result from investment *within* the North²².

Any wider benefits are more likely to arise from relocation of economic activity than from true economic growth. Thus there is a real danger that HS2 will benefit London rather than the North, while Leeds and Manchester would benefit at the expense of smaller centres such as Bradford and Rochdale: as a recent report has shown, the ten most impoverished cities in the North are remote from HS2 stations²³.

19 See <https://www.kpmg.com/UK/en/IssuesAndInsights/ArticlesPublications/Documents/PDF/Market%20Sector/Building%20and%20Construction/hs2-regional-economic-impacts.pdf>.

20 Tomaney, J [12 July 2011]. Oral evidence to House of Commons Select Committee on Transport. See <http://www.ncl.ac.uk/curds/news/item/curds-delivers-evidence-for-house-of-commons-transport-select-committee>.

21 Venables, A J, Laird, J and Overman, H [2014]. Transport investment and economic performance: implications for transport appraisal. Report to the Department for Transport. See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/386126/TIEP_Report.pdf.

22 See footnote 20.

23 Joseph Rowntree Foundation [2016]. Uneven growth : tackling city decline. See <https://www.jrf.org.uk/report/uneven-growth-tackling-city-decline>.

Finally, regenerating the North is not solely a transport matter²⁴. All the evidence indicates that, while transport may be a necessary condition to generate these wider economic benefits, they will only arise if cities invest in education, training, well-sited housing and development land, and IT facilities. In principle, appraisal of HS2's wider economic benefits should take account of the costs of such measures, but on balance it seems more appropriate to assess HS2 on the basis that these wider benefits will not materialise.

6 Sustainability

Sustainability should be thought of in economic, social and environmental terms. As seen above, the economic case, in terms of wider economic benefits, is weak. The social case is hardly mentioned but should have given greater consideration to those who will suffer the impacts of this development and to the majority of the population who will never use the line. The localised social impacts are especially severe on the approach to Euston, which involves a substantial loss of housing and established communities and many years' disruption caused by construction activity.

Environmental sustainability involves two issues: CO₂ emissions and local terrestrial effects. Originally the government claimed that HS2 was an integral part of its low-carbon transport strategy and that HS2's role is to provide a facility to which road and air traffic could be diverted. However, according to the latest cost-benefit analysis, HS2 would make virtually no difference to carbon emissions from transport. The claim cannot be reconciled with the forecast that only 4% of HS2 journeys would be diverted from road and 1% from air. 69% would be diverted from conventional rail, a far less carbon-intensive mode, and 26% would be new journeys which, by definition, will add to transport emissions.

The moral imperative to reduce carbon emissions from transport is indisputable. The failure of HS2 to contribute directly to this is a serious weakness. All the evidence indicates that the best approaches involve reducing the need or desire to travel, more fuel-efficient vehicles, lower and better enforced road speed limits, and imposing the true marginal costs of travel on users. HS2 fails to contribute to any of these. Moreover, the decision to operate at speeds in excess of 300km/h will add significantly to HS2's greenhouse gas emissions²⁵.

The government claims that it is doing all it can to mitigate the local environmental impacts. Even so, the remaining impacts are, as noted above, very large and are not covered in the BCR. Moreover they inevitably run counter to the objective of sustainability. These local impacts are made worse by the decision to design for 400 km/h, which requires a flatter and straighter route. A lower design speed, as adopted in France and Germany, would make it possible to choose a less damaging route, and at the same time reduce construction, operation and mitigation costs.

7 A failure in option generation

It is clear from this analysis that HS2 may not deliver as much extra capacity as is claimed, contributes little to its objective of enhancing connectivity and should not be assumed to

24 See footnote 21.

25 Raising the speed from 300 to 360 km/h would increase energy consumption by 23%. See <http://assets.hs2.org.uk/sites/default/files/inserts/hs2%20traction%20energy%20modelling.pdf>, p.4.

contribute at all to economic rebalancing or sustainability. It is therefore difficult to escape the conclusion that HS2 is a failure of what Eddington called option generation: “unless a wide range of appropriate options is considered, there is the risk that the best options are overlooked and money could be wasted”²⁶.

While HS2 was indeed proposed as a means of improving capacity and connectivity between London and the North of England, there was a tendency from the outset to assume that high speed was itself essential. Thus HS2 did not emerge from a comprehensive review of scenarios, options and priorities across the network, but as a fully-fledged proposal in its own right. That proposal was subsequently scaled back by omitting two of its key features – the links to Heathrow Airport and to HS1. Moreover, once the commitment was made and HS2 Ltd was established as an independent body its leaders adopted determined policies to build a railway as isolated as possible from the existing railway. Not surprisingly therefore no alternative high-speed scheme has been developed for consideration by Parliament and the public.

Other ways of increasing capacity have been considered. The report for the Strategic Rail Authority considered 14 broad high speed options, of which two were routed via the East Midlands, and a conventional new line²⁷. Some schemes not involving high speed were looked at in a consultant's report²⁸ in 2012. Several showed benefit/cost ratios higher than those calculated for HS2. The highest was achieved by the scheme prepared for 5IM (the consortium of local authorities opposed to HS2). This involves removing three bottlenecks on the existing WCML, lengthening trains and platforms, and on each train replacing one first-class carriage by a standard-class one. The (undiscounted) capital cost was estimated at £2.6 bn, and the benefit-cost ratio as 5.2 (6.1 including wider economic impacts).

A further study of strategic alternatives²⁹ developed five packages, some involving elements of high-speed running based mainly on the first phase of HS2, but for unexplained reasons omitted the 5IM proposal. These showed BCRs in the range of 1.7 to 2.7, excluding wider benefits. However, they were rejected partly on the grounds that they would impose unacceptable disruption on existing routes over periods ranging from three to 29 years. Current experience suggests otherwise.

Network Rail, notwithstanding some failures, has demonstrated that it can undertake large projects without disproportionate changes to the everyday delivery of a train service, not least by adopting new construction procedures. Examples include the comprehensive reconstruction at Reading and on the West Coast the new flyover at Norton Bridge. Moreover, HS2 itself will demand a large intervention in the daily working of Euston over a ten year period.

It is also important to stress that all of these options are designed to increase capacity and connectivity in the principal north <> south corridors. They do not consider other means of meeting the HS2 objectives of rebalancing the economy and enhancing sustainability. It was clear at the workshop that there are alternative ways to achieve HS2's objectives. Our French

26 The Eddington Transport Study : Main Report : volume 3, p.143. See <http://webarchive.nationalarchives.gov.uk/20090104005813/http://www.dft.gov.uk/162259/187604/206711/volume3.pdf>.

27 Atkins [2003]. High Speed Line study: Summary Report. See <http://webarchive.nationalarchives.gov.uk/+http://www.dft.gov.uk/pgr/rail/researchtech/research/hspedlinestudysummaryreport.pdf>.

28 See footnote 12.

29 See footnote 13.

contributor commented that he might consider investing in HS2 if the price were halved, but that its design was better suited to the French geography of widely dispersed cities, while the UK's economic geography is closer to that of Germany, whose high speed network involves lower speeds, more stops and greater connectivity with the conventional network.

The alternative options therefore include a more accessible, better-connected, less-high-speed network more akin to that of Germany; a focus on improving connectivity and agglomeration in the north; lower-cost interventions to address capacity shortfalls; a comprehensive review of the timetable structure to reduce interchange times across the country; and assessment of schemes to raise rail's low market share outside London. Equally, modifications to HS2 should be considered. The possibilities include reducing the impacts in Camden by making Old Oak Common the terminus, linking the West Coast Slow Lines to the Elizabeth (Crossrail) Line and pursuing less damaging and less costly designs for Euston Station. All of these should be assessed against one another, and against the current proposal, to ensure that, in Eddington's terms, the best options have not been overlooked and money is not being wasted.

8 A more considered approach to appraisal

A reappraisal should be based on an improved understanding of what underlies the recent record rates of growth in rail travel. It is important to know whether they are likely to be sustained and, if they are, whether they are desirable – there is for example a difference in economic value between journeys captured from other modes and journeys that would not otherwise have been made. 'Predict and provide' was rejected for road travel two decades ago, and it is similarly inappropriate for rail investment. This analysis should be accompanied by greater availability of data to support informed debate: it is unacceptable that highly germane statistics on train loading should have been declared commercially confidential and only extracted reluctantly under Freedom of Information rules.

If the wider economic benefits are to be included in the reappraisal, a much clearer understanding is needed of how they arise, what non-transport interventions are needed to secure them, and how they are distributed between stronger and weaker economies. In the absence of such an understanding it will be better to ignore them, but it still needs to be borne in mind that projects like HS2 may further unbalance the economy between and within regions.

It will also be important to consider carefully the external factors which might influence appraisal of these competing factors. What impact might the growth in automated vehicles have? Will communications technology change the market for long-distance travel or the ability to use travelling-time even more effectively? Would some substitution of ICT for travel be desirable, and if so, how could it be encouraged? Will changes in carbon or fuel pricing affect the market for high-speed rail and the costs of the electricity generation needed? What might happen to an already fragile global economy and indeed the UK's economy within it? These uncertainties could rapidly multiply to the point where a favourable outcome from so large a project was most unlikely.

The uncertainties point to the importance of an approach to appraisal which is more transparent in its assumptions and costings, more open to sensitivity testing and subjected to effective scenario testing. Rather than carry out a further formal cost-benefit analysis, which values some impacts in

detail and others not at all, we advocate a simpler multi-criteria appraisal which assesses the alternatives against HS2's four objectives, and also the issues of social and local environmental impact. Such an appraisal should be conducted objectively and dispassionately before we commit to the nation's largest-ever transport investment.

9 The conduct of the review

The review should be carried out expeditiously, to minimise any delay to the implementation of any elements of HS2 which are found to be justified. If established as a matter of priority, and given appropriate resources and powers of access to relevant material, it should be possible to complete such a review within a year. In the meantime, work on HS2 could continue. If HS2 is still found to be the most appropriate option, it will be able to be implemented without further delay. If it appears that the design could be significantly enhanced, it should still be possible to incorporate those design enhancements.

If HS2, even when modified, proves not to be the most effective option, there will inevitably be a significant abortive design cost. However, this will have arisen in the main as a result of the unquestioning approach to the project adopted by the government over the last several years and of HS2 Ltd's reluctance to consider challenges to their preferred designs. This should not be used as a reason for continuing to pursue a project for which other more cost-effective alternatives are available.

Finally, the review should consider lower-cost, shorter-time-scale measures that could generate more immediate benefits. If these prove to be cost-effective, there will be a strong case for pursuing them either as an alternative to or alongside any longer-term investment programme.

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The correspondence that led to the Workshop, its programme, the slides of the presentations and various other documents can be found on this website: www.passengertransportnetworks.co.uk.

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