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| **Institution:** University of Leeds | | |
| **Unit of Assessment:** 12 | | |
| **Title of case study:** Estimating official UK valuations of travel time savings – with implications for the benefit-cost ratio of major transport schemes including HS2 | | |
| **Period when the underpinning research was undertaken:** 2008 – 2017 | | |
| **Details of staff conducting the underpinning research from the submitting unit:** | | |
| **Name(s):** | **Role(s) (e.g. job title):** | **Period(s) employed by submitting HEI:** |
| Richard Batley | Research Officer/Fellow, Senior/Principal Research Fellow, Professor | 05/01/2000 – date |
| Stephane Hess | Principal Research Fellow, Reader, Professor | 01/05/2008 – date |
| Gerard de Jong | Visiting Professor, Research Professor | 01/04/2004 – date |
| Mark Wardman | Reader, Professor | 01/08/1999 – 31/01/2016 |
| Phill Wheat | Research Officer/Fellow, Senior Research Fellow, Associate Professor | 18/04/2005 – date |
| Thijs Dekker | Lecturer, Associate Professor | 01/12/2014 – date |
| Manuel Ojeda Cabral | Research Fellow, Senior Research Fellow | 02/02/2015 – date |
| **Period when the claimed impact occurred:** 2014 – 2020 | | |
| **Is this case study continued from a case study submitted in 2014?** No | | |

**1. Summary of the impact** (indicative maximum 100 words)

Arguably the most important concept in transport appraisal is the 'value of travel time savings' (VTTS)—the monetary value of reducing travel time by one minute, all else being equal—since time savings are typically the single largest component of the benefits of transport infrastructure schemes. In 2014/15, University of Leeds researchers re-estimated the Department for Transport's (DfT's) official national VTTS, and following extensive industry consultation, these re-estimates were committed to DfT's Transport Analysis Guidance (TAG) in 2017. Since the appraisal of publicly-funded transport schemes must adhere to TAG, the University's estimates of VTTS have had a substantive impact on the Value for Money (VfM) of all schemes submitted to DfT— and thus influenced which schemes were funded. For example, re-analysing the official economic case for HS2 with the new values, the forecasted net benefits increased by £5.1bn and the benefit-cost ratio increased from 1.8 to 2.0.

**2. Underpinning research** (indicative maximum 500 words)

The underpinning research is largely associated with a government-funded programme starting in 2010 to review the theoretical, methodological and evidential basis of TAG guidance on VTTS, and culminating in 2014 with the commissioning of a £1.4M study to update TAG with re-surveyed national estimates of VTTS. Given the significant influence of VTTS on the funding of transport schemes, the research programme was authorised at ministerial level.

As of 2010, DfT's official valuations were based on time vs. money trade-offs from a survey of travellers conducted in 1994. Over the subsequent 20 years, these values were regularly updated by DfT for GDP growth, but were not resurveyed. This was despite the fact that there had not only been changes in GDP since 1994, but also in many features of the journey experience, such as wi-fi, hands-free communication technology, and in-vehicle entertainment,

as well as advancements in research methods for estimating VTTS.

The underpinning research studies include the following contracts, which were awarded to the Institute for Transport Studies, University of Leeds (ITS Leeds) as key members of various consortia, via competitively tendered procurement processes.

[i] In 2010, ITS Leeds, John Bates Services (independent transport economics consultant) and the Danish Technical University were commissioned by DfT to conduct a scoping study of the research activities that would be required to update *VTTS for non-work travellers* (£75k contract value to ITS Leeds).

[ii] In 2013, ITS Leeds, John Bates Services and the Swedish Royal Institute of Technology were commissioned by DfT to review methods and evidence concerning the *VTTS for business travellers* (£56k). Output [1], which arose from this study, entails a systematic review of alternative approaches for valuing business travel time savings. A key recommendation of this study was that DfT should replace the established Cost Saving Approach (CSA) with the Willingness-To-Pay (WTP) approach for estimating business VTTS to take account of the increased productivity of travel time due to laptops and mobile devices. DfT subsequently accepted this recommendation, specifying that WTP should be used to estimate VTTS for business in their Invitation-To-Tender for the 2014/15 study [v].

[iii] In 2013, ITS Leeds and John Bates Services were commissioned to analyse the degree of *statistical uncertainty around DfT's existing non-work VTTS* (£5k). Output [2], which arose from this study, developed and implemented a novel methodology for deriving confidence intervals around VTTS estimates from the previous (2003) UK study of VTTS.

[iv] In 2013, ITS Leeds was commissioned by the European Investment Bank to develop a *meta-model of the relationship between VTTS and socio-economic and technological factors* (€30k). A key output from this study was re-estimation of the 'elasticity of VTTS with respect to GDP'—a metric which is used to update VTTS for GDP growth over time.

[v] In 2014, building upon the preparatory studies [i–iv], Arup, ITS Leeds and Accent (market research agency) were commissioned to undertake a *major study to re-estimate official UK values of travel time savings* (£500k to ITS Leeds from total contract value of £1.4M). This study delivered recommendations for revised national average values of in-vehicle travel time savings, derived from a WTP survey of some 11,500 travellers across the UK, covering all surface transport modes, and both business and non-work travel purposes. With regards to non-work travel, the study reported commute values that were ca.50% higher, and other non-work values ca.25% lower, than previous TAG guidance. With regards to business, the study reported marked variation in values by trip distance, with values ca.75% lower than previous TAG for trips of less than 20 miles, achieving parity with TAG at trips of ca.100 miles, and exceeding TAG for still longer trips.

Output [3] details the technical specification of the behavioural model that was developed and implemented in the course of the 2014/15 study. This includes treatment of the phenomenon of 'reference dependence', whereby travellers may perceive changes in travel time with respect to some cognitive reference point, which was previously explored in output [4]. Outputs [5] and [6] informed further aspects of the methodology for the 2014/15 study, with [5] developing the approach used to model uncertainties around VTTS estimates, and [6] developing the approach, grounded in Bayesian statistics, used to design the time vs. money trade-off experiments.

**3. References to the research** (indicative maximum of six references)

[1] Wardman M, Batley R, Laird J, Mackie P, and Bates J. How should business travel time savings be valued? *Economics of Transportation* 4(4), 200–214 (2015). https://doi.org/10.1016/j.ecotra.2015.08.003

[2] Wheat P and Batley R. Quantifying and decomposing the uncertainty in appraisal values of travel time savings. *Transport Policy* 44, 134–142 (2015). https://doi.org/10.1016/j.tranpol.2015.06.010

[3] Hess S, Daly A, Dekker T, Ojeda Cabral M, and Batley R. A framework for capturing heterogeneity, heteroskedasticity, non-linearity, reference dependence and design artefacts in value of time research. *Transportation Research Part B* 96, 126–149 (2017). https://doi.org/10.1016/j.trb.2016.11.002

[4] Stathopoulos A and Hess S. Revisiting reference point formation, gains-losses asymmetry and non-linear sensitivities with an emphasis on attribute specific treatment. *Transportation Research Part A* 46(10), 1673–1689 (2012). https://doi.org/10.1016/j.tra.2012.08.005

[5] Daly AJ, Hess S, and de Jong G. Calculating errors for measures derived from choice modelling estimates. *Transportation Research Part B* 46(2), 333–341 (2012). https://doi.org/10.1016/j.trb.2011.10.008

[6] Bliemer MCJ, Rose JM, and Hess S. Approximation of Bayesian efficiency in experimental choice designs. *Journal of Choice Modelling* 1(1), 98–127 (2008). https://doi.org/10.1016/S1755-5345(13)70024-1

All of the above journals are internationally recognised with rigorous review processes and international editorial boards. The quality of the underpinning research being at least 2* is demonstrated by all six references. Furthermore, these outputs arose from, or fed into, the underpinning research studies. The final reports from studies [i–iii] and [v] were subject to DfT, independent expert and industry stakeholder review, before publication on the DfT website. The final report from [iv] was expert reviewed by the European Investment Bank, but remains commercial-in-confidence.

Prior to leaving the University, **Wardman** contributed to the original research underpinning this case study through, e.g. Reference [1].

**4. Details of the impact** (indicative maximum 750 words)

**Impact 1: Underpinning research by ITS Leeds directly informs DfT's policy decision to commission a major £1.4M research study to update UK national values of travel time savings (2014).**

The underpinning research studies [i-iv] were the primary resource used by DfT to formulate a policy position on the robustness of TAG guidance on the valuation of travel time savings. DfT's position is documented in report [A] from 2013, which references ITS Leeds (p22 & p25) and concludes that a major new research study to re-estimate national values of VTTS should be commissioned (p25). Having secured ministerial approval, the £1.4M contract for the major study to re-estimate national values of travel time savings was tendered through the T-TEAR Lot 2 Framework and, following a commercial bidding competition, was awarded to the Arup/ITS Leeds/Accent consortium in June 2014.

**Impact 2: ITS Leeds successfully delivers the study to update UK national values of travel time savings (2015), and the values recommended by ITS are adopted in DfT's official TAG guidance (2017).**

Although commissioned across a challenging timeframe of 11 months, study [v] was completed on time and to specification [B]. Following a period of assimilation, DfT released the final report [C] from study [v], along with their own interpretation of the findings and proposals for updating national values of VTTS in TAG [D]. On p11 of [D] it is stated: *'This document relates to a research project recently undertaken on behalf of the Department by Arup, Accent and the Institute for Transport Studies (ITS), University of Leeds'*. DfT then consulted industry stakeholders [E] (see references to ITS Leeds on p12, p18 & p39) before finalising their

proposals on VTTS, securing ministerial approval for these changes, and issuing new TAG guidance in 2017 [F] (see references to ITS Leeds on p4 & p5).

**Impact 3: DfT and other policy stakeholders apply the updated TAG guidance on VTTS—based on research by ITS Leeds—to re-run the economic cases for major investment schemes (2017 onwards).**

As noted in DfT's letter of corroboration [G]: '*In practical terms, this means that from 2017 onwards, all business cases submitted to DfT for transport infrastructure schemes which generate time savings have been based upon the analysis conducted by ITS Leeds in the course of the 2014/15 study. This includes at least 35 schemes to date, ranging in size and scale from local schemes to regional and national transformational schemes including HS2, RIS1 and Crossrail2*'.

Furthermore, the implementation of the updated values in live appraisal work has had a material impact on the VfM of major investment projects in DfT's portfolio [H]. Overall, given the distribution of journey purposes and the different changes to VTTS for business and other non-work purposes, the updated guidance led to a ca.10% reduction in transport scheme benefits, but this masks significant variation across scheme types. More marked reduction in benefits (ca.40%) occurred where schemes were focussed mainly on leisure and/or shorter-distance business travel. On the other hand, the updated values had a small-to-moderate positive impact on benefits where schemes were focussed mainly on commuting and/or longer-distance business travel.

To illustrate, Table 6 (p26) of [H] summarises official HS2 Ltd. analysis of the impact of the new VTTS estimates on the net benefits and benefit/cost ratio (BCR) of the High Speed 2 rail scheme, whilst holding all other drivers of the BCR constant (e.g. implying that there is no change in travel behaviour as a result of the change in VTTS). The forecasted net benefits increase from £73bn to £78.1bn (2015/16 price and discounting base year), and the BCR increases from 1.8 to 2.0.

Similarly, Table 7 (p27) of [H] summarises official DfT/Highways England analysis of the 'Roads Investment Strategy' (RIS1), a cornerstone of which is a multi-year investment plan to improve the strategic road network. As a result of updating VTTS (and again holding all other drivers of the BCR constant), the forecasted net benefits decrease from £40.3M to £35.3M (2010 price and discounting base year), and the BCR reduces from 4.6 to 4.0.

**Impact 4: The reach of the impacts extends to other countries, via engagement of ITS Leeds researchers as expert reviewers/advisers/researchers at international policy forums and on other national VTTS studies (2018 onwards).**

The UK is one of a relatively small number of countries which commits significant public investment to comprehensive national VTTS studies. As such, many countries seek insight from ITS Leeds expertise to inform the design of their own studies, or to translate UK valuations to their own domestic conditions; see letter of corroboration from the NZ Ministry of Transport [I].

For example, in 2018, the International Transport Forum of the OECD convened a Roundtable at which **Batley** and **Dekker** (together with Iven Stead of the UK DfT) presented an invited discussion paper on the 2014/15 UK study [H]. During 2019–20, four further engagements followed which demonstrate various aspects of international impact:

- In the context of a new Dutch national study of VTTS, **Batley** was engaged by the successful bidder, the Significance consultancy, as one of three international experts providing critical review and advice.
- In the context of a new NZ national study of VTTS, an ITS Leeds team led by **Batley** was engaged by the NZ Ministry of Transport on an 18-month contract to provide client-side advice on VTTS and related interests.

- In the context of a new Irish national study of VTTS, a consortium of ITS Leeds (**Batley** & **Dekker**) and the SYSTRA consultancy were commissioned to translate (with permission of the UK DfT) the behavioural model from the 2014/15 UK study to Irish travel and socio-economic conditions. As a result, the Irish Government were able to generate updated estimates of VTTS through a research investment of less than €100k—a fraction of the £1.4M invested by the UK DfT in the 2014/15 study.
- In the context of a new Australian national study of VTTS, an ITS Leeds team led by **Batley** was engaged by Austroads, the apex organisation of road and traffic agencies in Australia and New Zealand, to provide client-side advice.

**5. Sources to corroborate the impact** (indicative maximum of 10 references)


[A] *'Understanding and Valuing the Impacts of Transport Investment',* Department for Transport (2013). https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/253860/understanding-valuing-impacts-transport-investment.pdf

[B] E-mail from the Economic Adviser, Transport Appraisal and Strategic Modelling, Department for Transport, 16 September 2015.

[C] Arup, Accent & ITS (2015), *'Provision of market research for value of travel time savings and reliability: phase 2 report'*. Report to the Department for Transport (2015). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/470231/vtts-phase-2-report-issue-august-2015.pdf

[D] *'Understanding and Valuing the Impacts of Transport Investment: Values of travel time savings',* Department for Transport (2015). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/470998/Understanding_and_Valuing_Impacts_of_Transport_Investment.pdff

[E] '*Understanding and Valuing the Impacts of Transport Investment: Values of Travel Time Savings, Consultation Response',* Department for Transport (2016). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/544165/understanding-and-valuing-the-impacts-of-transport-investment-values-of-travel-time-savings-consultation-response.pdf

[F] *'TAG unit A1.3: User and Provider Impacts'*, Department for Transport (2017). https://www.gov.uk/government/publications/webtag-tag-unit-a1-3-user-and-provider-impacts-march-2017

[G] Letter of corroboration from the Chief Analyst, Analysis and Science Directorate, UK Department for Transport, 16 December 2020.

[H] Batley R, Dekker T, and Stead I (2020). Worthwhile Use of Travel Time and Applications in the United Kingdom. *International Transport Forum Discussion Papers*, No. 2020/04, OECD Publishing, Paris. https://www.itf-oecd.org/worthwhile-travel-time-uk

[I] Letter of corroboration from the Chief Economist, New Zealand Ministry of Transport, 6 November 2020.