

Response to the HS2 Consultation
High Speed Rail: Investing in Britain's Future

nef (the new economics foundation)

Foreword

This submission is a response from nef (the new economics foundation) to the Government's consultation on the proposed high speed rail link between London and northern cities (HS2), *High Speed Rail: Investing in Britain's Future – Consultation*.¹ Our interest in this issue is in the decision-making process; we have no position on whether HS2 should or should not ultimately go ahead.

nef and their supporters The Freshfield Foundation have set up a programme to research the decision-making processes leading up to the HS2 proposals. The short term aim of this work is to try to make sure that the right decision is made about HS2 (whatever that might be). The long-term aim is to encourage a strategic and evidence-based approach to decision-making in government. Our response to the HS2 consultation is based on research carried out as part of this programme.

With its long-standing interest in holistic economic analysis, **nef** has been a pioneer of well-being measurement and the use of Social Return on Investment (SROI) methodology in the UK, including for public policy making. In April 2010, we published a report showing how the principles of SROI could be applied to infrastructure decisions.² The Freshfield Foundation is a grant-making trust with a strong interest in good process and sustainable development.

Our submission is intended to present an independent, impartial and constructive challenge on the case for HS2 as presented by the Department for Transport (DfT). Our aim is to raise the level of debate about this decision in particular and decision-making more generally.

In addition to this report, we have answered the consultation questions as posed by DfT in the consultation document. Our responses are attached here as an appendix.

¹ <http://highspeedrail.dft.gov.uk/> (last accessed, 29 July 2011)

² Kersley, H., & Lawlor, E. (2010). *Grounded: A New Approach to Evaluating Runway 3*. London: **nef**.

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Executive summary³

As it stands, the Government's case for a high speed rail link between London and northern cities (HS2) is incomplete and therefore cannot be used as a reliable basis for a decision on the project. Too much has been omitted from the analysis for it to be robust and persuasive. There is positive bias towards the scheme which does not give confidence that HS2 will deliver against its objectives and create more value for society than it will absorb in resources. The Government should postpone a decision on HS2 and commission a full independent analysis of the proposal before proceeding further.

It is important to acknowledge the complexities of decision-making on large-scale projects. The bigger the investment, the bigger the opportunity costs. Large, expensive infrastructure schemes with a life-cycle spanning many decades carry especially high opportunity costs. The only way to mitigate against the inevitable uncertainties of such a project is by conducting a comprehensive analysis of the impacts and considering different the options that deliver on strategic goals.

Despite these challenges there is a robust pathway for making convincing decisions. This begins with situating a project, particularly a large, impactful one, within national and sectoral strategies. Its direct contribution and inter-linkages with other policies and investments can then be openly assessed. Subsequently, strong appraisal is required for understanding how the scheme, and alternative options, will meet objectives, absorb resources and create value for society in its broad sense (i.e. across the economic, social and environmental spheres). Appraisal is essential for establishing how a scheme affects different groups in society, and for ensuring that resources are allocated to their most productive use.

The Government might claim this is the course pursued for HS2, but our reading of the evidence reveals that this is incomplete. As a result it is impossible to judge whether HS2 deserves support or not.

Despite there being a number of strategy documents relevant to high speed rail these do not amount to a top-down strategic flow leading to high speed rail. Without being clear how transport schemes, and specifically rail schemes like HS2, fit strategically, claims for what each one can deliver, such as making a major contribution to regional economic rebalancing, look disconnected and over-optimistic.

The appraisal of HS2 misses fundamental aspects of good practice, despite that good practice being laid out in HM Treasury's guidance, The Green Book. The DfT's cost-benefit analysis excludes all environmental and social outcomes although HM Treasury stresses their importance. By not evaluating wider impacts the DfT has in effect put their values at zero in cost-benefit terms, even though people do think these impacts are important and have value. Thus, the benefit-cost ratio, a number which carries weight with decision-makers, is based on a very narrow selection of impacts. The overall result is to over-claim benefits and understate costs, creating a strongly positive bias towards the scheme.

In the consultation, the DfT has made much of the carbon case for HS2, but this remains unconvincing. Over-optimistic occupancy rates, the failure to include a comprehensive estimate of the carbon emitted during the construction of HS2 and connecting it to other transport policies all point to an incomplete analysis. The DfT has given particular weight to the benefits of lower carbon emissions of HS2 over short-

³ This executive summary has been modified for public release since nef's consultation response was submitted to the DfT on 29 July 2011.

haul flights. But this would only apply if there is a clear policy to restrict the use of the freed runway slots and not filling them with carbon intensive long-haul flights.

In short, good process and principles of strong appraisal have not been applied. There is a danger that poor decision-making will follow and the country will be making an expensive and uncertain gamble on HS2.

The limitations of the HS2 appraisal are as follows:

1. Important material impacts of HS2 are excluded from the analysis
2. By separating rhetoric on objectives from the appraisal, it is not possible to test the claims that are being made for HS2 which has implications for accountability
3. Appraisal is not rooted in stakeholder engagement
4. Evaluation of potential alternatives is incomplete
5. Time savings are over-valued and over-emphasised
6. There are significant inconsistencies with existing rail capacity and future demand figures
7. The economic case is dependent on potentially optimistic economic growth
8. The opportunity cost of HS2 investment is poorly evaluated
9. Sensitivity testing is incomplete
10. The carbon case for HS2 has not been made.

We call on the Government to postpone a decision on HS2, and to commission a full-scale independent and impartial analysis of the proposal before proceeding further.

1. Embedding HS2 in strategy

There was no published transport white paper between 1975 and 1998. In the past fifteen years, however, the UK Governments have attempted to establish a transport policy that meets a set of goals. While expressed differently, the *New Deal for Transport White Paper* (1998), *Future of Transport White Paper* (2004), *Towards a Sustainable Transport System* (2007), and *Creating Growth, Cutting Carbon Local Transport White Paper* (2011) to some extent share the goals of improving quality of life and health, supporting economic growth, enhancing sustainability and promoting equality of opportunity. The Eddington 2006 and the McNulty 2011 reviews⁴ have provided the Government with detailed independent railway-focused assessments and recommendations to improve the UK transport infrastructure in a number of ways.

In this context, there has been some discussion within government about the merits of High Speed Rail. For example, the Channel Tunnel Rail Link Act of 1996, the Strategic Rail Authority's 2003 High Speed Rail study⁵ and the High Speed Rail Command Paper in 2010⁶ each considered the application of specific high speed rail (HSR) projects.

Despite establishing overarching end-principles for transport and considering specific HSR applications in isolation, the UK Government has not established a detailed national transport strategy that includes an elaborated plan for rail investments and clearly defined the role of HSR within the UK transport context. Such a disjointed approach makes it very difficult to ensure that transport investments planned or currently in development will meet the Government's fundamental objectives.

The HS2 project, therefore, is not part of a clearly defined constellation of transport investments designed specifically to achieve the Government's stated objectives for transport. It stands alone as a segregated initiative without clear connections to national or regional transport priorities in the near or long term.

The narrative of *High Speed Rail: Investing in Britain's Future - Consultation* (henceforth the Consultation Document) describes the range of objectives that HS2 is expected to contribute towards, although a clear listed hierarchy of objectives is not spelled out. Increasingly, however, in media coverage on HS2 proponents highlight the main objective being to increase capacity along the route through Birmingham and further north.⁷ This also ties in with the choice of alternatives considered, all of which are rail package options to tackle capacity issues. This indicates that the baseline for judging alternatives is delivery on capacity, although further impacts including unintended consequences are of course vital to a thorough understanding of the value of each option.

⁴ Eddington, R. (2006). *The Eddington Transport Study: the case for action*. HM Treasury, London, HMSCO; Office of Rail Regulation. (2011). *Rail Value for Money Study – realising the potential of GB rail*. London.

⁵ Atkins. (2003). *High Speed Line Study. Summary report*. Strategic Rail Authority.

⁶ Cm7827. (2010). *High Speed Rail*. London: Department for Transport.

⁷ For example, the Newsnight HS2 feature, 20 July 2011
<http://news.bbc.co.uk/1/hi/programmes/newsnight/default.stm>

3. Appraisal

3.1 The role of strong appraisal

Economic appraisal plays a major role in public-sector decision-making. Nowhere is this more important than in the commissioning of large infrastructure projects.

There is a perception in some circles that public decisions are ultimately made politically and that because of the need for assumptions, cost-benefit analysis simply gives you the result you want. We would argue that political understanding of an issue is helpfully informed by good appraisal. Done well, and holistically, appraisal provides a robust, transparent framework for capturing information and evidence and is a tool for understanding and comparing the potential value of different interventions.

Strong appraisal combines quantitative measurement of costs and benefits with qualitative assessment of the alternatives under consideration. The qualitative part of appraisal is important for understanding and making clear the logical flow from investment of resources through to activities through to outcomes and delivery of objectives.⁸

Economic appraisal is not just about whether a scheme will deliver a financial return, or economic benefits for a particular group. It is much broader; about understanding how it will meet its objectives, how it will affect different people, how it will absorb society's social, economic and environmental resources, and how it will create additional societal value. It requires bringing into the balance not just direct costs and benefits, but indirect, often unintended ones as well. This is recognised in economic theory and in the Government's own guidance on appraisal set out in HM Treasury's Green Book.⁹

If a scheme that looks financially sound imposes high associated costs on a community, such as job losses, excessive noise or air pollution, then society, viewed as a whole, may be worse off if it proceeds. Impacts like this can play out directly in financial terms in the long run, through increased health care costs for example. This is why going for short-term savings or returns can be a false economy.

The Department for Transport (DfT) has separate guidance for appraising transport schemes, the New Approach to Transport Appraisal (NATA).¹⁰ Our critique below deals specifically with issues coming to light in the appraisal of HS2, but we note that others have presented critiques of NATA itself which are relevant to transport appraisal in general.¹¹

⁸ One term for this logical flow is "theory of change" which describes how and why an investment is expected to achieve its objectives.

⁹ The Green Book explicitly recognises the importance of bringing onto the balance sheet the economic, environmental and social costs and benefits of a proposal. It also recognises that wherever feasible items without an established market price should have a value attached to them in order that they are not excluded from the appraisal. Where it is not possible to value an outcome, the Green Book recommends taking account of it through multi-criteria analysis.

¹⁰ See: <http://www2.dft.gov.uk/pgr/economics/rdg/integratedtransporteconomics3078.html> (last accessed 29 July 2011)

¹¹ Buchan, K. (2008). *Decision-making for Sustainable Transport*. Green Alliance/ Metropolitan Transport Research Unit.

3.2 How appraisal has been conducted for HS2

The elements of the appraisal for HS2 carried out to date are contained separately in two documents attached to the consultation: *The Economic Case for HS2*; and *The Appraisal of Sustainability*.

The *Economic Case for HS2* effectively sets out to assess how much welfare, or benefit, the Government's investment will deliver. Following DfT appraisal guidance in NATA, it values the primary economic impacts and calculates the net benefit of the proposal divided by the net cost to government to produce a benefit-cost ratio (BCR). The results are shown in Table 1 below. The figures show that the really big number in the appraisal is the benefit to passengers, a substantial proportion of which is journey time savings. Part of our commentary on the HS2 appraisal below considers the robustness of this number.

Table 1. Quantified Costs and Benefits of HS2¹²

Figures in £ are in billions

| Impact | Y-network | London-W Midlands |
|---------------------------------|--------------|-------------------|
| Benefits | | |
| Benefits to passengers | £38.3 | £17.5 |
| <i>Business</i> | £25.2 | £11.1 |
| <i>Other</i> | £13.1 | £6.4 |
| Other benefits | £-1.0 | £-0.9 |
| Net benefits | £37.3 | £16.5 (1) |
| Wider Economic Impacts | £6.3 | £4.0 |
| Total net benefits | £43.7 | £21.9 |
| Costs | | |
| Capital costs | £30.4 | £17.8 |
| Operating costs | £17.0 | £6.2 |
| Cost savings on classic network | £-3.1 | - |
| Revenues | £-27.2 | £-13.7 |
| Total net costs | £17.1 | £10.3 |
| BCR without WEIs | 2.2 | 1.6 |
| BCR with WEIs | 2.6 | 2.0 |

Note: (1) £7.3 billion or 44% of the net benefits comes from the time savings as a result of faster journeys.

Separate from *the Economic Case*, social and environmental aspects of HS2 are considered in the *Appraisal of Sustainability*.

We note that a full Environmental Impact Assessment will not be carried out until after the Secretary of State has announced his decision on whether or not to proceed with HS2.

¹² Figures reproduced from Tables 2 and 10 of HS2 Ltd, February 2011, *Economic Case for HS2*

3.3 The limitations of the HS2 appraisal process

Our concerns with the appraisal of HS2 can be summarised by ten key limitations.

1. The problem of excluding material impacts

The HS2 appraisal is split between *The Economic Case for HS2* and *The Appraisal of Sustainability (AoS)*.

There is only a limited synthesis of all considerations in the Appraisal Summary Table (AST) contained in Appendix 4.3 of the AoS. This broadly illustrates which impacts are expected to have a negative impact on the case for HS2 and which a positive impact, with some limited inclusion of values.

Critically, the cost-benefit analysis in the *Economic Case for HS2* excludes all environmental and social outcomes. Despite clear government guidance¹³ about the importance of capturing as many of the economic, social and environmental outcomes as possible, the BCR for HS2 is based on economic considerations alone. We recognise that the economic case is in compliance with NATA and that the intention behind it is to demonstrate value for money for the Government's investment. We caution strongly, however, that this reveals only a very narrow view of value which is not helpful for robust decision-making.

Important exclusions from the cost-benefit analysis are: the carbon, noise and community blight impacts; damage to the natural environment; and the socio-economic/distributional impacts. These outcomes from the scheme are just as real as the journey time savings to passengers. For all these social and environmental impacts there are accepted methodologies for capturing their value in cost-benefit analysis.^{14,15,16,17} We note also that although the DfT assesses possible job creation from HS2, the value of additional jobs is not included in the cost-benefit analysis, although it would be relatively straightforward to do so.

By excluding wider impacts the DfT has in effect put their values at zero in cost-benefit terms, even though people do think these impacts are important and have value. It may not be possible to assign exact values to impacts where there is no established market price, but using conservative and transparent assumptions ensures that a value of an acceptable order of magnitude can be included. The danger of excluding wider impacts from the cost-benefit analysis is that it delivers a biased result in which the only major outcomes included in the bottom-line number are the positive ones. In response to our question "what is your assessment of the risk that decision-makers rely on a number (the BCR) which only includes some of the impacts?" we received the following from HS2 Ltd:

"Our experience from HS2 is that the level of understanding of environmental impacts and risks is much greater by having them detailed as in our AoS, and we therefore consider that decision making would be less effective if we tried to incorporate all economic and environmental elements into a single measure".¹⁸ (our emphasis)

Our counter to this is that there is a very real risk that only accounting for select impacts leads to misallocation of society's resources.

¹³ HM Treasury. (2003). *The Green Book – appraisal and evaluation in central government*. London: HMTSO.

¹⁴ The Green Book (2003) contains specific guidance for valuing carbon emissions.

¹⁵ For damage to the natural environment, the ground-breaking 2011 National Ecosystem Assessment¹⁵ provides a baseline from which the DfT could draw values; there are also willingness to pay approaches for valuing natural environmental amenities.

¹⁶ The Green Book (2003) is particularly clear that equity considerations should be taken into account. This recognises that "the impact of a project on an individual's well-being will vary according to income", and that "a benefit or cost accruing to a relatively low income family would be weighted more heavily than one accruing to a high income family" p.24.

¹⁷ Noise and community impacts (commonly referred to as blight) are generally valued in terms of impacts on property values. DfT's consultation documents discuss this. Changes to property values as a result of a scheme capture changes in people's wealth or asset values. It is also valuable to capture loss of local networks by including established well-being indicators which can more accurately reflect the lived experience of blight.

¹⁸ Email correspondence HS2 Ltd to Helen Kersley at nef, 19 July 2011.

2. Separation of the rhetoric on objectives from the appraisal

The DfT has described HS2 as a once in a generation opportunity to create jobs and prosperity in the UK.¹⁹ The consultation document discusses how HS2 will contribute to economic productivity and competitiveness, help bridge the North-South divide, provide regeneration opportunities along the route, and generate thousands of jobs.

As far as possible, the impacts counted in the cost-benefit analysis for HS2 should relate to objectives, so decision-makers can judge how far a scheme will help in delivering them. In the case of HS2 the bulk of the quantified benefits are journey time savings which partly reflect an approximation for greater economic productivity. There are also measures of improved reliability and reduced crowding. Other objectives, however, such as regional balancing, regeneration, and contribution to environmental sustainability, are not reflected in the quantification of benefits. Partly this reflects the very real challenge of evidencing and measuring certain more indirect impacts such as environmental sustainability. It is because of this challenge that a clear qualitative explanation is required, heavily based on direct stakeholder involvement and available secondary evidence. This explanation links the inputs and activities of a project, with its expected outcomes. It is as much a part of good appraisal as the quantitative exercise.

In the case of HS2 such a logic chain would help clarify and demonstrate how the new rail line would deliver against stated objectives, with the appraisal incorporating values for all the potential outcomes wherever possible.

Evidence on the objective of rebalancing the economy

Much has been claimed for the contribution that HS2 will make to economic rebalancing. But the consultation documents do not present an analysis of the claim drawing together the evidence from primary and secondary research.

According to the DfT, a causal link between HS2 and a rebalancing of the economy can be made based on the assumptions that:

- ▶ As travel times decrease, cities will be better able to draw on and complement the economic strengths of London and the South East and thus compete in domestic and global markets
- ▶ Regeneration of areas around HS2 stations will reinvigorate some relatively deprived parts of London, Birmingham, Leeds and Manchester
- ▶ Construction and operation of HS2, alongside greater economic productivity and regeneration, will result in a net increase of jobs for the UK
- ▶ HS2 will release capacity on existing lines, enhancing intra-regional activity and prosperity.²⁰

Our review of the literature reveals that available evidence does not support these claims. For example, international high speed links have been the subject of several reviews.²¹ Despite being used in support of HS2, they do not in fact commonly demonstrate that high speed rail links between cities with varying levels of economic prosperity result in rebalancing. Other studies have found that high speed rail links tend to benefit more prosperous regions above other areas,^{22,23} especially if not accompanied by economic and skills strategies that give connected cities an economic specialism.

¹⁹ Department for Transport. (2011). Consultation Document, p.7.

²⁰ Ibid, pp.5 – 9.

²¹ See, for example: Albalade, G., & Bel, G. (2010). High-speed rail: lessons for policy-makers from abroad. *Working Paper 2010/3*. Research Institute of Applied Economics. Barcelona: University of Barcelona.

²² Lafourcade, M., & Thisse, J.F. (2008). New economic geography: A guide to transport analysis. *Working Paper No 2008 (2)*. Paris School of Economics. Paris: Paris-Jourdan Sciences Economiques Laboratoire D'Economie Appliquee – INRA.

²³ Puga, D. (2002). European regional policies in light of recent location theories. *Journal of Economic Geography*, 2(1), 373-406.

There are three considerations of particular note.

1. A net increase in economic prosperity and employment in one area could be the result of displacing activity and employment elsewhere. This means that some towns and cities might experience a decline in their prosperity, offsetting any potential increases in Birmingham, Manchester and Leeds. For example, Greengauge 21 and KPMG found that HS2 could actually have a negative impact on the Cardiff economy.²⁴
2. Other drivers of activity could mean HS2 makes little difference. For instance, the high speed rail links in Japan were accompanied by an increase in economic prosperity in cities which were growing anyway, making it difficult to untangle the difference the high speed rail link really made.²⁵ In the case of the UK, where cities such as Manchester and Leeds have seen substantial improvements in their Gross Value Added (GVA) in the past fifteen years, it is possible that HS2 will not add much more.
3. Even if HS2 did contribute to greater regional economic prosperity, it might not be enough to rebalance the economy. Even if HS2 resulted in a net increase in jobs and economic activity in cities outside London, London might still gain more leaving imbalances to persist. The case of the high speed rail link from Paris to Lille is often used to highlight the potential benefits for regional development. Lille did benefit, but studies show that Paris benefitted more.²⁶ This suggests that high speed rail can have the effect of unbalancing the economy further.

The North-South divide exists in the UK because of an uneven distribution of industry and skills as well as individual wealth. Better transport links are just one among a number of potential policies that could be considered for tackling the economic deficit between regions. Just taking transport options, evidence suggests that transport investment within cities and between Northern cities might be better able than HS2 to constructively tackle the North-South divide.²⁷

Beyond the issue of evidence to support claims of convergence, the DfT does not discuss how they would measure progress towards regional rebalancing. A system of data collection to take account of issues like displacement would be needed to assess HS2 against the stated objective to rebalance the economy. Simplistic measures of GVA will not be able to capture the distinct contribution from high speed rail.

3. Approach to stakeholder engagement

The major principal difference between our description of strong appraisal, informed by Social Return on Investment (SROI) methodology,²⁸ and the framework set out in the Green Book, is in the central role for stakeholders. Stakeholder engagement provides input in three important ways:

1. It requires thinking about all groups which are affected in a way which mitigates against prioritising particular parties and the outcomes that matter for them.
2. It allows for all material impacts, intended and unintended, to be captured because all stakeholder groups are included, and information about outcomes is sourced on the ground from genuine experience.
3. It helps derive outcome indicators and financial proxies to capture hard to measure impacts where there is no established value in the market.

Evidence from the suite of consultation documents is that stakeholder engagement was not core to the appraisal process. A good example of where we would consider stakeholder engagement to be vital is

²⁴ Greengauge 21 & KPMG. (2010). *High-speed rail consequences for employment and economic growth*. Kingston-upon-Thames: Greengauge 21.

²⁵ Sasaki, K., Tadahiro, O., & Ando, A. (1997). High-speed rail transit impact on regional systems: does the Shinkansen contribute to dispersion? *The Annals of Regional Science*, 31(1), 77-98.

²⁶ See Albalade & Bell. (2010). *Op. cit.*

²⁷ Manchester Independent Economic Review. (2008). *Reviewers Report*. Manchester: Manchester's Commission for the New Economy.

²⁸ For additional information on this methodology see: <http://www.neweconomics.org/projects/sroi-and-public-policy> and <http://www.nef-consulting.co.uk/services/sroi/>

around the impacts of regeneration at Euston and other locations to understand how local people and communities are likely to be affected, positively and negatively.

We also note that rail operators and investors do not form part of the appraisal. These are likely to be major stakeholders in HS2, potentially earning profits from the scheme. The DfT has approached the analysis by assuming there is no public-private partnership and that the funding flows are all public sector. The reality however is that there will be private sector involvement not least in constructing and operating the line. Understanding outcomes for them are critical.

4. Assessment of alternatives to HS2

In the consultation evidence for HS2, the DfT’s consideration of alternatives is poor. If applied appropriately, across all alternatives, cost benefit analysis is a good tool for assessing which alternative offers best value for society and how different groups are affected. It is not, however, a good tool to use for assessing whether one option in isolation delivers best value. Considering this it is imperative that all types of alternatives are investigated.

Our three main critiques of the DfT’s evaluation of alternatives are as follows:

- ▶ **Disparate goals require disparate alternatives:** DfT emphasis on classic rail alternatives ignores the value of package-based interventions.²⁹ A package-based intervention is simply a whole-system investment that includes multiple distinct elements designed to better meet a single objective or meet a range of goals. Examples are given in Table 2.

Table 2. Package-based intervention alternatives examples

| Goal | Alternative |
|--------------------------|--|
| Rail Capacity | Inter-city rail packages |
| Economic growth | Metropolitan transport investments for all major economic centres in England designed to improve regional agglomeration |
| Enhancing sustainability | Investments in business teleconferencing schemes, demand management programmes like “Smarter Travel Choices” ³⁰ |

- ▶ **Unrealistic comparator ensures inaccurate results:** the two preferred alternatives to HS2 cited in the DfT’s consultation literature, Rail Package 2 (RP2) and Scenario B³¹, do not include the potential impact of Evergreen 3 improvement on the Chiltern Mainline³², reconfiguration of West Coast Main Line (WCML) trains to maximise standard class capacity and the improvement of “pinch-point” stress along the line that would ultimately improve capacity. This decision artificially lowers the amount of current capacity available and thereby exaggerates the perceived case for large-scale capacity improvements in future, like HS2.
- ▶ **Inconsistencies in the comparison:** there are serious inconsistencies in the way the DfT compared HS2 with potential alternatives. When considering the impacts of HS2 against alternatives, the DfT has:

²⁹ Office of Rail Regulation. (2011). *Op. cit.* The recent report highlights the, “need to ensure that a full range of whole-system options [are] considered.”

³⁰ Committee on Climate Change. (2009). [Meeting Carbon Budgets](#) – the need for a step change. Presented to Parliament pursuant to section 36(1) of the Climate Change Act 2008. October, London . The report highlights the “Smarter Travel Choices” programme.

³¹ Oxera. (2011, 20 June). Review of the Government’s case for a High Speed Rail programme, Prepared for the Transport Select Committee. London. p.4.

³² <http://www.chiltern-evergreen3.co.uk/> (last accessed, 29 July 2011)

- **Omitted £500 million of Wider Economic Impact (WEI) benefits** from comparator scenarios.³³ If the DfT include expected WEI impacts the classic rail BCR would reach 2.0 – the same ratio as HS2 (London-Birmingham).³⁴
- **Omitted £1.9 billion of conventional rail-track upgrade costs** necessary for HS2 trains to operate between Birmingham and Manchester/Liverpool. The DfT has, however, included these upgrade costs for the classic rail alternatives.³⁵

The DfT comparison of HS2 and its primary alternatives reveals a large bias toward HS2 in the consideration of alternatives. The Government's current emphasis on classic rail alternatives to meet HS2's objectives only serves to superficially inflate perceived value of the HS2 option. The inconsistencies in the evaluation of WEI and infrastructure costs mean that HS2 and its alternatives have not been compared on a like for like basis.

The DfT has stated that HS2 is a bold project and it has ambitious and diverse goals. The alternatives considered alongside HS2 should be equally bold, creative and comprehensive.

5. Treatment of time savings

The case for HS2 presented by DfT rests on the value of time savings. Time savings is the measure used to value two main benefits: increased reliability on the rail line; and shorter journeys. Our concern is that the way in which time is valued by DfT overinflates the benefits.

Valuing travel time is an essential element in the conventional economic appraisal of transport because it is one of the few things about a transport project that can be easily measured. Whilst clearly defined, traditional methods for valuing time are, according to the DfT, "an area of debate"³⁶, with hosts of inherent technical and normative elements. Regardless of how the DfT captures the value of time for future travellers on HS2, the emphasis on travel time savings as a driver for the Government's case for HS2 is misplaced. The DfT's 2007 White Paper, *Delivering a Sustainable Railway* states that:

*"The CBI confirms that frequency and reliability of rail services matter more than journey time. Passenger Focus research confirms that cutting journey time is not a high priority for passengers either. Reduced journey time will often be an incidental benefit of measures to increase capacity..."*³⁷

Despite being an "incidental benefit" reduced journey time is the lion's share of the DfT's published economic case for HS2. For HS2 London – Birmingham, the DfT appraisal values the 30 minute travel time savings between London and Birmingham at £7.3 billion, 44 per cent out of a total direct net benefit of £16.5 billion, and greater than the combined benefits associated with improved reliability and reduced crowding.

Our analysis is that DfT value time at too high a level and in too simplistic a manner. These assumptions inflate the perceived economic value of HS2, as we discuss below.

The HS2 economic case separates valuation of journey time savings into two groups; working and non-working. Working time savings reflect the benefits to business users and their employers of faster journeys. This is because of the assumption that travel time is entirely non-productive. On this basis savings in travel time convert non-productive time (travel) into productive use (work). Time savings to business users are valued as the aggregate of the wage rate paid to the individual business traveller. And this benefit is assumed to be passed into the wider economy as enhancement to overall economic productivity.

³³ Oxera. (2011). *Op. cit.* p.5.

³⁴ Atkins . (2011, February). High Speed 2 Strategic Alternatives Study, London to West Midlands Rail Alternatives,. Retrieved from <http://www2.dft.gov.uk/pgr/rail/pi/highspeedrail/proposedroute/appupdate/pdf/updatereport.pdf>

³⁵ Atkins. (2011). *Op. cit.*; Department for Transport. (2011). *Economic Case for HS2: The Y Network and London - West Midlands*. Retrieved from <http://highspeedrail.dft.gov.uk/sites/highspeedrail.dft.gov.uk/files/hs2-economic-case.pdf>

³⁶ Department for Transport. (2011). *Economic Case for HS2: The Y Network and London - West Midlands*, p.26.

³⁷ Department for Transport. (2007). *Delivering a Sustainable Railway*. London. p.62.

It is projected that only 30 per cent of HS2 passengers will be business users.³⁸ Despite being such a small proportion of the overall HS2 travel population, business users, through the high value of rail travel time, generate two-thirds of the quantifiable benefits of HS2.³⁹

There are specific issues around the technicalities of valuing time and measuring travel time savings. In brief, the DfT's value of time:

- ▶ **Is highly subjective:** The value of rail passenger time used in HS2 benefits is based on the wage-rate of a set of passengers that participated in a decade-old transport survey.
- ▶ **Is without quality factors:** Time values do not include important factors like, how enjoyable it is to ride a specific type of transport or the value of being able to experience something previously inaccessible due to a quicker journey.
- ▶ **Ignores the marginal value of time:** The DfT values one minute of time savings at the same increment no matter how long the rail trip. Studies indicate that the value of time savings to an individual increases or decreases depending on the length of the overall journey. The perceived value of a unit of time savings actually changes i.e. the marginal value of time.⁴⁰
- ▶ **Is unrealistically high:** the DfT values rail travellers' time as if all business passengers earn an average annual salary of £70,000.⁴¹ If the current average salary rate for individuals in the ninetieth percentile (£46,428⁴²) is used as the base for the value of time, the BCR for the London-Birmingham section of HS2 would drop from 2.0 to 1.8. This would fall even further if median income figures were used.

6. Current rail capacity and future demand

Although enhanced rail capacity is one of a number of objectives discussed in the Consultation Document it is increasingly the reason spoken about in public underscoring the need for HS2. The issue of rail capacity is complex and highly uncertain. There are questions of how much demand for long distance travel in the UK will increase in the coming decades, whether long distance travel should be encouraged or discouraged and how best to meet potential future demand for rail travel.

The current capacity issue between London and the West Midlands is a function of the rail pricing structure for commuter flows of rail passengers.⁴³ This current capacity crunch is not due to a 'real' shortage of seats on trains between London and the North.

The main question is whether demand will increase beyond the capacity of the current conventional rail system and all potential improvements. The DfT forecast that demand for rail travel between London and the West Midlands will increase from their base year (2007/2008) by over 200 per cent by 2043.⁴⁴ We have not examined the DfT's demand models and do not have a view on whether this increase is conservative or optimistic. There are, however, a number of accuracy issues with the DfT's demand forecasts which are important to highlight. These issues call into question whether the forecasts should be used to inform the potential value of future investments.

For example, in the reference cases for HS2 and the other classic rail alternatives including Rail Package Two (RP2), the DfT has "made assumptions about the developments in transport in the UK that would be in

³⁸ Department for Transport. (2011). Economic Case for HS2: The Y Network and London - West Midlands, p.22.

³⁹ Ibid, p.31.

⁴⁰ Accent/Hauge. (1999). The value of Travel Time on UK Roads. Report to DETR, London; Buchan, K. (2008). *Op. cit.*; Kato, H. (2006). Nonlinearity of the Utility Function and the Value of Travel Time Savings: Empirical Analysis. European Transport Conference 2006, proceedings. Strasbourg, France.

⁴¹ Bluespace Thinking Ltd. (2010). *A Review of High Speed Rail - HS2 proposals*. Working Paper, April. Retrieved from <http://www.bluespacethinking.com/assets/user/reports/HS2%20Review%20PDF%203.pdf>

⁴² Office of National Statistics. (2010). Annual Survey of Hours and Earnings, 2010. Table 1.7a Annual Pay: Gross.

⁴³ Office of Rail Regulation. (2011). *Op. cit.*

⁴⁴ Figures compiled from 2010 HSR Command Paper and 2011 Economic Case for Consultation.

place in 2026.”⁴⁵ When constructing their reference case for HS2, the DfT did not include the planned Evergreen 3 Chiltern Main Line improvement reducing times from London to Birmingham.

- ▶ Evergreen 3, scheduled to become operational in 2011, will provide journey times from London to Birmingham in 90 minutes – only 6 minutes longer than the train from Euston.
- ▶ DfT has not always ignored Evergreen 3: it was included in the 2010 report *HS2 Strategic Alternatives – Rail Intervention*.

Also, the DfT overlooked basic and easily implementable strategies on existing trains that could expand capacity through train car reconfiguration. Declassifying under used first class coaches (which operate at a 20 per cent load factor from London to Birmingham) to standard class will increase capacity by essentially adding approximately an extra train car’s worth of capacity. This capacity improvement can be accomplished almost immediately with limited cost.

7. Assumptions around growth

The future scenario under which the Government is evaluating HS2 includes potentially optimistic forecasting assumptions concerning the health of the future economy. Economic growth, expressed in Gross Domestic Product (GDP) growth per-head, informs the forecasts of demand for rail journeys and future measures of the value of time.⁴⁶ Increases in value of time assumed by the DfT are predicated on positive forecasts of economic growth, but to a certain degree, passenger demand assumptions, cost projections and revenue expectations are all dependent on the assumption of a steady economic growth.

For infrastructure investments with long life-cycles, it is absolutely necessary to forecast the economic landscape of the UK in the future. The question is whether the DfT has taken an overly aggressive or cautious approach.

Based on recent history, we know that UK economic growth rates are unpredictable. UK GDP growth per-head decreased in 2008 and 2009. It has grown in 2010, but at a rate that is a far less than half of what the DfT is forecasting as the annual growth level for the next decade.

In the near to medium term, increases in the GDP growth rate from 2009 levels in the UK is likely, but the annual rate going forward, especially as far forward as 2026, is highly uncertain. The economic case for HS2 very easily could become loss-making in less stable growth scenarios. We do note that our comment here is a critique of accepted general forecasting approaches.

8. Opportunity costs

Every investment has opportunity costs.⁴⁷ For complex investments like HS2, the value of an opportunity cost can rise and fall depending on the risk and certainty of whether an investment’s returns or objectives will be realised. Given the level of uncertainty and subjectivity, there is significant risk that the HS2 project will only meet a fraction of its stated goals.

There are a number of more certain ways, as referenced above, to meet most of the objectives for HS2. Considering the rail capacity goal, smaller investments in upgrades produce similar BCR levels.⁴⁸ Achieving economic growth in northern cities between 2026 and 2033 could be achieved by targeted education and training programme expenditures.⁴⁹ Shifting UK transport toward reducing greenhouse gas emissions can

⁴⁵ Department for Transport. (2011). Economic Case for HS2: The Y Network and London -West Midlands, p. 27.

⁴⁶ Department for Transport. (2011). Values of Time and Operating Costs, TAG Unit 3.5.6, pp. 6-7.

⁴⁷ An opportunity cost is the added value one would receive from another investment option, like the interest on a savings account, if the expenditure was not made and the money was spent in some other way.

⁴⁸ Oxera. (2011). *Op. cit.*

⁴⁹ Tomaney. (2011, 31 May). Written evidence submitted to Parliament Transport Select Committee Hearings on HS2. <http://www.publications.parliament.uk/pa/cm201012/cmselect/cmtran/writev/rail/m14.htm> (last accessed 29 July 2011).

almost certainly be achieved to a greater extent than HS2 by further investment in current and future programmes like “Smarter Travel Choices”.⁵⁰

9. Sensitivity

The overall outcome of a complex project is a summation of the performance of all its components. The success of a project with myriad factors, such as HS2, can depend on how well a specific, or set of, components perform. It is necessary to conduct comprehensive evaluations of a project's assumptions and components to determine how sensitive the outcome is to changes in the variables. In economics, these evaluations are called “sensitivity tests”.⁵¹ The DfT's sensitivity tests for the forecasts and assumptions for HS2 are not sufficient, in breadth or depth, to provide an accurate evaluation of the risks and opportunities of the project.

Relating to the potential benefits generated by HS2, the only substantial sensitivity test discussed within the consultation documents concerns the DfT's decision not to count time travelling on the train as productive time. Evaluating the costs, the DfT primarily evaluates the sensitivity of some of the projected costs by evaluating the standard application of an “optimism bias”.⁵² According to the consultation document “cost estimates have been tested within HS2 Ltd and by an independent panel of experts.”⁵³ Despite this statement, no additional information concerning what specifically was tested, how it was tested and who comprised the panel of independent experts is given.

At best, this level of sensitivity testing is univariate on a very low level and does not take into account the potential accuracy benefits of testing more than one variable, or multivariate, concurrently. In reality, many different factors may change at the same time. Multivariate sensitivity tests could provide greater insight into how the value of HS2 will fluctuate under real-world circumstances. At present, the DfT sensitivity tests do not reflect this complexity and therefore have little evaluative importance.

10. Appraisal of the Carbon Impact of HS2

The Consultation Document argues that HS2 is part of the Government's plans for a low carbon economy, and makes three main claims about the CO₂e emissions related to the project.⁵⁴ We take each of these in turn in our comments below, but first we highlight a critical point about modal shift.

Modal shift

The Consultation Document states that,

“High speed rail is also an important part of our plans for a low carbon economy, helping us to meet our climate change targets by encouraging millions out of their cars and off the planes onto the train.”⁵⁵

According to the AoS, the potential changes in emissions due to modal shift from conventional rail, road or air travel over a 60 year period is a saving or increase of between -27.7 Mt CO₂e to +23.8 Mt CO₂e, with a ‘reasonable’ estimate of -7.4Mt CO₂e savings. The enormous range is primarily due to assumptions about how freed up flight slots are used. The lowest estimate assumes the freed capacity is retired, whilst the maximum figure assumes there is no change to domestic flights (the additional capacity is used for more

⁵⁰ Friends of the Earth. (2011). HS2 Review. “A national programme of measures to encourage greener alternatives for single occupancy car journeys 'Smarter Travel Choices' is estimated to save 2.9Mt CO₂ per year, at least 6 times as much as HS2. [“[Meeting Carbon Budgets](#)” Committee on Climate Change. October 2009]”

⁵¹ For example, a green grocer might see how their profit margin would change if the price they paid for apples doubled next month. This test would reveal how dependent or *sensitive* their profit is to changes in apple prices.

⁵² In the Economic Case for HS2, the DfT define optimism bias to be: “The tendency of project planners to be optimistic about the costs of a project/scheme and hence underestimate the costs. HM Treasury guidance states that when planning Government funded projects, an allowance to compensate for this tendency must be included.”

⁵³ Department for Transport. (2011). Economic Case for HS2: The Y Network and London - West Midlands, p.52.

⁵⁴ Department for Transport. (2011). Consultation Document, Foreword and pp. 37-38.

⁵⁵ Department for Transport. (2011). Consultation Document, Foreword and p.5.

domestic flights). The authors have not specified an upper limit for the worst case scenario, which relates to the freed slots re-used for international flights, although they note,

“As an illustration, flights from London to either New York or Shanghai would be one order of magnitude greater than typical UK domestic flights. The value of the upper range is expected to be large and positive resulting in a net increase in carbon emissions and aggregated carbon costs from HS2.”⁵⁶

An Environmental Audit Committee briefing submitted to the House of Commons Library in May 2011, pointed out that there is no indication about what the Government plans to do with the forecast reduction in air passenger demand, and thus the freed runway slots.⁵⁷ Given that Heathrow is at full capacity, it is unlikely that these slots will not be used. This view is also supported by a recent publication by Oxera (2011), submitted to the Transport Select Committee in June 2011.⁵⁸ Here the authors argue that given both Gatwick and Heathrow airports are at capacity, it is unlikely that these spare slots would not be re-used.

Given this, without a clear policy to restrict the use of the freed runway slots, given the weighting of this factor in the carbon appraisal, the carbon case for HS2 cannot be made.

A further point related to modal shift is that, while there is ample evidence from European experiences that modal shift from air to HSR does occur, an assessment of net carbon savings has to take account of the embedded carbon from construction of HS2 as well as operating emissions.⁵⁹ That is, it is the emissions parity with alternative modes that is important.⁶⁰

The first carbon assessment commissioned by the DfT for HS2⁶¹ found that for the London-Manchester link even if HS2 captured 100 per cent of travel between London and Manchester over a 60 year period, emissions produced when constructing the line would still be more than those saved by people using the train instead of cars or planes.⁶² However for London-Glasgow/Edinburgh route parity could be achieved when HS2 market share hit 62 per cent of all journeys. This finding – that longer-distance HSR routes tend to be less carbon intensive than medium-distance routes is supported by more recent research.⁶³

DfT’s main claims on emissions

Claim 1: Carbon emissions (per passenger mile travelled) of conventional rail are three times higher than those of high speed rail

The Consultation Document includes a chart showing the emissions per passenger of a range of different transport modes. High-speed rail emissions are represented by the Eurostar (HS1). For convenience we reproduce the chart here.

⁵⁶ Booz&Co and Temple. (2011). *Appraisal of Sustainability*, p.18..

⁵⁷ Environmental Audit Committee. (2011). *HS2 sustainability appraisal – climate change impacts*. London: House of Commons Library.

⁵⁸ Oxera. (2011). *Review of the Government’s case for a High Speed Rail programme*. Oxford: Oxera.

⁵⁹ For example, on building of the Lyon-Paris HSR in the early 1980s, the modal share of air traffic fell from 31 per cent to 7 per cent, and that of car and bus traffic fell from 29-21 per cent, where as rail traffic rose from 40 to 72 per cent. In the case of the Madrid-Seville line between 1991 and 1994 the modal share of air traffic fell from 40 to 13 per cent, and that of car and bus from 44-36 per cent, while train increased from 16 to 51 per cent; Albalate and Bel. (2010). *Op. cit.*

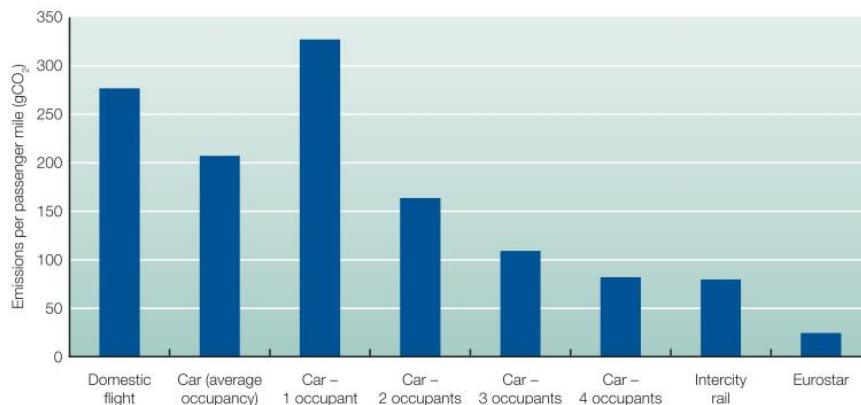
⁶⁰ Emissions parity: when modal shift from other modes (*viz.* air) to rail is just sufficient that the carbon emissions saved from the air mode exactly compensate for the increased carbon emissions of the new rail line.

⁶¹ Booz Allen Hamilton. (2007). *Estimated Carbon Impact of New North-South Line*. For Department for Transport. July. London .

⁶² Booz Allen Hamilton. (2007). *Op. cit.*

⁶³ Albalate and Bel. (2010). *Op. cit.*

Figure 1: Carbon emissions per passenger mile by mode of transport⁶⁴



The claim that high speed rail is less energy intensive than conventional rail is hard to reconcile with the relationship between speed and energy use.⁶⁵ And recent academic research examining the carbon intensity⁶⁶ of high speed rail and conventional rail does not support this claim.^{67,68}

Using an energy model⁶⁹, van Wee *et al.* (2003)⁷⁰, found that on a like for like basis (e.g. same distance, and equal distance between stops), energy and CO₂ emissions per seat kilometre of a conventional intercity train (speed 140 kph) was almost 50 per cent lower than a faster speed intercity train (200 kph) and 60 per cent lower than a high speed train (260 kph). This was the case despite assumed higher passenger occupancy rates on the higher speed trains. Albalate and Bel (2010) performed a cross-national study that compared the most significant high speed rail projects around the world⁷¹ against a number of factors, including the environmental impact. Based on their cross-national study, the authors concluded that HSR,

“...is not a particularly useful tool for fighting CO₂ emissions, being less environmentally efficient than conventional modern trains.”⁷²

Additionally, a DfT-commissioned report⁷³ also suggests that the Consultation Document is incorrect to imply there are lower carbon emissions from high speed compared to conventional rail. A graph, reproduced below in Figure 3, clearly demonstrates that conventional rail is less carbon intensive in terms of emissions related to its operation. However, emissions related to the construction appear to be relatively similar.

⁶⁴ Figure 1.2, Consultation Document, p. 37.

⁶⁵ The resistance of motion for a train is dependent on the speed at which the vehicle is travelling. As speed increases, more energy is required to travel a certain distance. However, the relationship between speed and energy is not a linear one. As the train goes faster the rate of increase in energy use also increases. This is because the resistance to motion increases (approximately) with the square of the train speed. There is a tried and tested formula to describe the relationship between speed and resistance in trains (see Appendix VI).

⁶⁶ Carbon intensity refers to the CO₂e emissions produced per unit of travel. This is often quoted as CO₂e per passenger kilometres - the total CO₂e (E) from the journey divided by the average number of passengers travelling that has been multiplied by the distance of the route.

⁶⁷ van Wee *et al.* (2003). *Op. cit.* p.304.

⁶⁸ Albalate and Bel. (2010). *Op. cit.*

⁶⁹ The authors used the PRORIN model, the PROgnose model for energy use and emissions for rail transport in the Netherlands see: Gijesen A, Brink R (2002) *Het spoor in model: Beschrijving en toepassing van het model PRORIN* (Bilthoven: Institute for Public Health and the Environment); van den Brink R, Gijesen A (2002) ‘Energy use and emissions by electric passenger trains: description and results of well-to-wheel model’ *Paper presented at the 11th International Symposium ‘Transport and Air Pollution’, Graz, Austria, 19-21 June.*

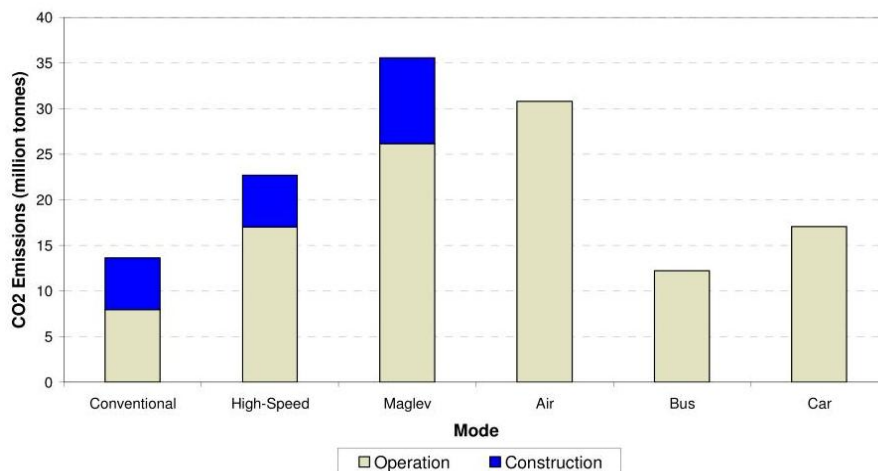
⁷⁰ van Wee *et al.* (2003). *Op. cit.*

⁷¹ Specifically: Japan (Shinkansen), France (TGV), Germany (ICE), Spain (AVE) and Italy (AV/AC).

⁷² Albalate and Bel. (2010). *Op. cit.* p.24.

⁷³ Booz Allen Hamilton. (2007). *Estimated carbon Impact of a new North-South Line.* London: DfT.

Figure 2: Simplified emissions for London to Manchester by Mode over 60 years⁷⁴



So why does the Consultation Document argue differently to all these other studies? The answer is that the Consultation Document fails to compare like with like. There are three reasons for this.

1. Emissions per passenger mile value for Eurostar presented in Figure 2 are calculated from an average grid carbon intensity figure for the UK, Belgium and France.⁷⁵ In contrast, the value for intercity rail is based on the CO₂e emissions from diesel and electric passenger trains in the UK.⁷⁶
2. The UK has a higher average grid carbon intensity than France because the French electricity generation mix consists of 74 per cent nuclear (2010 figures).⁷⁷ Nuclear electricity generation has lower carbon intensity than fossil fuel generation (gas, oil and coal).⁷⁸ Conversely, 74 per cent of UK electricity is generated from from gas, coal, oil and manufactured fuels (2010 figures).⁷⁹
3. The Eurostar figure also assumes higher occupancy rates (70 per cent) than UK occupancy rates which range between 28-45 per cent in the UK.⁸⁰

Claim 2: The emissions of HS2 will decrease over time as the proportion of low carbon electricity in the UK grid increases.

This claim is questionable. Where a project that will lead to a marginal increase in demand for electricity is being appraised, the marginal grid factor for carbon intensity of electricity should be used. This is an important point as the Department for Energy and Climate Change (DECC) assumes that the marginal fuel will continue to be fossil fuel based until 2020⁸¹, so the fall in the carbon intensity assumed in the Consultation Document is unlikely to occur.

⁷⁴ From: Booz Allen Hamilton(2007). *Op. cit.* Fig 1.1a p3.

⁷⁵ Reporting emissions from the Eurostar based on real time energy logging data, Paul Watkiss Associates (2010) used both average grid mix (based on average generation mix in the UK, France and Belgium) and supplier mix (based on BE, ET, SNCF and SNCB). Both methods were reported and employed. See: Paul Watkiss Associates (2009) *Update of Eurostar CO₂ Emissions using Energy Logging Train Data* (Oxford: Paul Watkiss Associates).

⁷⁶ AEA. (2011). *2011 Guidelines to Defra / DECC GHG Conversion Factors for Company Reports*. London: DECC/ DEFRA.

⁷⁷ http://www.rte-france.com/uploads/media/pdf_zip/publications-annuelles/rte-be10-fr-02.pdf (last accessed, July 23 2011).

⁷⁸ It is worth noting that these comparisons are not based on life-cycle emissions for fossil fuel or nuclear electricity generation.

⁷⁹ www.decc.gov.uk/media/viewfile.aspx?filetype=4&filepath=Statistics/publications/dukes/311-dukes-2010-ch5.pdf&minwidth=true (last accessed, July 23 2011).

⁸⁰ Network Rail. (2009). *Op. cit.* Table 2.12: pg. 25.

⁸¹ DECC. (2010). *Valuation of Energy Use and Green House Gases (GHG) Emissions for Appraisal and Evaluation*. London: DECC.

DECC advises that marginal grid factor should be used as opposed to the average grid intensity for project appraisal.⁸² The Consultation Document does not do this, using average grid factor to calculation emissions.

Claim 3: The per-passenger emissions of HS2 will be lower because the high speed trains will be substantially fuller than conventional trains.

The Consultation Document claims that HS2 will have an occupancy rate of 70%, but it does not make clear what assumptions this claim has been based on. We believe this is an unrealistically optimistic target for two reasons.

First, occupancy rates of European high speed rail services suggest that 70 per cent is at the upper end of the spectrum.⁸³ Second, the current average occupancy rate for current UK rail ranges from 25 per cent to 45 per cent.⁸⁴ HS2 would need to increase this by a factor of 1.5 to 2 in order to achieve 70 per cent.

We believe the AoS should have considered the impact of both high and low occupancy rates. For example, one study that does look into this concluded that although high speed rail has the potential to be the lowest energy consuming mode of transportation in the mix, it would need to sustain very high occupancy rates to achieve this (90 per cent).⁸⁵ Given the European experience, we do not believe that HS2 will achieve these high rates, and therefore are not convinced by this claim. At the very least, the occupancy rates should be based on a demand model output with a range to account for uncertainty.

There are several other issues of concern with the DfT's carbon appraisal. Two of the main issues are:

- ▶ **Poor treatment of uncertainty.** The Treasury's Green Book stipulates that where there is a high degree of uncertainty, a Monte Carlo analysis should be performed. The authors of the carbon appraisal explicitly state this has not been done. Furthermore, the two most significant drivers of carbon emissions from HS2 are also the most uncertain.
- ▶ **Incomplete appraisal of embedded carbon.** The carbon appraisal cites that given the lack of information about the route a number of factors have had to be set to zero. Additionally the appraisal has also failed to include a number of factors within their analysis, inter alia decommissioning of rolling stock and emissions from construction plant equipment used on site.

Given the incompleteness of their analysis, this raises serious doubt about the robustness of the conclusions drawn.

⁸² *Ibid.*

⁸³ Network Rail. (2009). *Op. cit.*

⁸⁴ *Ibid.*

⁸⁵ Chester and Horvarth. (2010). 'Life-cycle assessment of high-speed rail: the case of California' *Environmental Research Letters* 5: 014003

4. Conclusion and Recommendations

The case for HS2 put forward by the Government is incomplete. This means there is an insufficient basis on which to take a decision on whether to proceed or not. We recommend:

- ▶ Immediate and indefinite postponement of the timetable for a decision on HS2
- ▶ Establishment of a transparent process for rethinking the case for HS2
- ▶ Appointment of independent consultants to conduct a whole-society appraisal of the scheme alongside a plausible suite of alternatives. The appraisal should conform to HM Treasury's Green Book, enhanced by stakeholder engagement and a clear exposition of the theory of change for each alternative scheme.

Appendix

Response to the DfT HS2 Consultation Questions

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

- ▶ In general, we believe there is a strong case for enhancing sustainable inter and intra -UK transport capacity. However:
 - The DfT has *not* made a strong case for which specific types of capacity enhancements are necessary.
- ▶ There is no evidence that inter-city rail networks support regional economic growth or significantly entice otherwise unattainable foreign direct investment.

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

- ▶ No, there is no way of knowing at this stage. The DfT has overvalued the benefits and undervalued the costs in their appraisal of HS2.
- ▶ Furthermore, the appraisal of alternatives is incomplete in two ways: 1) The Government has not comprehensively evaluated the alternatives considered within the consultation documents; and 2). The DfT has not considered many viable alternative options to meet their stated goals.

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

- ▶ No. We do not agree that the case for the high speed rail network has been made. We do not therefore agree that the phased roll-out question is relevant.

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

- ▶ The thrust of this question is not relevant. The HS2 project is an investment that should not take place based on the inconsistent and incomplete evidence provided to the public.

Concerning the principles cited in the pre-amble to Question 4:

- ▶ We do believe that minimising the impact on the environment – human and natural – is of very high importance.

- ▶ We also believe that capacity factors and cost-control factors are strong components of any transport investment with HS2's ambitions.
- ▶ The speed principle is not a primary concern. For the UK, which is densely populated and well connected already, speed enhancements should be treated as a potential incidental benefit of transport network enhancement – nothing more.

5. 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?

- ▶ Our analysis did not produce outputs pertaining to this question. At this time, we do not have a strong opinion on specific route choice.

6. 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?

- ▶ For its purpose, the Appraisal of Sustainability (AoS) is a preliminary piece of desk-based analysis that should not play any significant role in any decision-making process concerning the transport needs of the UK.
- ▶ There are many issues raised within the AoS. Fundamentally, the DfT's proposal does not adequately deal with the uncertainty within their statements and assumptions.
- ▶ Assumptions and claims specifically made in reference to HS2's CO2 emission are very questionable and likely incorrect.
- ▶ Assumptions and claims specifically made in reference to the impact of Wider Economic Impact of HS2 are very questionable and likely incorrect.
- ▶ The research is not of necessary breadth or depth to be considered as evidence to support the case for HS2 or another course of action.

7. 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?

- ▶ Our analysis did not produce outputs pertaining to this question. At this time, we do not have a detailed opinion on the blight compensation scheme proposed.