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A Proposal for HS2 model development: study specification

in collaboration with

Prof. John Preston (University of Southampton)

prepared for High Speed Two Ltd.
May 2011

1 Introduction

John Bates Services is very pleased to have been invited to bid for the Project “HS2 model development: study specification”. For the purposes of this bid, we have teamed with Professor John Preston of the University of Southampton, an internationally respected expert on rail demand and analysis.

We see this as an important and challenging task: the proposed high speed line is a major piece of transport infrastructure and requires thorough and careful appraisal, using the best modelling tools available. To meet the terms of the Brief, we believe that the study needs to be carried out in a concentrated way by a very small team of experienced professionals. The work would be done entirely by John Bates and John Preston.

2 Reflections on the Brief

We understand that the existing suite of models has already been reviewed and that what is now required is an independent “scoping study” to “identify and to recommend priority areas for development or enhancement of the HS2 model and evidence base..”. This is expanded (in paragraph 3.2) “to provide recommendations of what developments are necessary, their importance and priority, and a work programme for a second stage of work illustrating how these might be best achieved in the time available [16 months].” The outcome of this model and evidence base development must be “robust” both to the envisaged Hybrid Bill process and to Public Enquiry. These are significant requirements.

While it is noted (paragraph 4.2) that this is “not a model audit”, it should be appreciated that a substantial understanding of the existing model will be needed in order to meet the requirements just discussed. From that point of view, we consider that the work is only “not a model audit” in the sense that we would not expect to check datafiles, software and program set-ups. An initial assessment of the documentation suggests that it is thorough and well-written, but experience of model review tells us that there will inevitably be instances where more information will be required. We assume that in such cases HS2 Ltd. will be able either to provide information directly, or to put us in touch with the responsible consultants. Clearly, this will need to be done expeditiously.

We concur with the relevance of all the areas of work described in paragraphs 5.2.2 to 5.2.8, and while we will review the models more widely, we will certainly address all of these in detail.

3 Proposed procedure for carrying out the work

Given the restricted timescale for the work, it will be important to build up an initial assessment of the main areas of sensitivity. While, informally, we expect these to be a) the assumptions about growth of travel demand in the corridor and b) the impact of HS2 on demand (in particular, mode choice and generation), there are various other components – such as those related to international/air traffic – which need to be

assessed. We assume that the Demand Model Analysis Report will provide guidance in this respect, but we would also expect to be guided by HS2 Ltd.

We concur with the Brief that it is unlikely (paragraph 4.3) that there will be sufficient time to commission any runs to investigate particular aspects. However, we will identify any appropriate cases if they arise.

The allocation of general review work between John Bates (JB) and John Preston (JP) will be along the following lines, with special attention to the key areas of work in paragraphs 5.2.2 to 5.2.8:

- Alternative Transport Models: JB
- Base Year Data: JB
- Future Year Demand: JP
- Mode Choice: JB
- Model Structure: JB
- Fares: JP/JB
- Competitive Responses: JP

This makes the best use of JB's specialist knowledge of general demand modelling, and of JP's specialist knowledge of rail markets. However, both members of the team will take joint responsibility for all aspects of the work and the deliverables.

In Week 1 the key documents (Demand Model Analysis Report, Model Development Report and Baseline Forecasting Report) will be read and preliminary assessments made in time for the Inception Meeting (IM), which both JP and JB will attend. While the remainder of the work programme is subject to agreement at the IM, the following is proposed:

Assuming HS2 will facilitate support, where necessary, for resolution of unclear items in the documentation, Weeks 2 and 3 will be devoted to a preliminary, but thorough, assessment of the key documents, leading to the production of the Interim Report (IR) and, it is assumed, a presentation to the Steering Group. Given the required timescale, it is unlikely that the IR could be made available much in advance of the Steering Group Meeting, but at the latest copies would be provided at the meeting.

The IR is the first project deliverable, and paragraph 5.4 of the Brief requires the proposer to suggest the format and contents, to be agreed at the Inception Meeting. We envisage this as having two distinct sections – the first summarising the conclusions of the preliminary assessment as well as an indication of early thoughts for enhancement, and the second setting out a proforma for the Final Report, in terms of section headings with page budgets. Overall we anticipate that the IR will be about 10 pages long.

A clear indication should be agreed at this Steering Group Meeting of the importance of including the three reports on the Airport Demand Model, International Rail Travel Demand Model, and Advice on the Assessment of Wider Economic Impacts.

Provisionally two days have been allowed for in the subsequent three weeks to cover these aspects.

Weeks 4-6 will be devoted to a) an elaboration of the assessment so as to cover at least all of the areas of work described in paragraphs 5.2.2 to 5.2.8 (our initial thoughts on these are given in section 4 below) and b) the design of a practical programme of work to address the perceived weaknesses as far as possible within the stated timetable. This will also be informed by the contents of the Model Framework Validation Report. The output from this will form the basis of the Draft Final Report. At this stage, the programme will be provisional and not fully elaborated, but the headings and description of all recommended items will be sufficiently clear to allow the Steering Group to form appropriate conclusions in Week 7.

During Week 7 and, in the light of the Steering Group meeting, during Week 8, the items in the recommended programme will be further reviewed and elaborated, with the intention of providing draft briefs which will be included with the Final Report. This will involve suggestions for primary research (including data collection) and for model development/innovation, set out as Work Packages which could in principle be separately commissioned.

Both team members are happy to be retained, together or separately as necessary, for subsequent discussions and meetings with the Analytical Challenge Panel and to provide ongoing challenge and advice on the stage two programme of work as envisaged in paragraph 3.2.

4 Some Initial Thoughts on the Key Issues

Although our views may well alter in the light of a more careful reading of the documentation, we thought it would be helpful to set out in brief our initial responses to the items in 5.2.2 to 5.2.8.

Alternative Transport Models, Mode Choice and Model Structure

We have a reasonable understanding of the DfT's LDM model, though we do not know its current state of implementation. Apart from being constructed on a tour, rather than trip, basis, we view its **structure** as relatively conventional. Most transport demand models offer a flexible "hierarchy" of choices (mode, destination) so that it should not be necessary to change the software platform in order to accommodate changes to the model. However, there may be a good case for "borrowing" model parameters from other comparable models (such as LDM) provided they deliver appropriate elasticities. Comparisons could also be made with some of the regional models (of which PRISM is an obvious example). Nevertheless, the most important consideration relates to whether the PLANET Strategic model is "fit for purpose".

In this respect, there are a number of questions, including the following. How sensitive are model results to assumptions of linear additive functions (for example the work of Marc Gaudry with Box Cox transformations, Andrew Daly on cost damping etc.)? How important are mode specific constants and parameter values? How well is station choice

dealt with in PLANET – does the assignment algorithm used mean that high speed rail gets an excessive share? In assessing the last question, the differences between frequency based and timetable based assignments might be usefully examined.

Base Year Data

While it is always desirable to operate a model from an up-to-date platform, as well as being of some cosmetic value, the more important requirement, in our view, is the soundness of the data – in particular the quality of the base matrices, and especially for the car mode, where the data is weakest. This quality will be affected both by the data available, and by the way in which the synthesis of different kinds of information has been carried out. The modal shift that could be induced by HS2 will be highly sensitive to the base year modal split. At the same time, it is unlikely to have changed much between 2008 and, say, 2010.

Future Year Demand

We see this as a critical area. How reliable are the forecast growth rates in the light of evidence from more mature high speed rail markets (e.g. Eurostar)? Is there evidence of saturation? What are the key parameters and is the assumed growth of some of these (e.g. value of time) sensible?

Fares

The question of premium fares raises important issues for the demand model structure, in terms of how HS2 is to be differentiated from “classic rail” in the choice model. As long as travel time is the only difference between the two rail options, the “choice” can be treated as wholly deterministic (based on minimum generalised cost), but with premium fares, presumably reflecting some aspect of quality, a probabilistic model is needed, ideally allowing for a distribution of the value of time. This topic was the main subject of JB’s involvement with Atkins on HS2 (see section 5 below). Another key issue is the number of fare categories to be modelled (e.g. First/Standard, Open/Off Peak/Advanced) and the direct and cross elasticities of demand with respect to these fares.

Competitive Response

Competitive response can include a number of dimensions, including competition between High Speed Rail operators, competition between High Speed and Classic Rail and intermodal competition, particularly with airlines and coach services. Competition may take place in the price, service quantity and/or service quality dimensions. Although the economic theory on oligopolistic competition can provide some insights, a more useful approach might be game-theoretic simulation models. For example, work on competition within the rail market using the PRAISE model in Britain and Sweden showed that head-on competition may be limited by high access charges, but route competition (e.g. between High Speed and Classic Rail) could be substantial. Qualitative approaches might identify the most likely competitive scenarios which are then simulated to determine quantitative results.

5 Suitability for the Task

John Bates is an Independent Consultant and a Demand Modeller of international reputation, with over 40 years' experience. He has been responsible for the design of many major model systems, at urban, regional and national levels. He has a detailed understanding of the principles which bind the various modelling components and has contributed substantially to the modelling guidance sections of WebTAG. In addition, his particular contribution is directed towards practical modelling, while maintaining appropriate compliance with theoretical requirements.

He has considerable experience as a Peer Reviewer/Auditor, and has a proven ability to get through the details of complex (and often poorly documented) models with a view to assessing their strengths and weaknesses. Through his experience of working with many other consultants, he has established fair and co-operative methods for teasing out key aspects of models which could easily otherwise be missed. He has assisted the Department for Transport as a Peer Reviewer for a large number of complex projects, and his collaborative but demanding approach has earned considerable respect.

While not specialising in rail, some of his recent work includes assisting Atkins with modelling work for HS2, reviewing ITS work on rail reliability for DfT (Tom Worsley), assessing use of the NMF within the National Transport Model for DfT (Stephen Rowan), working with Jacobs Consultancy in examining differences in respect of rail forecasts between LTS and other rail models, and work with SDG in analysing time series data to indicate the impact of congestion and other variables on rail demand. He has a solid understanding of the key demand processes recommended in PDFH.

His work with Atkins was during 2009, and, together with David Ashley of SKM, was largely confined to an assessment of fitness for purpose of the Planet Strategic Model, plus some preliminary work on demand modelling for premium fares. While these have provided some familiarity with the basic modelling work, it is not considered that they give rise to any conflict of interest. He has had no contact with the modelling work since November 2009.

John Preston has almost 30 years of experience as an academic in transport research and education. He is the Head of the School of Civil Engineering and the Environment at the University of Southampton, where he holds the Chair in Rail Transport and is Director of Development of Rail Research.

He has had no direct involvement in the HS2 project, but has produced two independent reviews for the RAC Foundation. The first review in 2009 reviewed international evidence, along with the studies in Great Britain by Atkins, Network Rail and Greengauge 21. The second review in 2010 focused on the work of HS2. He has also undertaken reviews of High Speed Rail for Seeda (the South East England Development Agency), for Strathclyde Partnership for Transport and Railteam. He was involved in an audit of the PLANET model in 1999. He has contributed to the Passenger Demand Forecasting Handbook on competitive responses in rail and was commissioned by the International Transport Forum to produce a paper on this topic (2009).

Short CVs for both team members are included as an Annex to this Proposal.

6 Availability

Over the period 23 May to 15 July JB is available on average half time (thus 20 days) and JP for one day a week on average (thus 8 days). However, both members will allocate their time appropriately to the project requirements, and the period of weeks 4-6 is expected to be one of particularly concentrated input.

JB is based near Oxford, and JP in Southampton: most of their liaison is expected to be by phone and email, but JB is able to travel to Southampton if face-to-face meetings are necessary.

The Brief asks for 4 meetings/presentations with HS2 to be costed. It is assumed that JB will attend all four of these, and JP will attend three, including the Inception meeting, where the details of JP's further meetings will be agreed.

7 Fee

The total firm fixed-price bid for this work is **£21,505 net of VAT**, which will be applied at the standard current rate. This includes all time and materials and travel costs. The travel costs are consistent with the “HS2 Contract Expense Reimbursement” document.

For ongoing engagement beyond the Stage 1 work, the following rates are proposed:

John Bates ██████████ per day, plus VAT
John Preston ██████████ per day

These daily rates do **not** include travel and other expenses, which would be charged as incurred, in line with HS2 conditions.

This offer is valid for 60 days.

8 Other contractual issues

The project would be managed by John Bates, who will represent the single point of contact referred to in paragraph 13.2.

Being a sole trader, [REDACTED]
[REDACTED] It is understood, from an email received from [REDACTED] of HS2 dated 18 April 2011, that this would not exclude him from bidding (in relation to section 16 of the standard HS2 Ltd Terms and Conditions).

In all other respect, the standard Terms and Conditions are accepted and understood.

For the avoidance of doubt, we here note the possible areas relating to conflict of interest, though we do not believe these are material:

John Bates member of MAP Panel with Jacobs Consultancy (no work awarded)
work for Atkins on HS2 in 2009 (see section 5 above)

John Preston member of MAP Panel with Arup (no work awarded).
reviewed HS2 reports for the RAC Foundation in 2010 (see section 5
above).

We both accept and hereby confirm the condition that if appointed for the Stage 1 work we will not assist other parties to formulate bids for possible Stage 2 work.

Short CVs for John Bates and John Preston

John Bates, MA (Cantab), PhD

John Bates is one of the foremost experts in the UK in both transport modelling and appraisal methodology, and has an international reputation. He has written and lectured extensively on both subjects, as well as having 40 years of practical experience.

He has considerable experience with multi-modal models, including the Dutch Long Distance Travel model, and, on the urban side, the LTS model in London, models for Manchester and Tyne & Wear (Newcastle), as well as Wellington, Auckland and Christchurch in New Zealand. From 1990 onwards, he worked with MVA Ltd on a number of urban projects, being the architect of the START model which applied the principles of urban transport modelling at a “strategic” level. From late 1991 till March 1995 he was Technical Advisor to the Department's Congestion Charging in London programme, where he directed the main modelling effort, including writing briefs and liaising with other consultants. Under his guidance a new strategic model (APRIL) was developed, with a number of "state of the art" urban modelling features, in particular a detailed model of Time of Day choice. This work built on his previous research on supply and demand equilibrium models. In further work with MVA he was a principal adviser to the team working on the new LTS91 Model, for LAD division, and was the chief Technical Adviser for a major project to develop a parking model (TRAM) for the Avon region as part of a study on Parking and Traffic Demand. This model built on his APRIL experience, while treating parking in greater detail.

In 1996 he played a major design role in the feasibility study for a national transport policy model for the Department, and he also contributed much of the advice on modelling in the IHT publication “Developing Urban Transport Solutions” and the Department’s GOMMMS. He developed and delivered a set of lectures to DfT and HA staff on the topic “Developing Intelligent Customers for Transport Modelling” (2002). He was a member of a team (with ITS Leeds and AEA Technology) carrying out the project “Evaluation of the multi-modal study process”, and reviewed the modelling and appraisal experience of a number of the Multi-Modal studies (2003). He was subsequently involved with TIF studies (congestion charging) in Manchester, Newcastle and Durham. He was the architect of an early version of a national car ownership model for the Department of Transport, and has an extensive knowledge of the current National Transport Model, through his role as an auditor (see below) and a member of the Technical Advisory Board (2009-2011).

He has been a leading figure in the development of stated preference techniques within the transport field, and has considerable expertise in evaluation methodology, in particular the valuation of time savings and reliability. In addition to his work in the UK, he has been an adviser to Value of Time studies in Sweden, Norway, New Zealand and Switzerland.

Some of his recent work specifically on rail includes assisting Atkins with modelling work for HS2, reviewing ITS work on rail reliability for DfT (Tom Worsley), assessing the use of NMF within DfT’s National Transport Model for DfT (Stephen Rowan), working with Jacobs Consultancy in examining differences in respect of rail forecasts

between LTS and other rail models, and work with SDG in analysing time series data to indicate impact of congestion and other variables on rail demand

He also has extensive experience as a reviewer, both for journals and in an “auditing” capacity, where, in addition to his work on the Multi-Modal studies, he has worked for the European Commission as a DRIVE auditor, and carried out a detailed audit of the Dutch National Model. He has established a reputation as a fair but demanding Peer Reviewer, and recent commissions include:

- Peer Review of Manchester Motorway Box Project, for DfT (2005-2010)
- Peer Review of ITS Leeds work on M6 Toll, for DfT (2008-2009)
- Peer Review of ITS Leeds study of Impact of Reliability on Passenger Rail Demand, for DfT (2008)
- Peer Review of Freight Matrices Project, for DfT (2010)
- Independent Review of GMPTE’s business case for Cross-City Bus (2010)
- Peer Review of DfT Airport Allocation Model (NAPALM) (2010)

He also reviewed the Great Britain Freight Model (GBFM) for ITEA, in collaboration with Ian Williams of WSP (2004-2005).

Recent Papers of Relevance:

History of Demand Modelling (2000, 2007), Chapter 2 in Handbook of Transport Modelling, (D A Hensher & K J Button eds), Pergamon

A New Look at Multi-Modal Modelling (2001) (with D Simmonds, A D May) PTRC European Transport Conference, Seminar on Applied Transport Methods, Cambridge

Values of Travel Time Savings in the UK (2003) (with P Mackie, M Wardman, A Fowkes, G Whelan & J Nellthorpe), Report to UK Department for Transport, Institute for Transport Studies, University of Leeds

Economic Evaluation and Transport Modelling: Theory and Practice (2003), Resource Paper for 10th IATBR Conference: Moving through Nets, Lucerne

Time Period Choice Modelling (2007), Chapter 17 in Handbook of Transport Modelling, (D A Hensher & K J Button eds), Pergamon, 2nd edition

Building base matrices from synthetic and observed data: a new model structure (2007), with G Terzis, S Marsh, M Logie, and H Neffendorf, PTRC European Transport Conference, Seminar on Applied Models, Leeuwenhorst, Netherlands

Guidance on freight modelling (2007), with I Williams, Y Jin, J Pharoah, and M Shahkarami, PTRC European Transport Conference, Seminar on Freight and Logistics, Leeuwenhorst, Netherlands

Modelling time period choice in large-scale hierarchical demand models: some problems and a solution (2007), with A Gordon, A Daly, and F Oladeinde, PTRC European Transport Conference, Seminar on Travel Time, Leeuwenhorst, Netherlands

An Agenda for Research on Reliability (2009), Keynote Address to European Transport Conference, Leeuwenhorst, Netherlands

Professor John Preston

Synopsis. Professor Preston has almost 30 years of experience in transport research and education. He has taught transport options on Economics, Engineering, Geography, Management and Planning courses. His research in transport covers demand and cost modelling, regulatory studies, and land-use and environment interactions. His initial work concentrated on rail but subsequent work has covered all the major modes of transport. He has held around 120 research grants and contracts, worth over £4.6 million, and has published over 200 articles, book chapters, conference and working papers.

QUALIFICATIONS:

1981. BA (Hons). Geography. University of Nottingham.

1987. PhD. Economics. University of Leeds.

1997 MA University of Oxford.

Member Chartered Institute of Transport (MCIT).

Elected Fellow of the Transport Research Foundation.

PRESENT POST:

2006- Transportation Research Group, School of Civil Engineering and Environment, University of Southampton.

Head, School of Civil Engineering and the Environment (from 1 August 2010)

Director, Transportation Research Group (from 1 July 2008)

Chair in Rail Transport and Director of Development of Rail Research.

PREVIOUS EXPERIENCE:

1997-2005 Transport Studies Unit (TSU), School of Geography and the Environment, University of Oxford.

Director, Transport Studies Unit and Reader in Transport Studies

Tutorial Fellow in Geography, St Anne's College

1982 - 1997. Institute for Transport Studies (ITS), University of Leeds.

1995-97. Senior Lecturer in Transport Economics and Course Director, MBA in Transport Management

1990-95. British Rail Lecturer in Rail Transport (Joint post with the School of Business and Economic Studies).

RECENT RELEVANT RESEARCH AWARDS

1. Rail Research UK Phase 1. January – September 2006. Funded by EPSRC.
2. HST Impact Study January 2006 – July 2008. Funded by SEEDA.
3. Rail Research UK Phase 2. September 2006 – March 2010. Funded by EPSRC.
4. HST Connectivity Study. April 2006 – February 2007. Funded by SEEDA.
5. Technology and Policy in UK and European Railways. May – September 2006. Funded by Korea Railroad Research Institute.
6. Evaluating the Long Term Impacts of Transport Policy: The Case of Rail Privatisation. Studentship funded by ESRC and OXERA. October 2006 – September 2009.
7. Forecasting the Use of New Stations and Services using GIS. EPSRC DTA Studentship. October 2006 - September 2009 (54).

8. The Effect of Station Enhancements on Rail Demand - Phase 2. Funded by the Passenger Demand Forecasting Council. July 2007 – February 2008.
9. Advice on Value-for-Money Examinations of the Rail Industry. Funded by the National Audit Office. February – March 2008.
10. High Speed Ground Transport. Glasgow – Edinburgh Corridor. Strathclyde Partnership for Transport. May 2008 to December 2008.
11. Passenger Demand Forecasting Handbook: Revisiting the Elasticity Based Framework. Department for Transport. October 2008 to November 2009.
12. London Overground Trip End Models. Transport for London. April to June 2009.
13. The Macro Social/Economic Impact of High-Speed Rail in Europe. Railteam. April to September 2009.
14. Tuning Transatlantic Co-operation in Rail Higher Education. EU-US Atlantis Programme. September 2009 – September 2011.
15. Barriers to Mode Shift. ATOC. September – November 2009.
16. The Case for High Speed Rail. RAC Foundation. September 2009 – August 2010.
17. Factor 20: reducing CO2 emissions from inland transport by a major modal shift to rail (with W. Powrie et al.). EPSRC Cross Disciplinary Feasibility Account. January 2010 – April 2011.
18. A Decision Support System for Optimising Local Rail Networks. EPSRC PhD Plus, October 2009 to September 2010. .
19. Rail Track Systems for the 21st Century (with W. Powrie et al.). EPSRC. April 2010 – March 2015.
20. Overcoming Capacity Constraints: A Simulation Integrated with Optimisation for Nodes (OCCASION) (with C. Potts and T. Besktas). EPSRC/RSSB. October 2010 – September 2012.

RECENT RELEVANT PUBLICATIONS

1. An Analysis of the Potential for On-track Competition in the British Passenger Rail Industry. (with G. Whelan and M. Wardman). *Journal of Transport Economics and Policy*, 33, 1, 77-94. 1999
2. The Demand for Public Transport: The effects of fares, quality of service, income and car ownership (with Paulley, N., Balcombe, R., Mackett, R., Titheridge, H., Wardman, M., Shires, J. and White, P. *Transport Policy* 13, 4, 295-306. 2006
3. The Relationship between Fare and Travel Distance (with F. Jorgensen). *Journal of Transport Economics and Policy*. 41, 3, 451- 468. 2007.
4. The Ex-ante and Ex-post Economic and Social impacts of the Introduction of High-Speed Trains in Southeast England. (with G. Wall) *Planning Practice and Research* 23 (3) 405-424. 2008
5. Competition in Transit Markets. *Research in Transportation Economics*. 23, 75-84. 2008.
6. The Relationship between Fare Elasticity and Trip Length – Some Comments (with F. Jorgensen). *International Journal of Transport Economics*. 26, 3, 361-375. 2009.
7. Trends in European Railways over the Last Two Decades. *Built Environment*, 35, 1, 5-17. 2009
8. Modelling Local Rail Demand in South Wales. (with S. Blainey) *Transportation Planning and Technology*. 33, 1, 55-73. 2010.