

The Economic Case for HS2: Value for Money Statement

January 2012

The Department for Transport has actively considered the needs of blind and partially sighted people in accessing this document. The text will be made available in full on the Department's website. The text may be freely downloaded and translated by individuals or organisations for conversion into other accessible formats. If you have other needs in this regard please contact the Department.

Department for Transport
Great Minster House
33 Horseferry Road
London SW1P 4DR
Telephone 0300 330 3000
Website www.dft.gov.uk
General email enquiries FAX9643@dft.gsi.gov.uk

© Crown copyright, 2012, except where otherwise stated

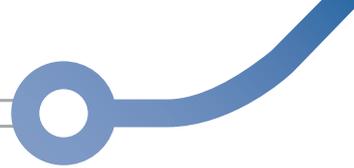
Copyright in the typographical arrangement rests with the Crown.

You may re-use this information (not including logos or third-party material) free of charge in any format or medium, under the terms of the Open Government Licence. To view this licence, visit www.nationalarchives.gov.uk/doc/open-government-licence/ or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or e-mail: psi@nationalarchives.gsi.gov.uk.

Where we have identified any third-party copyright information you will need to obtain permission from the copyright holders concerned.

Contents

Part 1: The Economic Case for High Speed 2	5
1. About this part	5
2. Conclusions on value for money	5
3. The Government's objectives for HS2	6
4. The economic case in decision making	7
5. The approach to forecasting demand for HS2	9
6. Assessing the benefits of HS2	10
Monetised Impacts	10
Wider Economic Impacts	11
Landscape	12
Noise	12
Air Quality	12
Greenhouse Gases	12
Non Monetised Impacts	13
Social and Distributional Impacts	13
7. Assessing the costs of HS2	14
Capital Costs	14
Operating Costs	15
Optimism Bias	15
Cost Sensitivity	16
8. Value for money assessment	17
How the benefit cost ratio has changed	17
The adjusted benefit cost ratio	18
Value for money conclusions	18



9. Risk and uncertainty	20
Risk Analysis	20
Sensitivity Tests	22
10. Alternatives to HS2	22
A new conventional line	22
Enhancements to the Existing Network	23
11. Concluding remarks	26
Part 2: Technical Criticisms of the Economic Case	27
12. About this part	27
13. Introduction	27
14. The ‘without scheme’ case	28
Specification of the ‘without scheme’ case	28
Consistency with the Strategic Alternatives	29
15. The appraisal of the Strategic Alternatives	31
Failure to properly consider the Strategic Alternatives	31
Specification of the Strategic Alternatives	32
The potential for managing demand using fares	32
16. Demand forecasting	33
Passenger Demand Forecasting Parameters	34
Alternatives to the PDFH	35
Forecasting period	36
The impact of technology	38
17. Appraisal	38
Business value of time	39
Risk and uncertainty	41
18. The subsidy impact of HS2 on the existing network	41

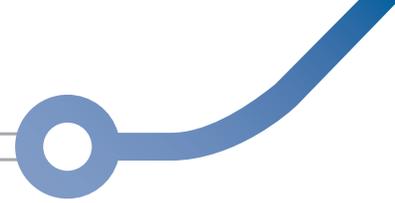
Part 1: The Economic Case for High Speed 2

1. About this part

- 1.1 This section of the report sets out the Government's view on the value for money of HS2 Ltd's proposed high speed rail network. It should be read in conjunction with the report *Economic case for HS2: Updated appraisal of transport user benefits and wider economic benefits for London to West Midlands and the Y Network* (HS2 Ltd, Jan 2012). The value for money assessment also considers the suitability and robustness of the approach to appraisal used by HS2 Ltd.
- 1.2 The value for money process summarised in this section forms an important part of the transport business case. The methodology used by the Department in setting out business cases ensures decisions are made which take account of all the relevant information, and follows an approach consistent with HM Treasury *Green Book* guidance. The value for money assessment constitutes the economic case for HS2 and considers whether all of the collective impacts delivered by the scheme represent good value for taxpayers' money. Although there are some overlaps, detailed information regarding the strategic, commercial, financial and management cases is not provided in this document.

2. Conclusions on value for money

- 2.1 The headline findings from our value for money scrutiny of HS2 are that phase 1 (London to West Midlands) lies towards the lower end of the medium value for money category.
- 2.2 Until important choices regarding the route and station locations for phase 2 (West Midlands to Leeds and Manchester) are made it is not possible to provide a definitive value for money assessment for the full Y network. Further details of the second phase of the scheme, including a recommended route, will be provided by HS2 Ltd in March 2012.
- 2.3 For London to West Midlands HS2 Ltd estimate the benefit cost ratio (BCR) to be 1.4. This takes into account those impacts where there is a firm evidence base to support their conversion into monetary units. The Department then takes into account additional impacts that can be monetised, but where the evidence base is less certain i.e. wider economic impacts and landscape.
- 2.4 Including the additional effects of wider economic impacts (+£4.1bn) and landscape (-£1.0bn) produces an adjusted BCR of 1.6. Including the impact of recent updates to the Office of Budget Responsibility's economic outlook is expected to reduce the BCR by around 0.1. Including this



impact moves the adjusted BCR to the boundary between medium and low value for money.

2.5 We judge that while some of the non-monetised impacts would place downward pressure on value for money e.g. heritage and biodiversity, others would contribute to improving value for money e.g. improvements to accessibility and to station facilities at Euston. However, we cannot say whether taken together the net impact would be sufficient to move the scheme into the low value for money category, although there is a risk that this could be the case.

2.6 For the proposed extensions to Leeds and Manchester, key route choices are yet to be made. As such HS2 Ltd currently estimates the BCR to be 1.6 to 1.9. The upper end of this range represents an assessment based on city-centre station locations with good links to other transport hubs. The low end of this range represents a conservative estimate as it assumes all stations are outside city centres and offer poor connectivity to the existing rail network.

2.7 Given that a route for the Y network beyond the West Midlands has not yet been proposed or decided, it is not possible to evaluate a number of impacts of the scheme e.g. townscape, heritage, biodiversity, noise etc. Adding HS2 Ltd estimates of Wider Economic Impacts for the Y network produces a BCR range of 1.8 to 2.5, although this omits a wide range of effects that will be captured in the value for money assessment

once scheme design is sufficiently developed to estimate them. The most significant missing monetisable impact is likely to be the effect on landscape, which would have to be valued at around £8 billion to reduce even the low end of this BCR range to 1.5. This compares to a valuation of just under £1 billion for the initial London to West Midlands phase.

2.8 It should also be noted that the benefit cost ratio (and hence the value for money assessment of HS2) will change over time. Factors which would cause the assessment to change in the future include revised forecasts of GDP, updates to the models used by HS2 Ltd, the development of environmental valuation techniques, the refinement of cost assumptions (including fuel costs), and changes to the Department's demand forecasting and appraisal framework.

3. The Government's objectives for HS2

3.1 The catalyst for the Government's assessment of new line and enhancement options on the key north-south rail routes is the continuing pattern of demand growth for rail travel, which is forecast to outstrip available capacity over the coming decades. For this reason, the primary objective for the options under consideration is that they should provide an effective solution to capacity constraints. Whilst the focus of this work has been on inter-city markets, clearly it is crucial that the impacts on other key rail markets,

both passenger and freight, should be considered in any assessment.

- 3.2 Although the primary objective is to enhance capacity, the Government is clear that in considering options, the full range of their potential impacts should be taken into account. This includes:
- Impact on network performance – including both journey times and reliability. This could also include impacts as a result of disruption for passengers as infrastructure works are carried out.
 - Environmental impacts, including on carbon emissions, but also local environmental impacts such as air quality, noise, and landscape.
 - Wider economic impacts, including both those that can be monetised, such as the effect on agglomeration, but also any broader impacts, such as those which may be driven by changes in land use as a result of new or improved transport infrastructure. This might also include impacts on regeneration and employment.
 - Financial costs – including both the costs of constructing and operating new or improved infrastructure, but also the impact on industry revenues (covering both any new lines and the conventional network).

3.3 This document sets out the Department for Transport's overall economic assessment of the options considered against the full range of factors described above. It should

therefore be read in conjunction with the assessment of the options' respective performance against the Government's strategic objectives provided in *High Speed Rail: Investing in Britain's Future – Decisions and Next Steps* (DfT, Jan 2012).

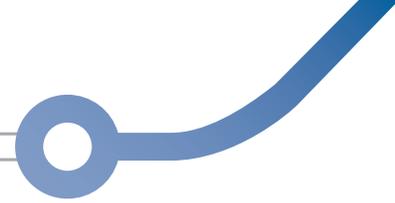
4. The economic case in decision making

4.1 The approach used by the Department in setting out business cases ensures decisions are made which take account of all the relevant information, set out in five cases consistent with HM Treasury *Green Book* guidance. The five cases are designed to show whether schemes:

- Are supported by a robust case for change that fits with wider public policy objectives – the strategic case;
- Demonstrate value for money – the economic case;
- Are commercially viable – the commercial case;
- Are financially affordable – the financial case; and
- Are achievable – the management case.

4.2 The relevant guidance for the transport context is described in *The Transport Business Case* (DfT, Apr 2011)¹. It sets out how investment decisions are made, and highlights what information is required at the different stages to

¹ See *The Transport Business Case* (DfT, Apr 2011)



inform decision-making for investment funding. Decision-makers are presented with evidence against all five cases when considering the business case for a scheme. Therefore value for money is only one factor that is taken into account when choosing whether or not to proceed to the next stage in the appraisal process.

Value for Money Category	Benefit Cost Ratio
Poor	Less than 1.0
Low	Between 1.0 and 1.5
Medium	Between 1.5 and 2.0
High	Between 2.0 and 4.0
Very High	Greater than 4.0

4.3 Within the five case model the economic case answers the question “What value for money does the proposal represent?” Answering this question means comparing a range of options. We have looked in detail at the economic case for a new high speed line and for and options based on enhancements to the existing rail network (the ‘strategic alternatives’). These have been tested against a ‘without scheme’ reference case in order to assess the economic, social, environmental and public account impacts that a transport intervention may bring about. We have also considered whether a new conventional speed line might offer better value for money than the high speed alternative.

4.4 If we could put all these impacts into monetary terms, then the Benefit Cost Ratio (BCR) would account for all the economic costs and benefits and we would be able to judge the value for money of the proposal using the BCR alone. This would also allow us to allocate the scheme directly to a value for money category:

4.5 However, not all impacts can be expressed in monetary terms and, of those that can, we have more robust evidence for the monetisation of some impacts than others. In assessing value for money, we use a three-stage approach:

- We start with those impacts where the evidence for the monetisation is robust. We call the resulting BCR the ‘initial’ BCR.
- We then add those impacts where monetisation is possible, but where the evidence for doing so is less robust. We call the resulting BCR the ‘adjusted’ BCR.
- We then take into account qualitatively those impacts for which it is not possible to give monetary values. Depending upon their expected magnitude, this may alter the value for money category of the proposal.

4.6 The diagram below summarises this approach:

Initial BCR (robust, monetisable impacts)	Adjusted BCR (less robust, but monetisable impacts)	Judgement (whether non-monetised impacts could shift VfM)
Travel Time Savings	Reliability	Townscape
Crowding Benefits	Regeneration	Heritage of Historic Resources
Noise	Wider Economic Impacts	Biodiversity
Air Quality	Landscape	Water Environment
Greenhouse Gases	Journey Quality	Security
Physical Activity		Access to Services
Accidents		Affordability
Cost to Broad Transport Budget		Severance
Indirect Tax Revenue		Option Value

4.7 Schemes could also have distributional effects across different socio-economic groups; especially those groups considered vulnerable e.g. lower income, disabled, and children. Where this is the case, distributional effects also need to be considered as part of the design process, ensuring that adverse distributional impacts are mitigated wherever practicable.

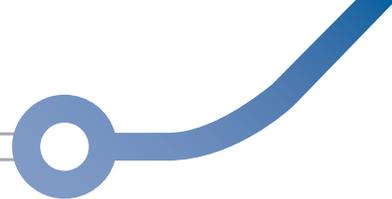
5. The approach to forecasting demand for HS2

5.1 The Department’s Transport Appraisal Guidance provides detailed advice about transport modelling to estimate the main impacts of schemes on users (time savings, revenue and crowding effects). Due to their scale,

the consequences of major transport schemes such as HS2 are likely to be widespread and complex and will lead to changes in transport conditions that will affect the decisions of individuals both directly and indirectly, and may have impacts on land-use.

5.2

Therefore it is important that an appropriate level of effort is provided to assess these consequences, to ascertain the extent to which scheme objectives are met and problems solved, and to estimate the value for money of the project. Based on these criteria HS2 Ltd has undertaken a very substantial analytical exercise, and has assessed scheme impacts using the best available modelling tools. Their analysis provides a reasonable foundation for decision-makers to have confidence in its outputs, whilst



recognising that there are inevitable uncertainties at this stage which will need to be addressed as the project progresses. It is very common for the business cases for major projects mature through time to the point where they are sufficient to support final decisions on whether to proceed to construction.

5.3 Forecasts of future long-distance travel have been taken from existing DfT forecasting tools and/or published DfT forecasts.

- A bespoke forecast of rail demand was produced by HS2 Ltd using historic relationships between changes in rail demand and factors that influence rail demand such as economic growth. These are in line with DfT guidance and are taken from rail industry's Passenger Demand Forecasting Handbook (PDFH) versions 4.0 and 4.1.
- Forecasts of highway demand are taken from the DfT National Trip End Model Programme (NTEM)². HS2 Ltd has used the most recent version of the model outputs to inform their economic case.
- Forecasts of aviation demand are taken from the DfT National Air Passenger Demand Model. HS2 Ltd has used the most recent DfT forecasts reported in *UK Aviation Forecasts (August 2011)*.

5.4 These forecasts of future year demand were then fed into an existing modelling framework (the PLANET framework) in order to estimate how

passengers would respond following the introduction of high speed rail services, and the changes to the pattern of complementary services on the classic rail network. In light of these changes it is then possible to conduct cost benefit analysis of anticipated impacts of the scheme using appraisal techniques that are consistent with the Green Book.

6. Assessing the benefits of HS2

Monetised Impacts

- 6.1** To conduct cost benefit analysis of all impacts on a comparable basis, appraisal techniques that are consistent with the Green Book are applied. To bring these impacts to the same units for comparison, monetary valuations are applied wherever possible. For example, values of time are applied to convert the time savings (in minutes) calculated by transport models into a monetary value for time-savings.
- 6.2** Some of the valuations that are applied in transport appraisal can be taken directly from prices paid in markets, or forecasts of prices in future markets e.g. fuel prices. Other valuations have been derived from survey-based research techniques to help elicit the value that people put on impacts e.g. the valuation of some noise impacts, and the value of travel time savings. Where valuations rely on research or experimental methods they are reviewed by experts to ensure that they are robust enough to be used in cost-benefit analysis.

² See <http://www.dft.gov.uk/tempro/>

- 6.3 It should be noted that, at this stage, there are a number of monetised scheme benefits that it has not yet been possible to quantify due to the level of detail currently available. Such impacts include regeneration benefits and journey ambience improvements due to the redevelopment of Euston, for which a detailed design is not yet available.
- 6.4 Where the Department is entirely confident in the techniques used to assess scheme impacts, advice on their application in transport appraisal is provided in WebTAG guidance. On this basis HS2 Ltd has used standard DfT recommendations in estimating the monetised aspects of the scheme appraisal where appropriate.
- 6.5 HS2 Ltd also estimated the monetised value of wider economic impacts generated by the scheme. The economic case for HS2 identifies the three main types of wider economic impacts of agglomeration, imperfect competition, and labour market impacts.
- 6.6 WebTAG guidance uses UK based research on the relationship between productivity and population mass in deriving estimates of agglomeration which can be defined as the changes in productivity enjoyed as a consequence of improved accessibility.
- 6.7 The agglomeration effects from HS2 are identified to relate mainly to improvements to urban transport networks, to local rail services, and also road congestion relief as a result of released capacity. Agglomeration impacts are estimated to be the most significant element of the wider economic impacts of HS2.
- 6.8 It should be noted that in respect of phase 2 of the scheme some journey times between cities on HS2 services would be very short (as little as 20 minutes for example) and significantly shorter than can be achieved at present. Therefore there is considerable scope for agglomeration benefits from phase 2 of the scheme.
- 6.9 Imperfect competition impacts relate to the benefits that are obtained from increased output by businesses that can be stimulated by a reduction in transport costs. In the HS2 economic case, imperfect competition benefits are estimated as a 10% uplift to business user benefits, as recommended in WebTAG.
- 6.10 Labour market impacts cover the impacts that transport schemes may have on labour markets by reducing the time and costs of travelling. The HS2 economic case reports that these benefits of HS2 are expected to be small. While the calculation of these benefits has not been scrutinised in detail, descriptive information provided by HS2 Ltd provides assurance that these impacts have been calculated in line with WebTAG guidance.
- 6.11 Finally, a further potential labour market impact of transport schemes is the movement of jobs to more productive areas. This impact has not been quantified in the HS2 economic case, and is frequently not estimated in appraisals of major transport schemes.

Estimation of the impact requires use of an appropriate land-use model, which has not been available for HS2.

Landscape

- 6.12 The assessment of landscape impacts was carried out by the Department in line with standard value for money procedures and is based on the methodology outlined by the Department for Communities and Local Government in its document *Valuing the External Benefits of Undeveloped Land* (DCLG, 2001). While the value of adverse landscape impacts is sensitive to the underlying analytical assumptions regarding land type and mitigation measures, the estimated disbenefit of £960m (2011 prices, 2011 present value) should be regarded as an upper limit to the impact as it is based on the route presented at consultation and does not take into account the route changes described in the *Review of Possible Refinements to the Proposed HS2 London to West Midlands Route* (HS2 Ltd, Jan 2012).

Noise

- 6.13 HS2 Ltd has carried out a detailed assessment of noise impacts that is fully compliant with WebTAG requirements. While broadly strategic in nature the work is sufficiently detailed to give us confidence that estimates are of the correct order of magnitude. The most recent estimate of noise impacts which includes the mitigating impacts of the recent route changes places a value of £36m (2011 prices, 2011 present value) on the noise impacts of HS2.

Air Quality

- 6.14 HS2 Ltd estimates some local air quality improvements as a consequence of the London – West Midlands phase. This figure takes into account changes in air quality achieved through a reduction in car vehicle kilometres from modal shift but does not take into account air quality improvements that may accrue as a consequence of reduced aviation vehicle kilometres, nor any disbenefits arising from station access. However, relative to the overall scheme benefits the size of monetised air quality impacts is small and unlikely to affect the overall value for money of the scheme.

Greenhouse Gases

- 6.15 HS2 Ltd has improved its treatment of greenhouse gas emissions since consultation. In line with Department for Energy and Climate Change (DECC) guidance the appraisal of HS2 considers greenhouse gases in two ways. Where emissions come from activities that are part of the EU Emissions Trading Scheme we include the cost of the extra permits that would be needed. Where emissions come from activities that are not part of the Emissions Trading Scheme we count the impact as a disbenefit. This disaggregation is captured within the figures reported in *Economic case for HS2: Updated appraisal of transport user benefits and wider economic benefits for London to West Midlands and the Y Network* (HS2 Ltd, Jan 2012) and forms the basis of this value for money assessment.

Non Monetised Impacts

6.16 The value for money assessment additionally considers a number of other factors that are not monetised. The Department's analysts then assess whether these are likely to change the value for money categorisation of the scheme. In many instances, this assessment has drawn from the detailed analyses included in the *Appraisal of Sustainability* (HS2 Ltd, Feb 2011) which was published as part of the suite of consultation documents. For phase 1 of the scheme (London to West Midlands) these non-monetised impacts are summarised in the table below:

Impact	Assessment
Townscape	Neutral
Heritage	Moderate adverse
Biodiversity	Slight adverse
Water environment	Significant adverse
Security	Not assessed
Access to services	Neutral to moderate beneficial
Affordability	Not assessed
Severance	Slight adverse
Options value	Slight beneficial

6.17 It should be noted that the assessment of these impacts is largely based on the line of route as specified at consultation in February 2011. Changes to the route described in the *Summary of Effects of HS2 London to West Midlands Route Refinements* (HS2 Ltd., Jan 2012) and *Review*

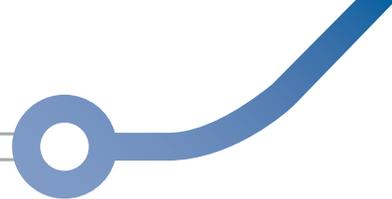
of HS2 London to West Midlands Appraisal of Sustainability (HS2 Ltd., Jan 2012) have been designed to mitigate against many of the adverse impacts summarised in the table above. In addition, many of these impacts would be mitigated further during the detailed scheme design stage.

Social and Distributional Impacts

6.18 The Social and Distributional Impacts (SDIs) of HS2 have been analysed by HS2 Ltd in line with the Department's WebTAG guidance. The analysis enables an appraisal of both potential social impacts resulting from the scheme on a range of measures and the extent to which identified impacts are distributed unevenly on potentially vulnerable groups (e.g. low income households, older people, disabled people) affected by the scheme.

6.19 The Department's analysts have assessed the analysis submitted by HS2 Ltd, and drawn the following conclusions:

- Overall SDIs resulting from the scheme are positive and/or neutral across most of the eight measures used (air quality, noise, security, accidents, accessibility, severance, affordability, user benefits).
- Positive impacts are identified in relation to accessibility and user benefits. However, in the absence of more information on the profile of potential users it is not possible to conclude whether distribution of these impacts is uneven across social groups, although currently rail



use is concentrated in higher income groups. Despite these limitations, it is possible to conclude that any impacts are likely to be positive in absolute terms.

- Positive impacts on personal security are likely to result around station and interchange infrastructure as a result of the scheme (e.g. Euston Station, Curzon Street Station). Any positive benefits will be experienced by potentially vulnerable groups who are identified as being over-represented within those areas.
- Impacts on affordability, accidents and air quality were screened out ahead of detailed analysis due to the marginal and dispersed level of the mode shift effects, although we note the need to manage local air quality impacts as part of the overall air quality strategy in some areas.
- Though some negative severance impacts might be expected during construction it is concluded that scheme design can hope to mitigate these impacts (the *Appraisal of Sustainability* assessed these to be 'slight adverse'). Any mitigation will need to be based on an understanding of local issues as can only be gained during the detailed design and consultation stage. Severance impacts in urban areas are likely to be unevenly distributed to potentially vulnerable groups due to their over-representation in these areas.

- The analysis has identified mixed impacts in relation to noise. Positive impacts will occur, notably for those in areas near existing network where scheme design will mitigate noise impacts for those currently experiencing it. However, some noise increases will be experienced at some locations along the route. HS2 Ltd will continue to explore and refine their approach to mitigation during the detailed design stage.

7. Assessing the costs of HS2

Capital Costs

- 7.1 As part of the review of the economic case for the London to West Midlands section of HS2, the Department carried out a peer review of HS2 Ltd's capital cost estimates. This found that overall, for a project at such an early stage of development, the estimate is based on a good level of base information and all the key cost categories have been allowed for. There is evidence of internal challenge of the costs within HS2 Ltd as well as benchmarking of costs from a range of industry sources (both nationally and internationally covering both rail and other construction sectors).
- 7.2 As a result of this exercise a number of adjustments have been made to the London to West Midlands capital costs to include additional provisions for Euston London Underground works, depot facilities, and additional risk allowances associated with train operating company compensation charges.

7.3 However, there are a small number of residual points where we believe that it could be appropriate to make an additional allowance for cost risk. This additional risk relates to items where the DfT's review noted that the percentage allowances proposed by HS2 are lower than those currently being experienced by other existing major rail projects including Thameslink, Crossrail and King's Cross. The Department does, however, recognise the pitfalls associated with making direct comparisons with other projects since each has its own unique circumstances. In particular the scale of HS2 means that the repeat nature of some of its elements will generate economies of scale.

7.4 The items where there is a difference of view on the percentage cost are project management, preliminaries and site supervision and design. We consider that there may be additional cost risk of up to circa £0.5 billion in total, which would reduce the BCR by approximately 0.05. We have taken this into account in reaching our view of the overall value for money categorisation of HS2.

Operating Costs

7.5 Operating costs for both high speed and classic rail services have recently been updated to take into account the most up-to-date information available. Discussions between the Department, its consultants and HS2 Ltd have enabled estimates to be refined and have ensured that both HS2 Ltd and the Department's Strategic Alternatives' operating cost

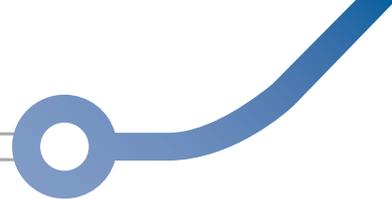
assumptions have been revised on a consistent basis.

7.6 As a result of this exercise HS2's operating costs have changed over time. When compared with estimates available in February 2011 the most recent HS2 Ltd operating costs for high speed services have increased, and the operating cost savings from a reduced classic line service have fallen. These changes are in some areas significant and may have altered the balance of costs and benefits for specific services. Therefore there may be some scope to re-optimize the service pattern in the light of these new cost assumptions and improve the value for money of the scheme.

Optimism Bias

7.7 Optimism bias is the term used to describe the systematic tendency for project appraisers to be overly optimistic about project costs, benefits and duration. To address this tendency, project appraisers must make explicit adjustments to the estimates of project costs, benefits and duration based on empirical data to inform project decisions. A project's financial costs should include a sum for contingency, but should not include the optimism bias adjustment as this is only for the purpose of assessing the value for money of a project.

7.8 The Department undertook a review of HS2 Ltd's treatment of optimism bias in the HS2 economic case. It addressed:



- the degree of compliance with the process specified by HM Treasury and DfT appraisal guidance;
- the reasoning provided to support the reduction in optimism bias from 66% to 34%; and
- the treatment of operating cost-savings in the appraisal analysis.

7.9 The review found that the process specified by HM Treasury and DfT appraisal guidance had been followed, that most of the reasoning provided for the reduction in optimism bias was sound, and that the treatment of operating cost-savings was comparable to other large rail infrastructure schemes. It also recommended further work to independently verify the mitigative actions that had been taken, to strengthen the justification provided for some of the optimism bias adjustments, and to examine the research underpinning the uplift applied to operating costs. On this basis the provision for optimism bias is considered to be adequate.

7.10 Since the estimates of operating costs in the economic case include elements of new expenditure and reductions in other expenditure that would result from the implementation of the proposal, they represent the net change in operating costs. It has been argued that whilst optimism might lead a scheme promoter to underestimate the new operating costs of their proposal, such optimism might also lead them to overestimate the size of cost savings that would be achieved elsewhere.

7.11 While it seems likely that such an effect might exist, both HM Treasury and WebTAG guidance are silent on the treatment of operating cost savings. Therefore we believe it is prudent to consider the impact of this assumption on the BCR via a sensitivity test. Removing this allowance would increase the scheme costs by £685m and reduce the BCR by approximately 0.07.

Cost Sensitivity

7.12 The business case for high speed rail has been prepared on the basis that Government plans to complete the full network for HS2. However, it is common practise to assess the impacts of separable scheme elements individually. We have therefore considered what additional costs would be needed for phase 1 of the scheme should the extensions to Manchester and Leeds not proceed. Similarly we have considered whether there are also cost savings to be achieved on a similar basis. HS2 Ltd's initial estimates of these items include:

- Plus £500m for works at Colwich Junction to enable long-term operation of an enhanced service pattern on the West Coast Main Line north of Lichfield.
- Minus £80m for a smaller Birmingham Curzon St station.
- Minus £60m for a smaller Washwood Heath depot.
- Minus £130m for the delta junction north spur, which would not be needed.

- Minus £320m of additional provisions for items arising from the operations concept.
- There could also be a less costly rebuild of Euston to accommodate a smaller number of services than would be required for the Y network; HS2 Ltd has not estimated what the cost savings might be.

7.13 Taking these, plus £500m of additional on-costs described in section 7.4, we have undertaken a sensitivity analysis of including additional costs of £410m. This reduces the BCR by approximately 0.04.

8. Value for money assessment

How the benefit cost ratio has changed

8.1 The *Economic Case for HS2* (HS2 Ltd, Feb 2011) reported a central case BCR for phase 1 of the scheme of 1.6, including Wider Economic Impacts this increases to 2.0. Since then a number of features of the economic case have changed, some of which

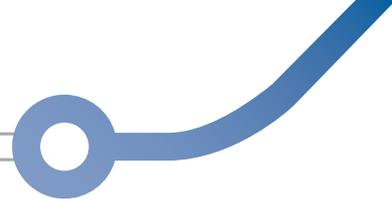
are within the control of HS2 Ltd and others which are not. The deteriorating short-run economic outlook, for example, cannot be influenced by HS2 Ltd but will have had a bearing on the economic case for the scheme, as will recent decisions regarding changes to the existing rail network. On the other hand, HS2 Ltd has, for example, been able to refine its assumptions regarding service patterns in light of new information about such changes.

8.2 The strength and resilience of the case for HS2 in light of a range of scenarios for economic growth is tested and described in the sensitivity testing section later in this report. This section instead focuses on the main changes to the benefits and costs for phase 1 of the scheme since they were last reported in February 2011.

8.3 Table 1 below summarises the evolution of the benefits, revenues and costs for HS2, starting in step 1 with the figures reported in the *Economic Case for HS2* (HS2 Ltd, Feb 2011) and concluding in step 7 with the most recent outputs from HS2 Ltd's modelling.

Table 1 – Benefit Cost Ratio walkthrough (All figures reported in £bn (2011 prices, 2011 present value))

	Step						
	1	2	3	4	5	6	7
Benefits	16.6	18.9	17.4	17.8	18.5	19.3	19.1
Revenue	13.7	15.5	15.0	15.0	14.2	14.5	13.9
Costs	24.0	27.2	27.2	27.2	27.2	27.2	27.4
BCR	1.61	1.61	1.41	1.45	1.42	1.52	1.41



8.4 Walking through the most significant changes captured in each of the steps:

- From step 1 to step 2: Price base and discount year are updated to 2011 (from 2009)
- From step 2 to step 3: GDP forecasts are updated to reflect March 2011 OBR short-run forecasts (to 2016) and July 2011 OBR long-run projections (2017 onwards).
- From step 3 to step 4: Base year demand data are updated to 2011 (from 2008) to reflect significant changes in long-distance travel patterns e.g. significant growth in patronage on the West Coast Main Line and decline in domestic aviation.
- From step 4 to step 5: Changes to the 'without-scheme' specification are made to improve consistency with assumptions underpinning the forthcoming High Level Output Specification (HLOS) assumptions.
- From step 5 to step 6: Corrections to the specification of released capacity on the existing rail network are made to capture improvements to the do-minimum described in step 5.
- From step 6 to step 7: Infrastructure cost estimates are updated in line with further work on scheme design and operating costs are revised as described in paragraph 7.6. Minor changes to the released capacity service specifications are made.

The adjusted benefit cost ratio

- 8.5 Table 2 sets out the calculation of adjusted benefit cost ratios for both phases of the proposed scheme. For London – West Midlands, HS2 Ltd estimate the BCR to be 1.4. The additional impacts that can be monetised are Wider Economic Impacts and landscape, and including these gives an adjusted BCR of 1.6.
- 8.6 For the Y network, HS2 Ltd estimates the BCR to be 1.6 to 1.9. The range for the Y network is driven by uncertainty over the route and the location of stations which gives a range of transport user benefits, indirect tax effects, and forecast revenues. For the Y network the addition of Wider Economic Impacts gives a BCR range of 1.8 to 2.5. An assessment of landscape impacts has not been undertaken as a route for the Y network north of Birmingham has not yet been decided.

Value for money conclusions

- 8.7 The adjusted BCR for phase 1 of the scheme lies at the lower end of the medium value for money category. We note that while some of the non-monetised impacts would place downward pressure on value for money e.g. heritage and biodiversity, others would contribute to improving value for money e.g. accessibility benefits, improvements to station facilities at Euston and the potential for private sector contributions. Therefore we cannot say whether taken together, these would be sufficient to move into the low value for money category.

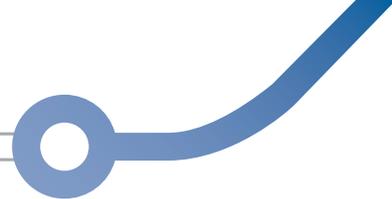
8.8 It should be noted that HS2 Ltd has not been able to capture the impact of the most recent (November 2011) Office for Budget Responsibility economic forecasts in their central case within the time available. However, on the basis of HS2 Ltd's sensitivity testing we anticipate the impact of the revised short-run GDP forecasts to reduce the BCR for the scheme by around 0.1. Including this impact moves the adjusted BCR to the boundary between medium and low value for money.

8.9 For the Y network, key route choices are yet to be made. As such HS2 Ltd estimate the BCR to be 1.6 to 1.9, depending on whether stations are located outside or within city centres. Given that a route for the Y network beyond the West Midlands has not yet been proposed or decided, it is not possible to evaluate a number of impacts of the scheme e.g. townscape, heritage, biodiversity, noise etc.

8.10 Adding HS2 Ltd estimates of Wider Economic Impacts for the Y network

Table 2 – Adjusted BCR calculation (figures are £bn, 2011 price base, 60 year appraisal period). Numbers may not correspond directly due to rounding

	London to West Midlands		Y Network	
	Business	Other	Business	Other
Transport User Benefits (including reliability)	12.3	7.8	28.8 to 32.3	15.3 to 17.4
Other benefits		0.5		0.8 to 0.9
Greenhouse gases		0.1		0.2
Change in indirect taxes to government		-1.6		-3.6 to -3.9
Wider Impacts		4.1		5.7 to 12.3
Landscape		-1.0		Not modelled
Net benefits		22.2		47.2 to 59.3
Capital costs		18.8		36.4
Operating costs		8.6		21.7
Revenues		13.9		31.8 to 34.0
Net cost to government		13.5		26.3 to 24.1
Adjusted BCR		1.6 (medium)		1.8 to 2.5 (medium to high)



produces a BCR range of 1.8 to 2.5, although this omits a wide range of effects that will be captured in the value for money assessment once scheme design is sufficiently developed to estimate them.

what the most likely overall outcome is e.g. how many of the events tested by sensitivity test will come to pass, and what would be the overall consequences of this for the scheme value for money.

9. Risk and uncertainty

9.1 Risk and uncertainty are two separate concepts. With risk we have an understanding of the likelihood of different outcomes, meaning we have a distribution e.g. there is a 30% chance of one particular outcome, and a 20% chance of another. Risk analysis then allows us to consider the combined impact of a number of different risks at the same time, giving us the probability of different overall outcomes. The results of a risk analysis carried out by the Department around HS2 Ltd's central case is described below.

9.2 With uncertainty we do not understand the likelihood of different individual outcomes and this limits our ability to look at the probability of different overall outcomes through risk analysis. Instead where we have uncertainty we use sensitivity tests. These are usually 'either/or' tests where we individually vary an element of the central case, for instance by looking at what would happen if the line were limited to 300kp/h running. Sensitivity tests help us understand what the implications for the business case of such a circumstance, although no probability is ascribed to this circumstance arising. The disadvantage of sensitivity tests, is there can be a large number of them, and it can be difficult to say

Risk Analysis

9.3 As a supplement to the value for money advice provided in the main body of this paper and a complement to HS2 Ltd's sensitivity analysis, the Department carried out a risk analysis of phase 1 (London to West Midlands) of the proposal. The analysis is intended to provide an illustration of the range of possible outcomes that could result from varying key input assumptions, and of the strength of the relationship between important inputs and the BCR of the proposal.

9.4 In conducting the analysis, the Department focussed its efforts on including the risk factors that that we believe to exert the greatest influence over the benefit-cost ratio, and that can most readily be incorporated into the risk analysis. It does not attempt to include the impact of uncertainty (where a continuous spread of risk around a value cannot be assumed) as this dealt with separately in the sensitivity analysis.

9.5 Risk analysis is a technique that can be applied to determine the combined impact of multiple sources of risk on an outcome. The approach relies on the definition of ranges of risk around key factors, and the repeated simulation of the impact of different combinations of those factors on the outcome in question. A key advantage

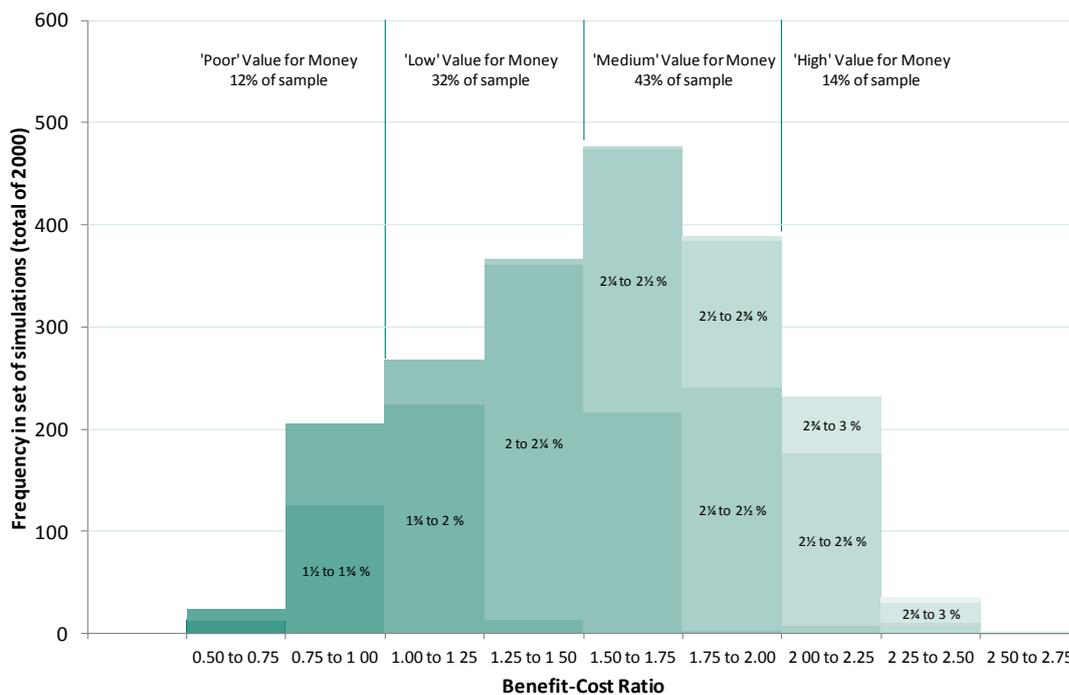
of using such an approach is that it guards against excessive weight being placed on extreme outcomes that would require the coincidence of a set of unlikely events to occur.

9.6 We have concentrated our efforts on those factors that we believe to exert the strongest influence over the benefit cost ratio including the rate of GDP growth, the value of greenhouse gas emissions, construction costs, the responsiveness of rail passengers to changes in income and fares, landscape values and attributes of the road traffic that is removed from the highway network as a consequence of mode shift onto HS2.

9.7 Chart 1 illustrates the results of the risk analysis, from which it is possible to draw the following conclusions:

- taking account of the risks which have been quantified here, the ‘most likely’ value for money category for the proposal is medium (BCR between 1.5 and 2) – though there are clearly some elements of uncertainty that could change this in ways that we cannot easily reflect;
- there is a very strong correlation between GDP growth and the value for money of the proposal and much rests on expectations of long-term economic growth;

Chart 1 – Distribution of Benefit Cost Ratios split by long-term average GDP growth rate



- under the more optimistic long-term GDP growth scenarios, with sustained growth higher than 2.5% p.a. (the post-war average), the proposal could represent high value for money. However, such a rate of economic growth is significantly higher than Office for Budget Responsibility expectations.

Sensitivity Tests

- 9.8 HS2 Ltd has reported a broad range of sensitivity tests in their document *Economic case for HS2: Updated appraisal of transport user benefits and wider economic benefits for London to West Midlands and the Y Network* (HS2 Ltd, Jan 2012). These allow us to respond to ‘what if?’ questions where it is not possible to assume a spread of risk around the central case.
- 9.9 The results of the sensitivity tests are not repeated here. However, it is worth noting that the greatest upward sensitivities are the high fuel duty and higher GDP growth. Changes to fuel costs affect demand for rail because as the costs of motoring rise people become more likely to switch to other modes. The high fuel duty sensitivity represents a 50% increase in the rate of fuel duty over and above that currently forecast for 2043. However, similar increases in pump price may also occur as a consequence of higher crude oil extraction or refining costs. Under these circumstances the BCR for phase 1 of HS2 increases by around 0.5.
- 9.10 We also note that the benefit cost ratio is most sensitive downward to changes in the demand cap date,

long-term GDP growth projections and the choice of demand forecasting parameters. As noted in our value for money conclusions above, the effect of short-term changes to GDP growth need to be taken into account. While it has not been possible to incorporate the November Office for Budget Responsibility short-term forecasts into the central case for HS2 within the time available, extrapolating other modelled results suggests that the BCR would fall by a maximum of 0.1 as a consequence of the revised economic outlook.

10. Alternatives to HS2

- 10.1 As well as assessing the economic case for HS2, the Government has also considered alternative options. This includes both sensitivity testing by HS2 Ltd to consider the comparative case for a new conventional speed line as an alternative, and also an assessment of a range of options for enhancements to the existing north-south lines.

A new conventional line

- 10.2 The sensitivity test carried out by HS2 Ltd indicates that building a new line for conventional speed (125 miles per hour) rather than high speed would reduce both the capital and operating costs of the new line. This is because although a new conventional speed line would require similar viaducts, tunnels and stations to a new high speed line, it would be possible to make savings in terms of the detailed specification, as well as in respect of rolling stock costs and

power consumption. However, a new conventional speed line would also attract fewer passengers than HS2, which would reduce the revenues generated. As a result, the total cost saving is estimated to be just £1.4 billion.

- 10.3 Because a new conventional speed line would attract fewer passengers, and because the time savings benefits for those passengers would be much lower, the reduction in benefits from reducing line speed is much greater than this, and is estimated to total approximately £6.2 billion. This means that the additional benefits from upgrading to high speed would be expected to outweigh the additional costs by a factor of more than 4 to 1.

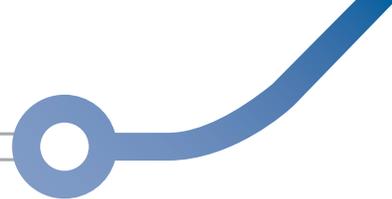
Enhancements to the Existing Network

- 10.4 The Government has also assessed a number of options for improving capacity and journey times through enhancing the existing north-south lines. This has helped us to understand what capacity and journey time improvements could be possible through an approach of this kind, and what would need to be done to enable these. In general these alternatives have significantly lower capital costs than HS2, but also deliver significantly lower benefits.
- 10.5 This work has built upon earlier analyses carried out for the Department for Transport by Atkins of both enhancement packages on the West Coast Main Line alone, and wider enhancement ‘scenarios’ including interventions across all three

major north-south routes. These analyses attracted significant numbers of comments from consultation respondents both supporting and opposing an approach of this kind.

- 10.6 In updating the earlier analysis, we have focused on the packages which delivered best value for money and which were the subject of most discussion in consultation responses. In addition to updating the economic analysis carried out by Atkins, we have also commissioned advice from Network Rail, as the custodian of the conventional network, on the cost, deliverability and operational impacts of these options. Both reports have been published alongside this document³.
- 10.7 On the West Coast corridor, we have focused on Rail Package 2 (RP2) and RP2A, which are packages of extra long distance capacity delivered by an increase in train service frequencies on the West Coast Main Line (WCML) with supporting infrastructure enhancements. RP2 and RP2A are identical except that RP2 reduces the allowances built into the existing timetable to help maintain performance levels, whereas RP2A retains the current approach. It should be noted, however, that the West Coast Main Line currently shows comparatively poor PPM performance, and Network Rail have indicated that further work would be required before they could support an approach which both

³ See *High Speed Rail Strategic Alternatives Study: Update following consultation* (Atkins, Jan 2012) and *Review of the Strategic Alternatives to High Speed Two: A Report by Network Rail* (Network Rail, Jan 2012)



reduces timetable allowances and at the same time increases the number of services on this route.

- 10.8** In addition, a number of consultation responses also supported an alternative enhancement package on this route, which was proposed by 51M, a group of local authorities. We have also carried out an economic analysis of this package, and it is considered in Network Rail's advice.
- 10.9** For comparison with the wider network we have also updated the analysis of Scenario B, which was the only alternative which offered benefits in excess of its costs. This enhancement scenario enables increased passenger capacity and enhanced long distance service frequency, through a range of infrastructure enhancements including upgrades to stations and junctions, and additional tracks.
- 10.10** In updating the economic analysis of these enhancement packages, we have made a number of adjustments to their costs in the light of Network Rail's advice, points made in consultation, and also the post-consultation review of HS2's capital and operating costs. This has seen reductions in both capital and operating costs. The capital costs have reduced because two major infrastructure elements have been altered. The operating costs have also reduced as a result of the review of operating costs which was carried out across both HS2 and the Strategic Alternatives. These changes are explained in more detail in Atkins' report.

10.11 The packages assessed deliver a valuable increase in long-distance capacity, albeit with increased peak crowding. In contrast, they deliver only a more limited increase in outer suburban capacity. And in terms of inner suburban capacity into Euston, RP2 delivers no increase at all and the 51M scheme sees a small reduction in capacity⁴. Network Rail's review has indicated that this means that the packages cannot resolve the substantial crowding forecast on suburban services.

10.12 Under the 51M proposal, Network Rail's analysis indicates that the number of passengers standing on services into Euston in the peak hour could rise from 800 currently to between 1,900 and 2,200 by 2035. Crowding levels would also increase under RP2, albeit to a slightly lower level, with Network Rail forecasting between 1,500 and 2,000 standing passengers in the peak hour. This would be balanced by higher peak load factors of around 92 per cent.

10.13 On the southern stretch of the West Coast Main Line, it is difficult to see what further infrastructure enhancements could be deployed to cope with further increases in demand. In other locations, the increase in long distance services will mean that the scope for growth in freight and/or local

⁴ 51M did not provide a detailed all-day timetable, and as such assumptions have had to be made about both service levels and impacts on rolling stock utilisation. It is not clear that the 51M timetable can be run with the amount of rolling stock which underpins the BCR reported below, and if not then the 51M BCR would be overstated.

or regional services will be severely restricted.

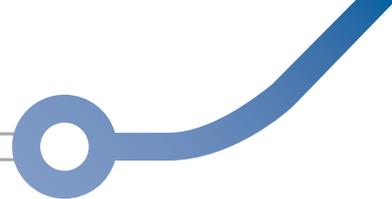
- 10.14 There are also other important compromises which should be borne in mind when considering the economic analysis:
- There are strict limits to the journey time improvements that are available through upgrades to the existing infrastructure;
 - Network Rail raise some concerns about the challenges presented by very high service intensities of this kind for maintaining reliability levels;
 - Programmes of upgrades on this scale are likely to be highly disruptive for passengers, particularly given the increase in rail demand on these routes over recent years; and
 - Carrying out works on the 3 major north-south lines could exacerbate these impacts, as there may not be diversionary routes available.

10.15 The results are of this updated analysis are set out in table 3 below⁵. The London to West Midlands packages have higher benefit cost ratios than the initial phase of HS2, although even the best of these still offers less than half the level of benefits. In contrast, the benefit cost ratio for Scenario B is lower than that for the HS2 Y network. In all cases, of course, it should be noted that a decision on the merits of alternative schemes should not be taken on the basis of the benefit cost ratio alone.

Table 3: Benefits and costs of the alternatives to HS2

Economic Summary Statistic	Present value of benefits (£bn)	Present value of costs (£bn)	BCR
Package 2	7.9	2.0	4.0
Package 2A	7.0	2.6	2.7
51M	6.1	1.2	5.2
Scenario B	≈13.9	9.3	≈1.5

5 The BCRs presented below rely on improvements to rolling stock utilisation efficiency. Should these not prove deliverable then the BCRs would fall.



10.16 In addition to the costs included in this economic analysis, Network Rail's review identified some potential and likely additional costs that we have not been able to include in this analysis. This includes expenditure on depots and on maintaining the line once a more intensive service is running, and a risk that a major remodelling of Euston may prove necessary. Network Rail's review has also identified potentially significant additional costs on the MML and the ECML that would be required to deliver the Scenario B service specification.

10.17 Even allowing for these additional costs, it is likely that the value for money of the strategic alternatives on the West Coast Main Line is likely to remain higher than for HS2, though it is not currently clear to what degree. There are, however, a number of important compromises in terms of outputs that need to be recognised, and which are discussed.

11. Concluding remarks

11.1 This chapter has set out the economic case for High Speed 2, which forms an important part of the transport business case. The headline findings from our value for money scrutiny are that phase 1 (London to West Midlands) lies towards the lower end of the medium value for money category. As key route choices for the proposed extensions to Leeds and Manchester are yet to be made, the BCR for the Y network is estimated as a range of 1.8 to 2.5, although this omits a range of effects that will be captured in the value for money assessment once the scheme design is sufficiently developed to estimate them. The chapter has described the methods used to assess the benefits and costs of HS2 that have led to this value for money assessment, and analysis of risk and sensitivity analysis that have been undertaken.

11.2 This chapter has also described the value for money of alternatives to HS2. Whilst some of these have higher BCRs than HS2, they do not deliver the quantity of benefits of HS2, nor do they have such a strong strategic case.

Part 2: Technical Criticisms of the Economic Case

12. About this part

12.1 This section of the report reviews the criticisms raised in responses to the *High Speed Rail: Investing in Britain's Future* consultation document relating to technical elements of the economic case for HS2. Views and evidence provided to the Government in written responses to the consultation were considered in producing this report. It provides analysis to support the Secretary of State for Transport's decisions as set out in *High Speed Rail: Investing in Britain's Future – Decisions and Next Steps* (DfT, Jan 2012).

13. Introduction

13.1 A wide range of consultation responses were received that raised issues relating to the economic case for HS2, as set out for consultation. Many of these related to the approach that had been used for the appraisal of HS2. Since responsibility for transport appraisal guidance lies with the Department for Transport it is appropriate that the Department responds to those issues directly.

13.2 A number of respondents were supportive of the conclusions of the economic case or considered that the Government's approach underestimated the benefits of the project. Other respondents felt that *The Economic Case for HS2* (HS2 Ltd,

Feb 2011) was overly optimistic or made unsubstantiated assumptions⁶. The non-technical issues raised in relation to the economic case for HS2 are discussed in Chapter 4 of the *Review of the Government's Strategy for a National High Speed Rail Network* (DfT, Jan 2012), and issues regarding the specific application of that guidance by HS2 Ltd are dealt with in the *Economic case for HS2: Updated appraisal of transport user benefits and wider economic benefits for London to West Midlands and the Y Network* (HS2 Ltd, Jan 2012).

13.3 A number of consultation responses also made a number of technical criticisms about the way that the Government's economic case for consultation had been developed. The remainder of this document considers these technical criticisms in turn. These can briefly be summarised as:

- An argument that the 'without scheme' assumptions were inappropriate;
- An argument that the appraisal of the strategic alternatives to high speed rail was inadequate;
- An argument that the approach to demand forecasting was flawed;

⁶ See *The Economic Case for HS2* (HS2 Ltd/DfT, Feb 2011)

- An argument that the assumptions on benefits (particularly reliability and time savings) were overstated; and
- An argument that insufficient account had been taken of risk and uncertainty.

14. The ‘without scheme’ case

14.1 Prior to consultation DfT carried out an appraisal of the costs and benefits of classic rail enhancements in parallel with HS2 Ltd’s assessment of high-speed rail options. The results of this work were reported in *High Speed Rail Strategic Alternatives Study: Strategic Alternatives to the Proposed Y Network and the Economic Case for HS2*.

14.2 A number of consultation responses raised criticisms of the ‘without scheme’ or ‘do-minimum’ case. These criticisms, which are quoted and addressed below, tended to focus on the composition of the do-minimum case for HS2 and the consistency of assumptions between the assessment of high-speed rail and the alternative, classic-rail based enhancement packages. In particular they have queried the use of different service specifications for rail in the do-minimum.

Specification of the ‘without scheme’ case

14.3 The ‘without scheme’ assumptions for HS2 were a common theme amongst consultation responses. Correspondents remarked that ‘a

do minimum of doing nothing but committed schemes is unrealistic and gives rise to unrealistic benefits from subsequent interventions.’ Many responses said that in their opinion this created ‘unnecessarily high levels of crowding, thus exaggerating the benefits of HS2.’ As a bare minimum they believed that ‘Evergreen 3 should be included in the appraisal do-minimum case.’

14.4 WebTAG Unit 3.15.5 provides some wider, generic advice on developing the ‘without scheme’ case in the central scenario⁷. It states that ‘the without-scheme case in the core scenario should represent a realistic view of what is likely to happen in the absence of the scheme proposals. It will usually correspond to maintaining present transport facilities and implementing the more certain aspects of regional and local transport strategies.’ By limiting the scope of the without-scheme case to committed schemes only, the appraisal of HS2 focuses on more certain interventions.

14.5 It is appropriate, however, to keep the ‘without scheme’ specification under review in the light of new decisions on infrastructure and service patterns to ensure it represents the most up to date information on committed schemes. This is what has happened as the economic case for HS2 was updated following consultation, and the ‘without scheme’ specification now includes both Evergreen 3 and the Ordsall Curve infrastructure schemes

⁷ Further advice on the approach to specifying the ‘without scheme’ case can be found in WebTAG Unit 3.15.5 *The Treatment of Uncertainty in Model Forecasting*

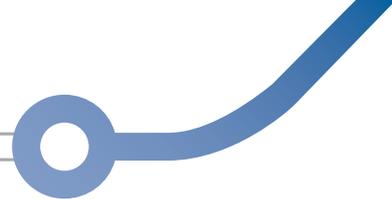
(to which the Government is now committed), and agreed changes to service patterns, including the introduction of new and extended inter-city services and faster outer suburban services on the West Coast Main Line (WCML).

- 14.6 WebTAG goes on to suggest that ‘There may be circumstances where it is clear that transport conditions without the project are such that further improvements to the transport system are likely. Where that is the case, these improvements should be included even if they weren’t identified in the list of transport changes.’ However, WebTAG also notes that this kind of without-scheme improvement should not involve large expenditures as it would run the danger of severely distorting the appraisal. Where this is an issue, the improvements should be redefined as an alternative with-scheme case.
- 14.7 It is important not to presuppose large expenditure on uncommitted projects in the without scheme case. If such expenditure was to be included, it would be appropriately considered in the strategic alternatives or otherwise as separate strategic options to be appraised. The current without scheme scenario incorporates important (but nevertheless relatively minor) improvements to capacity and it is clear these do not achieve the wider scheme goals set out in part 1 of this document.
- 14.8 The WebTAG advice, therefore, strongly supports our current approach of treating the Strategic Alternatives as

additional ‘with scheme’ options rather than as a more substantial ‘without scheme’ scenario as suggested in some consultation responses.

Consistency with the Strategic Alternatives

- 14.9 Some consultation responses noted there were small discrepancies between the without scheme assumptions used for the assessment of alternative schemes to HS2. They went on to suggest this ‘prevented comparison of the results of the evaluation of alternatives with those of HS2 on a common basis and had the effect of understating the relative benefits of the alternative.’
- 14.10 When commissioning the appraisal of alternative enhancement packages it was the Department’s explicit intention to be able to assess different packages in a way that was directly comparable to the assessment of high-speed rail and therefore it the HS2 modelling suite. The latest comparison of strategic alternatives with the core scheme reported in *High Speed Rail Strategic Alternatives Study: Update Following Consultation* (Atkins, Jan 2012) has been able to ensure the modelling of alternatives has been carried out on a consistent basis. In previous appraisals, however, due to the more limited future-year capacity provided by the alternative enhancement packages on the West Coast Main Line (WCML) it was necessary to adopt a different without-scheme specification than for HS2. The rationale for both approaches are described in detail below.



- 14.11 In order to have confidence in the results of any transport modelling exercise it is essential that the interaction between supply (highway, rail and air services) and demand (the propensity to travel) in the model reaches a stable equilibrium⁸. This is known as model convergence and is essential if we are to have confidence in the outputs of any modelling exercise.
- 14.12 Where capacity on the network is limited relative to the demand imposed by individuals wishing to travel, a suitable stability can be very difficult to achieve in transport models. As a consequence of the large projected increase in long-distance rail travel by HS2 Ltd, both the alternative packages and high-speed rail proposals experienced this complication in the modelling prior to the consultation. Due to the more restricted future capacity of the alternatives, these difficulties were more acute when modelling enhancements to WCML services only. The same issue did not arise in respect of the alternatives to the proposed Y network, which were modelled on a consistent basis with HS2.
- 14.13 To remedy this problem, additional capacity was added to accommodate the demand and allow model convergence. The addition of these extra services is simply a work-around solution to allow the model to function as it should and do not necessarily represent our expectations of future service patterns. This approach is in line with best practice guidance described in WebTAG, which allows a modest adjustment to capacity and service assumptions as part of the model calibration process.
- 14.14 Because the strategic alternatives offer less capacity in the 'with scheme' scenario than HS2, a greater number of extra services were required to allow the model to converge. Consequently the equivalent services must be included in the 'without-scheme' scenario to minimise any distortion introduced as a consequence of their inclusion.
- 14.15 The most recent update to the model carried out following consultation has resolved all of these issues in respect of all the options considered. Therefore the assessment of both the WCML and Y network strategic alternatives has been carried out on a basis that is consistent with that used for the core scheme.
- 14.16 This improvement is largely due to the impact of updating the model to a more recent base year and hence including the recent enhancements in capacity delivered on the WCML. This redistributed travel away from the East Cost Main Line, which had the more acute convergence issues in the model. We are therefore content that the recent update of the Strategic Alternatives allows a direct like-for-like comparison with the core scheme and fully addresses the concerns raised in consultation responses.

8 Further advice on the importance of model stability and convergence can be found in WebTAG Unit 3.10.4 *Variable Demand Modelling: Convergence, Realism and Sensitivity*

15. The appraisal of the Strategic Alternatives

- 15.1 Concerns regarding the Strategic Alternatives raised in consultation fell largely into three areas:
- Failure to properly consider the Strategic Alternatives;
 - The precise specification of the Strategic Alternatives; and
 - The potential use of fares policy and yield management techniques to delay the requirement for building HS2.

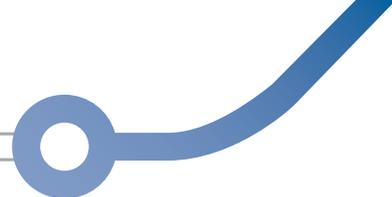
Failure to properly consider the Strategic Alternatives

- 15.2 Concerns were raised by a number of respondents opposing the Government's proposals that there were alternative strategies to HS2 based on enhancing existing lines which had not been given proper consideration, and which would be cheaper and lower risk but would still deliver many of the benefits that could be achieved from high speed rail.
- 15.3 The Government does not consider that enhancement alternatives were not properly considered. As part of the suite of consultation documents, the Government published economic analysis by Atkins of a number of enhancement scenarios to enhance network capacity and performance across the three main north-south lines, as potential alternatives to the proposed Y network. This analysis, which was also summarised in the

consultation document, showed that only one of the options considered, referred to as Scenario B, was able to offer benefits in excess of its costs.

- 15.4 In addition, the Government also commissioned Atkins to update an earlier appraisal of options to provide additional long distance capacity on the WCML, which had been carried out in preparation for the previous Government's 2010 Command Paper, *High Speed Rail*. This updated economic analysis was published on the Department for Transport's website shortly after the beginning of the consultation period. However, the Government considers that in the light of its overall proposed strategy for a Y-shaped national network, the wider network scenarios described above provide the most appropriate comparator.

- 15.5 The Government received a large number of comments and suggestions received from consultation respondents dealing with both of these analyses. We have therefore commissioned further work in the light of these. This includes an update by Atkins of the economic analysis of the most promising packages, and also carrying out an economic analysis of a potential 'optimised' package on the WCML put forward in consultation by the 51M group, a consortium of local authorities opposed to HS2.
- 15.6 A number of consultation responses also commented on the costs of the proposals, and of their impact on the existing rail network, for instance in terms of disruption for passengers.



For this reason, the Government has also commissioned advice from Network Rail, as the custodian of the network, on the costs, deliverability and operational impacts of the key packages.

- 15.7 Both Atkins' and Network Rail's reports have been published as part of the evidence base underpinning the Government's decisions following consultation. The Government's view of the economic and strategic cases for enhancements of this kind are discussed respectively in Part 1 of this document and in chapter 5 of the *Review of the Government's Strategy for a National High Speed Rail Network*.

Specification of the Strategic Alternatives

- 15.8 A particular concern raised by some respondents was that the alternative packages had not been correctly specified, and that there were more optimised versions which could deliver better value for money. The Government asked Network Rail to consider this in its report on the key alternatives packages. This indicated that there were some infrastructure elements which were not necessarily required to deliver the service specifications on the West Coast Main Line, although they did contribute additional journey time savings. The Government has therefore removed these in the version assessed in Atkins latest report. It has also tested the 'optimised' version of Rail Package 2 proposed by 51M in its consultation response.

- 15.9 In respect of the key alternative to the Y network, Scenario B, Network Rail concluded that significant additional infrastructure investment would be required to deliver the service pattern specified, which would further increase costs (and hence reduce value for money). However, the Government also notes that forecast long-distance load factors under Scenario B, particularly on the Midland Main Line, are comparatively low, and therefore it may conversely be possible to reduce some costs by specifying a less intensive service pattern. It is not clear what the overall effect of these adjustments would be on value for money, but there may be some scope to increase the benefit cost ratio through further optimisation. It should be noted, however, that none of these changes would address the crowding issues forecast on suburban services at the southern ends of these routes.

The potential for managing demand using fares

- 15.10 Some consultation responses suggested that there was scope to optimise the take up of existing services and potentially delay the need for high speed rail by using fares policy to achieve more effective capacity utilisation.
- 15.11 While more sophisticated pricing structures may offer scope to improve the absolute case for the alternative packages, it is not clear that this would result in an improvement in the case relative to HS2.

- 15.12 Since the strategic modelling suite used to assess both HS2 and the alternatives is not designed to be capable of modelling the impact of demand management techniques, the Department agrees that it may be possible to improve the case for some, if not all, of the alternative packages in this way. However, a number of consultation respondents in favour of HS2 noted that similar pricing structures could also be used to improve load factors on high-speed rail services.
- 15.13 The availability of cheap off-peak tickets has the potential to increase the demand for long-distance high-speed rail travel relative to that reported in the *Economic case for HS2: Updated appraisal of transport user benefits and wider economic benefits for London to West Midlands and the Y Network* (HS2 Ltd, Jan 2012). While the same can also be said for rail alternatives that use the existing network, the scope to accommodate additional off-peak demand on the existing network is more restricted.
- 15.14 It could therefore be argued that due to the enhanced capacity on offer under HS2, demand management techniques offer greater scope to improve the case for HS2 than they do for alternative packages.
- 15.15 Given the existing network is already very busy during peak periods, it is possible that any demand management activity under alternative packages would also involve fare increases on overcrowded peak services to encourage rail passengers to travel on earlier/later trains. Such a policy could generate additional net revenue from crowded rail services, depending on how it is designed, and could improve conditions for those passengers who continue to travel at the busiest times. However, passengers who decided to change their travel patterns could experience welfare benefits or disbenefits.
- 15.16 HS2 Ltd acknowledges the potential benefits to be achieved from a more refined approach to fares in *The Economic Case for HS2: Updated appraisal of transport user benefits and wider economic benefits for London to West Midlands and the Y network* (HS2 Ltd, Jan 2012). The report notes the significant analysis that would be needed to understand the impact of market competition, regulatory frameworks and fares policy/structures on the potential benefits that could be secured and which have not been assessed to date. HS2 Ltd's intention to carry out further work in this area during the next phase of scheme development will form an important feature of the economic, financial and commercial case for the scheme.

16. Demand forecasting

16.1 The main criticisms claimed of the approach to forecasting demand for HS2 can be summarised briefly as:

- The assumptions used for forecasting future long distance rail passenger demand are argued to be out of date;

- The relationships described by those assumptions are argued not to hold over the forecasting period for HS2; and
- The impacts of changes to technology are argued not to have been taken into account when predicting future travel patterns.

Passenger Demand Forecasting Parameters

- 16.2 A number of consultation responses noted that ‘out of date assumptions on the income elasticity of demand for forecasting rail demand were used’, going on to suggest that the forecasts would be ‘substantially overstated’.
- 16.3 In response it should be noted that HS2 Ltd’s approach to demand forecasting follows the Department for Transport’s definitive forecasting and appraisal guidance. This is set out in full in WebTAG and we are content that the HS2 rail passenger demand forecasts were produced on the basis of official Departmental advice⁹.
- 16.4 WebTAG is updated periodically to reflect the latest available evidence. In order to provide a stable framework to practitioners, the guidance is updated once a year and the update covers all transport modes. The latest version of the WebTAG guidance on rail passenger demand forecasting has recently been released for consultation, with the definitive version due to be

published in summer 2012 in line with the orderly release process¹⁰.

- 16.5 Our guidance regarding rail passenger demand forecasting is based mainly around the recommended elasticities and values contained in various editions of the Passenger Demand Forecasting Handbook (PDFH). PDFH is maintained and developed by the Passenger Demand Forecasting Council (PDFC)¹¹.

- 16.6 While the Department is a member of PDFC, it does not automatically include PDFH conclusions and recommendations in WebTAG, nor is it obliged to do so. Instead, DfT carries out a critical assessment of each version of PDFH before making a judgement on whether the evidence used is suitable to warrant inclusion in the Department’s official guidance. The end result may be the adoption of some but not necessarily of all of PDFH’s recommendations. For example, the Department’s current definitive guidance has retained the fares elasticities in PDFH 4.0, rather than adopting the more recent values from PDFH 4.1, as its analysis has indicated that PDFH 4.0 is better

9 Further advice on rail passenger demand forecasting can be found in WebTAG Unit 3.15.4 *Rail Passenger Demand Forecasting Methodology*

10 A proposed set of revisions to the Department’s rail passenger demand forecasting methodology have recently been made available for consultation. They do not yet (and may never) constitute official Departmental guidance.

11 PDFC brings together all of the Train Operating Companies, Network Rail, Department for Transport, Transport Scotland, the Office of Rail Regulation, Transport for London and the Passenger Transport Executives Group. Its aims include the procurement of research into demand forecasting issues relevant to the rail industry, and the maintenance of the forecasting handbook. Further information on PDFC and PDFH is available on the ATOC website

at explaining outturn trends in rail demand than the more recent evidence.

16.7 The central case for HS2 is based on the current definitive version of WebTAG. This does not include changes proposed in the latest version of PDFH (version 5.0) as the Department is still considering the evidence base for some of these proposed changes. The Department's recently released consultation WebTAG guidance adopts PDFH 5.0 values for the disbenefit of crowding and for the split of trips by purpose (business, commuting and leisure).

16.8 PDFH 5.0 also contains new fare and income elasticities which describe the impact of economic growth and fare changes on rail demand. The Department is currently considering whether to include these values in future editions of WebTAG and has not yet concluded whether or not to do so. However, in response to points raised during consultation the updated economic case for HS2 includes a sensitivity test to PDFH 5.0 recommendations regarding how rail passengers respond to changes in income and rail fares. This showed that PDFH 5.0 income and fare elasticities reduce the initial benefit to cost ratio by 0.4¹². However, it should be emphasised that, as with many other sensitivity tests, this is intended to provide the lower bound of the impact of PDFH 5.0 fare and income

elasticities. This is because different levels of demand will mean that service patterns on both HS2 and classic rail can be further optimised to improve the BCR of the PDFH scenario.

16.9 Within the timescales available it has not been possible to test the impact of the most recent crowding values. The crowding values in PDFH 5.0 are lower than those reported in earlier versions and represent a higher tolerance to crowded conditions than previously recognised by the evidence. Since crowding benefits make up 15% of the total transport user benefits for the scheme, a reduction of 20% would reduce crowding benefits by approximately £580m. Since the new crowding values are intended to form part of our core guidance from summer 2012 the next update to the economic case for the London to West Midlands phase of HS2 will need to reflect the latest WebTAG recommendations.

Alternatives to the PDFH

16.10 The PDFH is widely regarded as offering an industry recognised standard that provides the 'starting point' for a very broad range of forecasting applications. This brings many benefits and it is important that the forecasting framework contains robust recommendations and evidence so that industry-wide recognition is maintained. In order to ensure that it reflects the most up-to-date evidence available the Handbook is subject to regular review.

12 A full set of sensitivity test results is reported in *The Economic Case for HS2: Updated appraisal of transport user benefits and wider economic benefits for London to West Midlands and the Y network* (HS2 Ltd, Jan 2012)

- 16.11 Based upon issues raised in a number of such assessments the Department specified a major programme of work to enhance its approach to estimating rail passenger demand elasticities. The primary objective of this research project was to re-estimate the background growth (economic, socio-demographic and land-use, and inter modal competition) and fare elasticities for use within PDFH.
- 16.12 The work was commissioned in conjunction with the Passenger Demand Forecasting Council (PDFC) and Transport Scotland and initial findings of the study were delivered under the title *Revisiting the Elasticity Based Framework* in March 2010.
- 16.13 The Department has since carried out a detailed examination of the study results to ensure they are transparent and replicable, are based on robust data, and are able to accurately replicate past trends in rail demand. At the national level we are broadly content that the *Revisiting* study outperforms the PDFH methodology. However, more detailed work to test how well the framework performs at a sub-national level is needed before we could consider adopting the study findings into WebTAG guidance or recommending they be included in the PDFH.
- 16.14 Some responses to the consultation remarked that ‘the forecasting period was extended well beyond the time frame for which the assumed relationships used in the demand forecasts could be considered stable.’
- 16.15 The Department recognises the limitations of an elasticity-based approach for forecasting demand over a long time horizon. However, we remain comfortable that the PLANET suite (and its reliance on elasticity based forecasting methods) was the best tool available to HS2 Ltd when they began developing the economic case for HS2.
- 16.16 Recent research into long-term rail forecasting found that the relationship between GDP and rail passenger demand remains remarkably consistent over the period 1980 – 2005¹³. Based on this evidence it is not implausible to assume a stable relationship for a further 25 to 35 years, though clearly there are some uncertainties. We know from experience that major infrastructure projects can have an impact which goes well beyond a short forecasting period. It would be irresponsible to accept that because there are uncertainties over the longer term, this should invalidate attempts at longer term planning.
- 16.17 Even though the relationship between GDP and rail demand has held for a long period of time we cannot assume that it will continue indefinitely. On the other hand we have no information as to when the relationship will cease (if indeed it will cease). HS2 have therefore reported the results of different scenarios regarding the choice of demand cap in their sensitivity analysis.

Forecasting period

13 See *A Time Series Analysis of Rail Demand in Great Britain* – a paper to the European Transport Conference (MVA Consultancy, October 2010)

16.18 The appraisal period for phase 1 of HS2 is 60 years beyond the scheme opening in 2026 in line with Green Book guidance. The economic case presented at consultation in February assumed demand growth to 2043 which was then capped at that level. The updated analysis of the HS2 business case reduces the time period over which demand is forecast to grow (from 35 years to 26). This is because the model base year has been updated from 2008 to 2011, while the demand cap year has been brought forward from 2043 to 2037 as the faster growth for long-distance rail travel means the demand cap is reached earlier. As a consequence, our appraisal does not apply rail demand elasticities to a large number of years in the appraisal period.

16.19 The Department's *Rail Passenger Demand Forecasting* guidance set out in WebTAG unit 3.15.4 explains some of the weaknesses associated with using alternative forecasting methods for long-distance rail travel. For example, existing multi-modal models treat the link between rail demand and income very differently from elasticity-based models. The treatment of this relationship in multi-modal models leads to them significantly under-forecasting the demand for rail travel when compared to outturn data. Evidence of this can be found in *Rail Passenger Demand Forecasting Research: Uni-Mode and Multi-*

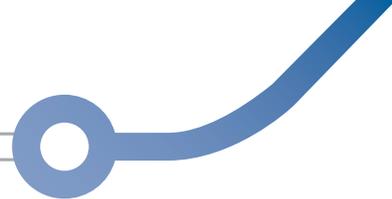
Modal Rail Demand Forecasting (MVA Consultancy, March 2007)¹⁴.

16.20 In addition:

- To obtain an accurate calibration, multi-modal models require a comprehensive trip origin-destination matrix which describes the ultimate origin and destination of journeys made by all modes. The costs of obtaining a sufficiently large sample of rail users/trips from household survey data are prohibitively large.
- Multi-modal models are least accurate when estimating demand on minority modes e.g. rail constitutes around three percent of all journeys within Great Britain.
- The data and processing requirements of multi-modal models mean they are generally more expensive to build, maintain and run.

16.21 Based on the points above it can be argued that the elasticity framework remains the best approach for estimating rail passenger demand currently available. However, the Department recently took delivery of a multi-modal tool designed explicitly for producing forecasts of long distance travel demand. While the capability and accuracy of this tool is currently untested, reviewing the Long Distance Model will form an important aspect of the Department's ongoing activity to assess new methodologies and tools as they become available.

14 See *Rail Passenger Demand Forecasting Research: Uni-Mode and Multi-Modal Rail Demand Forecasting* (MVA Consultancy, March 2007)



Any changes that could provide further confidence in the demand forecasts for HS2 or further insights into the complexities of a scheme of this nature will be considered in advance of the next iteration of the economic case for HS2.

16.24

Understanding the impact of improvements in communications technology is harder to predict. For example, the exponential improvement over recent decades in communications technologies has not led, as some predicted, to declining demand for travel but has happened concurrently with an era of rapid growth in travel. Inevitably we cannot forecast the influence of every factor that we believe affects rail demand. However, since our models are based on either time-series or a combination of time series and cross-sectional data we implicitly model variation in technology through time and between geographic or demographic market segments. Assuming that this variation exists and we expect it to continue into the future, its influence is captured within our forecasts of travel demand.

The impact of technology

16.22 A number of consultation responses raised issues regarding the way in which technological change is reflected in our forecasts of future long distance travel. There are two aspects of technological change that can influence the demand for travel. Firstly, the technology used to transport us from one place to the next may change e.g. low carbon vehicles, faster rail services, managed motorways etc. Secondly, improvements in technology may influence the overall demand for travel e.g. video-conferencing, home-working etc.

16.23 Considering these in turn, the Department explicitly takes into account expected improvements in transport-related technology within its forecasts. For example, we can capture improvements in vehicle efficiency in our forecasts of road traffic (through an estimate of the likely impact on travel costs) and emissions insofar as these trends can reliably be predicted. Where there is a regulatory mandate for technological changes, we assume these are met in the central forecast scenario, and faster/slower progress is assumed in the other scenarios.

16.25

Using rail as an example, there is demonstrable link between technological change, productivity improvements and consequently GDP growth. Since GDP growth is a key driver of rail demand, the impact of continuing improvements in technology is implicitly captured within our forecasts of rail demand. However, occasionally there are unpredictable events and technological shocks that cannot be foreseen. In order to compensate for this lack of foresight we use sensitivity analysis to adjust for any uncertainty in future transport demand, testing the resilience of proposed solutions to unexpected circumstances.

17. Appraisal

17.1 A large number of consultation responses raised issues regarding both the underlying assumptions and the monetary values used by HS2 Ltd to appraise the transport user benefits of HS2. In particular, responses tended to focus on:

- The value of travel time for business passengers;
- The treatment of risks and uncertainty surrounding the economic case.

Business value of time

17.2 Many consultation responses argued that ‘an incorrect value of working time for rail travellers was assumed, against known experience that people use their time on trains productively.’ It is first important to recognise that the key issue of interest is not whether people are productive on trains, but how much more or less productively any time savings are used, compared to how they are used in transit.

17.3 The value of time savings for business travellers used by HS2 Ltd is consistent with standard DfT appraisal guidance and corresponds well with evidence from behavioural studies¹⁵. Such behavioural evidence provides a powerful comparison to survey based evidence since it is based on how people actually behave, rather than how they say they will behave.

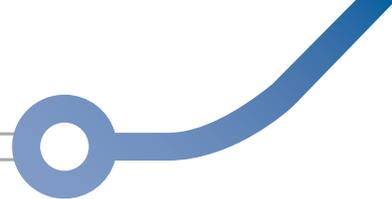
17.4 When valuing business time savings it is necessary to make certain simplifying assumptions and this is reflected in the ‘cost savings’ approach the guidance adopts. In particular, it assumes travellers do not work during journeys, but that all time savings result in additional productive time or reduced costs to employers¹⁶.

17.5 A change in approach would require robust empirical evidence to better understand a number of factors. For example, a business traveller may or may not work on a train for some or all of their journey. They may or may not use any time savings for productive work: if a journey starts or ends at home, some proportion of the time saved may translate into increased leisure, at least in the short run. Conversely, where a faster journey allows a longer day at the destination it may enable the traveller to spend more time with valuable clients or suppliers.

17.6 While academic studies have attempted to answer these questions, they often rely on travellers reporting how they spend time, which may differ from how they actually spend time. One such study is the *Productive Use of Rail Travel Time and the Valuation of Travel Time Savings for Rail Business Travellers* (Mott MacDonald et al, June 2009) carried out for the Department and which has been mentioned in several consultation responses. This study only provides a partial analysis of the complex issues regarding the productive use of travel time and it

15 Further advice on the business value of time can be found in WebTAG Unit 3.5.6 *Values of Time and Operating Costs*

16 Both direct wage costs and other labour costs which vary with hours worked, such as national insurance and pension contributions



is the Department's view that further work to consider long-term responses to changes in journey time is needed to complement the short-run analysis described in the research above. This is acknowledged by the study authors in their follow up document *Value of Working Time and Travel Time Savings: Long Term Implications Report* (Mott MacDonald et al, December 2009). We intend to publish both documents early in 2012.

- 17.7 If appraisal were to incorporate the possibility that work may be undertaken during rail journeys, then it must also take into account that the productivity of such work is likely to diminish in crowded conditions. Passengers forced to stand may be unable to perform work on a laptop, for example. To the extent that HS2 reduces crowding on existing rail services, it could increase productive time available to travellers on those services. Once again, however, there is a lack of evidence to determine what may represent a suitable factor for such an adjustment.
- 17.8 Even if it were to prove valid to reduce the value of business time savings due to on-board productivity, if this were done in isolation it would represent an incomplete treatment of the issue. It would in practice be necessary to consider all of the associated impacts on appraisal results, including a potential uplift in the value of de-crowding benefits. There may also be benefits for those individuals who switch mode to rail and high speed rail following the introduction of HS2, although it is not currently possible

to quantify these benefits. HS2 Ltd has attempted to represent some of these impacts via a sensitivity test as reported in the *Economic case for HS2: Updated appraisal of transport user benefits and wider economic benefits for London to West Midlands and the Y Network* (HS2 Ltd, Jan 2012). We have tested these conclusions with leading academics in the field who agree that in the short-term sensitivity tests are the only feasible way to handle these uncertainties.

- 17.9 It should also be noted that there are a number of other impacts regarding time savings that may increase their value in future updates to the economic case for HS2. For example, there is evidence that people value time savings more for longer journeys, which suggests that the benefits for a scheme such as HS2 may be understated¹⁷. In addition there is some evidence that the Department's non-work values of time are currently too low.
- 17.10 The Department intends to carry out further work over the coming year to further study the implications of the use of travel time, and to assess the feasibility of more sophisticated treatments of business travel time savings. If the results of this work are robust and available in time to inform the Hybrid Bill conclusion on whether or not to proceed with HS2 we will ensure they are adopted in future

17 See *Meta-analysis of UK values of travel time: An update*, Pedro A.L. Abrantes, Mark R. Wardman (Transportation Research Part A: Policy and Practice Volume 45, Issue 1, Jan 2011)

iterations of the economic case of HS2.

- 17.11 In summary, while the Department agrees it is a simplification to assume that travellers do not work on the train, there is currently insufficient robust evidence to address all of the uncertainties above and determine their combined effect. We conclude that the existing approach is sufficient to inform the current decision, but that further work is desirable to inform the development of the business case in coming years.

Risk and uncertainty

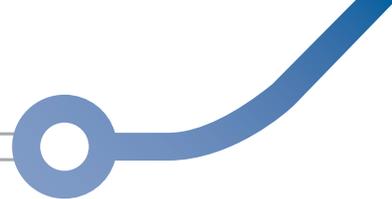
- 17.12 Some consultation responses argued that *The Economic Case for HS2* (HS2 Ltd, Feb 2012) did not sufficiently take into account the potential impacts of risk and uncertainty on the case for high speed rail. However, the Department notes that a full suite of sensitivity tests designed to represent the most likely or significant impacts was reported for consultation and has since been updated in the *Economic case for HS2: Updated appraisal of transport user benefits and wider economic benefits for London to West Midlands and the Y Network* (HS2 Ltd, Jan 2012).
- 17.13 In order to complement the sensitivity analysis reported by HS2 Ltd and to give decision-makers greater confidence in the likely range of outcomes, the Department has since carried out its own risk analysis of the case for high speed rail. This is described in detail in section 9.

18. The subsidy impact of HS2 on the existing network

- 18.1 One criticism of the analysis of costs and benefits for HS2 made by the 51M Group was that there had not been an examination of the subsidy requirements on the existing network once HS2 was operational, and that because the subsidy requirement would be a consequence of the introduction of HS2, it should be added to the resource costs of HS2, reducing its BCR.

“The analysis that has been carried out by HS2 Ltd has not estimated the impact on subsidy on the classic network. It has calculated the net impact of new revenue from HS2 less the loss of revenue from the classic intercity services. And it has made allowance for the cost savings from services withdrawn from the classic network. But no business model of the classic network has been developed to allow the profitability and subsidy needs of services that will be operated on it after HS2 to be analysed.”

- 18.2 The Government agrees that it is important to understand the wider financial impact of HS2 on the existing network, but does not accept the suggestion that there has been an unsuitable level of assessment to understand the high level impacts on the rail network as a whole.
- 18.3 The *Economic Case for HS2* (HS2 Ltd, Feb 2011) that was published as part of the consultation provided



an assessment of the total impact of the introduction of HS2, including the revenue and cost of HS2, the impacts of cost saving and revenue redistribution on the existing network, and additional revenue from new services on the existing network. Whilst there may be a need for subsidy on HS2 in the early years, the modelling suggests that even when the impacts on the existing network are accounted for, HS2 would be operationally profitable over the appraisal period, with revenues expected to exceed operating costs from 2030 onwards.

18.4 It is fair to say that the introduction of HS2 is likely to change the type of service that will be offered on corresponding lines such as the West Coast Main Line. However, this does not necessarily reduce the profit making ability of such lines. The potential to deliver fast intercity services using HS2 will make opportunities available for improved commuter services on existing lines, and improved and new connectivity between different conurbations. The congestion and crowding on the existing network may well have resulted in a level of suppressed demand that could be accommodated through higher frequency, less crowded services on the existing network. For example, improvements in services from places like Milton Keynes, which has significant growth plans, could see increasing demand for rail travel.

18.5 In addition, with greater capacity on the network, connections could be made between towns and cities where connections are currently difficult, or where the journey via rail is unattractive due a slow running service. Both of these elements could encourage shifts onto rail from other modes such as private car and help accommodate new rail markets to serve a wider proportion of the population. This would provide for increasing demand and could reduce the need for public subsidy.

18.6 It is not possible at this early stage to make a meaningful representation of any likely detailed subsidy levels at a route by route level due to the substantial uncertainty about how the rail market might develop in the interim period, which is why high level modelling as undertaken by HS2 Ltd was appropriate at this stage. However, both the Government and HS2 Ltd recognise that further work needs to be done to develop an improved understanding of this issue. This should be based on a wide range of scenarios regarding the operation of HS2 and the existing network so that the impact on revenues of HS2 and the existing network under different planning scenarios can be separated and given consideration. However, this will need to recognise that there is significant opportunity for choice for future Governments and train operators (well into the future) to determine how they wish to deal with released capacity on the existing network.

18.7 Therefore, as part of the further development of its modelling suite, HS2 Ltd will seek to develop tools allowing it to undertake detailed modelling of the effects of different pricing structures on HS2. This will include identifying the differing impacts on HS2 and existing network revenues, considering different options in respect of regulation and competition and analysing the potential commercial decisions of both high speed and conventional operators. This will not only allow a better understanding of the potential revenue impacts for both HS2 and the existing network, but also inform any decisions on future regulatory requirements and commercial structures. However, this work does not change our overall assessment of the appropriateness of the assessment undertaken by HS2 Ltd at this stage of the scheme's development.