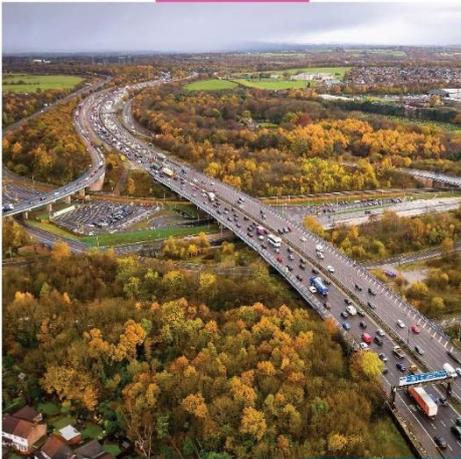


DFT APPRAISAL AND MODELLING STRATEGY

TRANSPORT FOR THE NORTH
COORDINATED NORTHERN
RESPONSE



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Transport Analysis, Modelling and
Economics (TAME) team

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INTRODUCTION

1. The Department for Transport (DfT) has launched a consultation exercise to gather views on the scope and priorities for their new Appraisal and Modelling Strategy to help ensure that their guidance, WebTAG, remains best practice and addresses the likely future challenges facing practitioners and decision makers conducting transport appraisal.
2. The Strategy aims to provide robust, flexible and easy to use modelling and appraisal tools that can be used to inform the critical policy decisions that will be made over the next five years. The DfT consultation sets out their initial views within five key themes and provides initial views on priorities. The themes are:
 - **People and place** – emphasises the importance of understanding cities and the urban realm, built environment, well-connected communities and wellbeing. More advanced analytical methods are required to value improved journey experiences and the value of place for both individuals and communities.
 - **Reflecting uncertainty over the future of travel** – the future of travel is highly uncertain, largely due to a combination of technological and behavioural uncertainties. Need to develop understanding of emerging and future technologies and better tools to capture and communicate uncertainty to decision makers.
 - **Modelling and appraising transformational investments and housing** – Northern Powerhouse Rail and the Trans-Pennine Tunnel are referenced as examples where the strategic objectives of major schemes extend well beyond 'traditional' transport outcomes and productivity benefits beyond those generated by agglomeration effects.
 - **Supporting the application of WebTAG and making it more user friendly** – including options for building capability including; use of case studies; sharing of best practice and clearer guidance.
 - **Developing and maintaining modelling and appraisal tools to meet user needs** – recognises that different sources of evidence and modelling approaches may be needed in future. Emphasis on 'big data' in transport models, strengthening the link with evaluation and better use of evidence.
3. Transport for the North (TfN) have worked with practitioners in partner organisations to coordinate this Northern level response to the DfT's consultation. We have also consulted the Northern academic community and the transport consultancy supply chain in preparing this response, although it should not be interpreted as representing their views. It is also

important to note that the TfN response focuses on issues that are particularly important for pan-Northern, regional-level transport planning, and that there are many very important local transport issues not covered, on which TfN partner organisations will respond separately. In this context, this response provides a collective view as to where DfT should focus efforts to strengthen and expand current guidance, as well as focus areas for research.

4. TfN welcomes the draft Strategy as a further step towards an appraisal system which can better represents transformational investment and wider economic impacts. Whilst important steps have been made towards a more rounded approach to appraisal beyond value of time measurement, TfN's Northern partners continue to express concerns about the focus of WebTAG and perceive the system to be skewed against investment in Northern transport schemes. Many of the areas identified in the Strategy reflect TfN analytical priorities and the approach to appraisal outlined in the draft TfN Strategic Transport Plan published in early 2018.
5. There are areas where the Strategy could either be improved or strengthened. Some of these reflect wider weaknesses within the DfT, such as the separation of road and rail planning, and the limited focus on programme and portfolio level appraisal. There are a number of areas which the Strategy could have covered – particularly the rebalancing agenda, employment and skills.
6. The draft response reflects the technical nature of the consultation and focuses on the specific and practical “pain points” faced by practitioners working on Northern business cases. It uses the approaches TfN has developed on modelling tools, scenarios and economic appraisal to illustrate where the department should be focusing its efforts. The wider challenges for the consultation include:
 - a) **Rebalancing** – This is one of the Government's key aims, something TfN and Partners fully support, and this is reflected in the recent 'Rebalancing Toolkit'. However, the toolkit is relatively qualitative and is not particularly well integrated with the rest of WebTAG. The Parliamentary Transport Committee Rail Infrastructure Investment inquiry raised this issue in its report (as did TfN and Rail North in their evidence to the committee). The Government's response to the committee suggested that issue would be addressed in this consultation. Not progressing the rebalancing agenda will increase the perception of bias in the appraisal process against Northern projects.
 - b) **People and place** - The emphasis on wellbeing, community and amenity is welcome, but more needs to be done to quantify these impacts and build them directly into the economic case and the assessment of economic welfare. We need an integrated holistic view that recognises the interaction of transport with other sectors, including first order links to local economic growth, public health and safety,

energy, digital and housing, and second order links to areas like crime or education achievements.

- c) **Continuation of research into agglomeration with renewed ambition** – It is important that the Department continues its paused research into agglomeration and ensures that this study retains its ambitious objectives to broaden and deepen the evidence base, particularly around:
- agglomeration over longer distances and for polycentric regions;
 - dynamic effects based on analysis of time-series data if possible;
 - specialisation vs urbanisation effects, which may be particularly relevant for industrial clusters in the north of England.
- d) **Proportionality** – provide clearer guidance on what level of analysis is proportionate at different stages of scheme development for different types of scheme. Current approach leads to doing more than is required in some areas and less in others.
- e) **“WebTAG compliance”** - rigidly adhering to WebTAG guidance is likely to be the lowest cost and safest option for most scheme promoters. The Department could be more proactive in publishing examples of successful business cases that have used innovative modelling and appraisal. It is important that WebTAG stimulates innovation in transport modelling and appraisal. There is a risk that a set of guidance that is perceived as prescriptive stifles innovation and prevents the industry from making progress in developing robust new tools and techniques.
- f) **Data availability** – the consultation rightly recognises inter-regional trade data and spatial planning data as two key areas where Central Government could take a stronger lead in coordinating standardised, regularly updated national datasets.
7. TfN are also soon to launch a new Data, Modelling & Appraisal Strategy, which echoes the key messages of this response and provides more detail on TfN’s plans to address some of the issues raised. The TfN Strategy is well aligned with the DfT Strategy, covering issues such as shaping new travel markets in an uncertain future; and enhancing the transport system’s user experience. Whilst there are overlaps, TfN’s strategy is focused on the specific challenges TfN and partners face with planning a sequenced portfolio of transport infrastructure investment spanning up to 30 years and across the whole of the North of England.
8. To ensure future investment planning is fair, and to provide great planning efficiencies, TfN believe there is now a real opportunity for practitioners to present decisions makers with one voice for: data;



forecasting; and investment decisions. This theme is at the heart of TfN's Strategy and should also feature strongly in the DfT Strategy. This will require new approaches to modelling and appraisal to allow greater exploration of strategic and economic narratives, as well as adding key missing data, modelling and appraisal ingredients to better understand market creation and shaping. As well as working towards a fair modelling and appraisal system, and a more efficient operating model for the North's business case activities, the framework also focuses on providing consistent quality and providing proportionality with a 'right-first-time' goal.

Consultation Questions and response

Consultation Question 1: *Do you agree that these themes reflect the most pressing priorities for development of our Appraisal and Modelling guidance? If not, what other themes do you think we should be exploring?*

10. The themes set out in the consultation are broadly welcomed and reflect the fact that the Department is listening to concerns of stakeholders and practitioners in the North. There is a strong alignment between these themes and the emerging TfN Data, Modelling and Appraisal Strategy, and TfN believe there is significant scope for the Department to collaborate on research and development with TfN and partners to rapidly improve the evidence base and build confidence in new approaches.
11. There are three key areas that we believe are not sufficiently covered by the five themes, as listed below.

Rebalancing the economy

12. Rebalancing is one of the Government's key aims, and this is reflected in the Department's recent 'Rebalancing Toolkit'. However, the toolkit is relatively qualitative and is not particularly well integrated with the rest of WebTAG. There are several analytical issues related to this theme that the Department could begin to address in a more quantitative way. Illustrative examples are listed below.
 - a. **Wider infrastructure costs** – If a large-scale programme of transport related investment supports net migration into regions like the North from London and the South East, there may be a resource and public expenditure saving due to the lower marginal cost of increasing the provision of wider infrastructure (water, waste, electricity etc.) and public services (hospitals, schools etc.). We understand that the National Infrastructure Commission is considering research in this area, and we would support the involvement of the Department in this research.
 - b. **Economic resilience** – The UK economy is highly dependent on financial services in the City of London, which can be vulnerable to wider global uncertainty, making the UK economy less resilient overall. Programmes of transport investment outside London that help to support skilled employment growth in a more broad-based range of markets will help to increase the resilience of the UK economy. More research and analysis to quantify the value of that resilience to the economy, perhaps in collaboration with HM Treasury, would be welcomed.

Employment and skills

13. One of the major economic issues that TfN and partners are trying to address is the lack of skilled workers and well-paid, productive jobs in the North. We do not believe the consultation sufficiently covers some of the key analytical issues and questions surrounding labour markets. Illustrative examples are listed below.
 - a. **Labour and skills market failures** – Inadequate transport can be a barrier to matching people to jobs or training, leaving people staying in unemployment longer or taking a job that does not match their skillset.

Guidance on whether and under what circumstances this constitutes a market failure would be welcomed.

- b. **Full valuation of employment** – Related to the discussion on rebalancing above, moving a person from unemployment to employment in a region with structural unemployment can be more valuable than in a region with a well-functioning labour market. We would welcome consideration of whether WebTAG can provide guidance on appraising this. There could be linkages with the Department for Work and Pensions (DWP) who already try to account for: social impacts; reduction in NHS costs from movements into work; etc.
- c. **Linking existing housing to jobs** – The dependent development guidance covers the value of new development, but there is limited guidance on valuation of making existing, vacant housing stock more attractive by improving access to employment. This is perhaps a more relevant issue in the North of England than it is in London, where housing capacity is constrained, and new development is essential.

Pain-Points

- 14. From a practitioner's point of view a well-balanced strategy should not only explore new modelling and appraisal approaches but should also look at areas associated with practical delivery of analysis that are currently taking significant resources away from developing strong economic cases. To illustrate this, we have highlighted set of high-level pain-points to stimulate discussion and ensure that practitioner voices are more fully represented.
- 15. Pain-points are not merely operational issues but also limitations that have restricted the ability of practitioners to deliver against objectives. Due to the wide variety of circumstances facing different transport authorities this is particularly prevalent in developing a fair planning system whilst trying to find efficiencies. Practitioners have worked hard to find the best balance for this dichotomy, but this remains a significant challenge and may require more radical solutions.
- 16. TfN have undertaken their own assessment of current modelling and appraisal pain-points, split into three sub-groups of: data and model consistency; model purpose and specification; and computer resources. All three of these sub-groups could feature in guidance and have therefore been included in this document and are summarised below.
- 17. Data & Model Consistency Pain-Points: Combining models and appraisals from different projects, can introduce error and is computationally difficult. Issues include:
 - a. **Disparate zoning systems** – Dealing with disparate zoning systems can introduce significant error and waste substantial effort.
 - b. **Base model misalignment** – Dealing with misaligned base models can introduce significant error and waste substantial effort.
 - c. **Poor local representation** – Aggregate models can substantially dilute the local representation within models and to such an extent that models

report low levels of congestion but the user experiences substantially higher levels.

- d. **Poor data standards** – Dealing with errors in the basic definition of data within models can cause gross-error and can waste substantial effort.
- e. **Lack of local data** – Many data and parameters are normalised from a wide variety of sources and presented as nationally representative. Some data and parameters are of unknown origin, definition or quality.

18. Model Purpose & Specification Pain-Points

- a. **Model runtimes limiting exploration** – Excessive transport model runtimes are limiting 'transport planning' exploration. Such models are designed to better represent capacity and build robust economic cases. However, they are not appropriate for exploration, and their use can result in substantial effort being expended with limited exploration in return.
- b. **Limited model functionality** – Existing transport models can have restricted functionality that can limit their usefulness for exploration.
- c. **Limited segmentation** – Existing transport models can have limited traveller segmentation that does not allow a full understanding of the user experience or building a compelling economic narrative.
- d. **Integration of innovative approaches** – Due to uncertainty over the extent to which innovative approaches will be considered, current modelling and appraisal often has limited focus on estimation of non-standard benefits, dynamic impacts of mega-projects, or the combined impacts of interventions at the programme and portfolio level. We acknowledge that these issues are considered in detail in the consultation, and we provide further comments below, but include this point here for completeness.

19. Computer Resources Pain-Points

- a. **Difficulties using the latest algorithms and hardware** – Conventional models often use processes and algorithms optimised for the efficient use of early computer resources (with roots as far back as the 1970s), and do not easily adapt to new approaches and technologies, for example data parallelisation required to exploit advanced Graphics Processor Unit (GPU) technology. This means we live with long model runtimes, which can cause quality and delivery problems as described above.
- b. **Inconsistent IT platforms and software** – Misunderstanding of the optimal approach for running models and holding data can create significant inefficiencies.

- c. **Limited data sharing** – Misunderstanding of the optimal approach for transferring data can create significant inefficiencies.

Addressing Pain-Points

20. We believe that many of these pain-points can be addressed, particularly if a coordinated approach is taken by practitioners across the UK. WebTAG could potentially be a vehicle for providing this level of coordination, with these issues being considered as priorities for strengthening existing guidance and for expanding guidance and research. This could either be done by expanding existing consultation themes or potentially highlighting the need for a new theme, but this could be decided at a later stage if the DfT chose to undertake a pain-points assessment of their own as part of their strategy development.
21. TfN have undertaken an assessment of how the pain-points could be addressed and have critiqued these into three separate groups of: 'Operations'; 'Enablers'; and 'Focus Areas'. The Operations group is largely associated with resource and quality management which does not seem to naturally fit in the DfT's strategy, and therefore is not included in this document.
22. The Enablers group has been further split into two sub-groups of: 'Modules and Interfaces'; and 'Cloud Solutions'. Both sub-groups could feature in guidance and are summarised below.

23. Modules and Interfaces

- a. **Modularisation** – Building strong interfaces between models to allow different options to be combined, thereby avoiding tie-in to single software suppliers or models. This allow better integration and compatibility of models, as well as time and resource efficiency.
- b. **Consistent interfaces** – Introduce standardisation to make data and models more accessible, work towards high levels of data interoperability and have reporting at different levels of access, from expert modellers to members of the public.

24. Cloud Solutions - Moving to cloud based 'Virtual Machines' (VMs) and file storage, and so:

- a. providing **scalable computing** for use as a modelling platform and data analytics platform, with scope for introducing GPU and machine learning enhancements;
- b. allowing the **sharing** of VMs in the model and appraisal ecosystem, allowing upload to and download from common file share, saving double handling of data; and
- c. providing a **more cost-effective** platform in terms of software and hardware costs.

25. The Focus Areas group has been further split into two sub-groups of: 'Data & Model Interoperability'; and 'Reducing Aggregation in Useable Models'. Both

sub-groups could feature in guidance and have therefore been included in this document and are summarised below.

26. Data & Model Interoperability

- a. **Consistent base data and forecasts** – This should be given a high priority in the first 18 to 24 months as it is likely to remove many of current pain-points.
- b. **Automating the development of zone correspondence** – This is feasible as data is consistently held at property or full postcode level throughout England, and with sufficient coverage for the rest of mainland Great Britain.
- c. **Automated & consistent model components** – There are numerous options to automate the creation of model components, including travel matrices and basic networks. This could introduce significant quality improvement and consistency, and cost efficiencies.
- d. **Develop data model** – A unified data model could lead to seamless data interoperability.

27. Reducing Aggregation in Useable Models

28. WebTAG contains strong guidance for developing conventional transport model and appraisal tools to check operational performance and to develop a robust economic case. However, such tools are often too detailed for exploration of new transport scheme options and simplified faster-running models may be required. Tools of this nature do exist but are often used for exploring marginal changes (e.g. elasticity based models), rather than the 'transformational' impacts of potential mega-projects, or large portfolios of schemes.

29. As such the key focus area for expanding WebTAG should be the development of exploratory tools, appropriate for market shaping and more transformational mega-projects, programmes and portfolio. This type of tool is more likely to be developed in partnership with the DfT and regional or devolved government due to its scale, cost and its enhanced ability to explore and set policy. Key features include:

- a. high-level of segmentation;
- b. short runtimes;
- c. application of aggregate transport supply modelling or more abstract supply models.

30. To help focus the strategy for the first 18 to 24 months it would therefore be useful to recognise the continued need for two-tier model architectures, with the upper-tier holding an exploratory tool and the lower-tier holding a conventional transport model, with a focus on the exchange of information between the two modelling tiers. Following this, the strategy should focus on ways of improving the exploratory nature of the upper-tier tool, and for both tiers investigating ways to achieve useable runtimes and reduce the dumbing-down effects of aggregation.



31. This area is particularly relevant to the 'Reflecting uncertainty over the future of travel' theme, which is covered further below.



Consultation Question 2: *What considerations should inform the scope and priorities of our strategy, particularly over the first 18-24 months?*

Guidance Context

32. The DfT's WebTAG has served transport modelling and appraisal practitioners well. It has provided an interpretation of the HM Treasury's Green Book that rivals any other department's efforts and has enabled robust economic cases to be developed consistently across England as part of the DfT's funding process. However, current WebTAG has largely evolved in the context of funding applications and has a bias towards addressing marginal market failures. These cases are characterised by excessive levels of congestion restricting the economy, meaning a strong economic case can be presented by relieving this congestion. This includes congestion forecast through DfT's National Trip End Model (NTEM) Central Scenario forecast and related processes. The use of the NTEM Central forecast, and the associated WebTAG appraisal, has provided a practical and proportional approach for transport authorities to seek funding for local projects, and has enabled cost-effective support from private sector consultants. Being able to develop robust economic cases in this context should continue and options for improving this area could be categorised as *strengthening* existing WebTAG, which could be captured in updates to current WebTAG units.
33. In contrast to cases of marginal market failure, persistent poor transport connectivity over a period of decades can lead to non-marginal, or structural market failure, whereby peoples' behaviour and the pattern of economic activity adapt to 'make do' with the status quo. In such cases, a 'market shaping' approach may need to be considered¹ to achieve long-term regional socio-economic objectives and kick-start economic interactions between areas in a concerted, coordinated way. There has been significant development on how frameworks, like TfN's Analytical Framework, should be applied to enable an objective led approach to shaping markets, and as part of moving focus to re-balancing the UK economy and better understanding the user experience. This includes how frameworks can be used to provide a fair way to understand programme and portfolio level investments, as well as enabling consistent quality and providing significant efficiencies for local projects belonging to constituent transport authorities.
34. Programme and portfolio level investment, as well as 'mega-projects'², is more likely to be considered by DfT in partnership with regional and devolved government. Such scale could result in the development of regional guidance for transport planning to best meet the needs of specific regions. This could principally include advice on tools that allow regional planners to explore regional policy, with a focus on shaping markets. Such tools may be

¹ UCL, Institute for Innovation and Public Purpose, The economics of change: Policy and appraisal for missions, market shaping and public purpose, July 2018

² Mega-project definition: substantial capital costs that have transformational effects felt at a regional and even national level

unaffordable to many transport authorities and WebTAG does not cover guidance for this area well. Therefore, options within the context of exploring economic narrative for mega-projects, programme and portfolio levels could be categorised as **expanding** WebTAG, which could include introducing new, and potentially regional, WebTAG units.

35. Within either category of strengthening or expanding WebTAG there are areas of missing evidence that require more detailed investigation before formalising into either national or regional guidance. This is a key area for collaboration where the DfT can work in partnership with the regions to develop evidence to support areas currently with limited or no guidance. And this may be essential to cover the variety of research areas and could see regions specialising in different areas of guidance to feed into a wider collaboration, coordinated by the DfT. Any options within this context could be categorised as **research**, which would feed into existing or new WebTAG units.

Prioritisation

36. The DfT Strategy should adopt a 'balanced portfolio' of WebTAG improvements. This should reflect that strengthening current WebTAG units is likely to represent the quickest Return on Investment (RoI). Consequently, expanding WebTAG through the introduction of new units can be expected to have a slower RoI and research into new evidence to support WebTAG can be expected to have the slowest RoI.
37. It would therefore seem prudent to spread the priorities within these three improvement areas with the strongest early focus on strengthening existing units and then on introducing new units. That way practitioners are most likely to see early value from implementing the strategy, while planning begins on the introduction of new units and research, both which have inherently longer lead times.
38. It would also seem prudent to take a detailed look at practitioner's current pain-points described above as part of the strategy development exercise and augment WebTAG units with improvements targeted at tackling these. Tackling pain-points will require improvements within all three improvement areas (of strengthening, expanding and research) and by adopting this approach practitioners will have greater appreciation of and connection to the strategy. This should therefore go a long way to meet a key aim of the strategy for more robust, flexible and easy to use modelling and appraisal tools.
39. In this context, the strategy should prioritise the areas listed below.
- a. The strategy should recognise that transport impacts much more widely on the economy, society and environment, and a key feature of the strategy should be to capture a more holistic 'systems' view in modelling and appraisal.
 - b. The strategy should recognise limitations of narrower 'predict-and-provide' approaches and towards a 'vision-and-validate' approach in which a planner can test a policy vision against a range of futures.
 - c. The strategy should accept that we need to achieve better representation of the constraints that people and businesses experience, but this must not be at the expense of retaining model speeds to explore many futures.



- d. The strategy should recognise that exploration needs a more dynamic land-use / transport interaction model with many model timesteps that better match real population and business behaviours and show how better connectivity enhances an area's attractiveness.
- e. The strategy should consider the most relevant segmentation of people and businesses for understanding the impacts of interventions within an uncertain future and should consider new segments that are more likely to experience change up to 2050.
- f. The strategy should consider a system that can model the accumulative effect of sequencing many individual interventions within the whole lifecycle of an investment programme or portfolio.
- g. The strategy should look to exploit new technology & data parallelisation to try and keep model runtimes useable.

40. More detailed consideration on the priorities by theme are covered in following sections as answers to the remaining consultation questions.

Consultation Question 3: *What should be our priorities for improving the appraisal of people and place and why? Please select up to three areas.*

41. The three areas identified for improvement are listed below.

42. **Welfare valuation of place attractiveness** – Transport can improve the attractiveness of places to business and individuals through improving accessibility, and also enabling regeneration and improvements to urban realm. These improvements can manifest as land-value uplift, which is relatively straightforward to estimate and measure post-hoc. However, there remain concerns about combining these measures with transport user benefits and agglomeration for fear of double-counting or missing important components of benefit. We believe that there is scope to moving towards a consistent, unified framework for estimating net welfare impacts, based on a number of existing methodologies^{3,4}. We do not underestimate the risks and challenges associated with attempting this, as it would require a relatively fundamental re-assessment of how we apply transport economics in practice. However, we believe the value of achieving this would be very high. Ideally, this framework should be standardisable and agnostic to modelling software so that a wide range of scheme promoters and practitioners can apply it.

43. **Holistic Systems View** – There is an increasing awareness of the interaction of transport with other sectors, including first order links to local economic growth, public health and safety, energy, digital and housing, and second order links to areas like crime or education achievements. WebTAG is focused on the transport system and does cover 'one-way' first order links of transport system to other sectors. However, there is a growing need to take a more holistic 'systems' view and capture the 'two-way' interdependencies between different sectors, and understand both first and second order linkages. Increasing collaboration between the Department for Transport and other Government and non-governmental organisations in these fields is to be welcomed, particularly where efforts are made to develop analytical frameworks to assess multi-sector systems. There is scope to improve the evidence base in key areas of existing WebTAG, and significant areas to expand WebTAG to cover the wider systems view. Examples of areas for improvement include:

- a. a more quantitative approach to distributional analysis, assessing the wider welfare and equity impacts of transport interventions;
- b. interactions with the energy sector as electric vehicles are increasingly used;
- c. public health impacts from air pollution and active travel;
- d. resilience of transport infrastructure to a changing climate with more extreme weather events;

³ James Laird (2015) Working Paper "De-bunking the convention that the rule of half is only appropriate with fixed land uses"

⁴ David Simmonds (2012): Developing land-use/transport economic efficiency appraisal. Paper presented to the European Transport Conference, Glasgow, 8-10 October 2012



- e. place-attractiveness externalities (e.g. does cycling make areas more attractive to non-cyclists?);
- f. the tourist economy, particularly around international gateways; and
- g. interactions with perceived and actual crime rates as places become more accessible.

44. There may also be a need to review the models capable of assessing these interactions, such as system dynamics models, and how sharing data between separate modelling systems could be optimised. Transport Systems and Future Cities Catapults have undertaken significant research into this area and could provide valuable lessons learnt and support going forwards.

45. **Improving evidence on customer experience** – We welcome proposals to improve the evidence base on the Value of Travel Time Savings (VTTS) under different conditions. We suggest that the focus on customer experience and journey quality is prioritised. Examples include:

- a. the impacts of technology (real-time information, on-train Wi-Fi) on perceived journey time and interaction with other Generalised Journey Time parameters (e.g. crowding, wait, interchange);
- b. comfort from new rolling stock, particularly in situations where existing rolling stock is very old;
- c. highway reliability and resilience; and
- d. freight reliability and resilience, where we believe there may be useful data available from freight operators if it can be collected in a commercially sensitive manner.

46. We also request that any new survey data is made available at a disaggregate level to allow regional or further segmented analysis.

Consultation Question 4: *What should be our priorities for improving our understanding and treatment of uncertainty in modelling and appraisal and why? Please select up to three areas.*

48. TfN's remit is to develop a long-term Strategic Transport Plan for the North of England, and is therefore primarily focussed on long-term uncertainty. We believe that scenario analysis is best suited to this type of long term planning, and our response is therefore focussed on the scenario approach to uncertainty, rather than trying to empirically estimate the probabilistic variance in transport outcomes using bottom-up methods. However, we acknowledge that this may be an important area for other transport bodies who are more focussed on short term operational delivery of transport systems.

49. The three areas identified for improvement are listed below.

- a. **Ensuring decision makers look beyond the NTEM Central forecast**
 - The Department should commit to work with decision makers to ensure that the central scenario is not the only one considered, otherwise scenario and sensitivity analysis has limited value. We understand that this can only be achieved if the quality, balance and presentation of scenario and sensitivity analysis is improved, but the argument will be somewhat circular if promoters and practitioners perceive that the central scenario is the only one considered in the decision-making process. We are currently engaging with the Department on a number of projects with regards to a variety of future scenarios. This is highlighting the need to first explore what types of scenarios should be used to support different objectives and economic narratives. It is also identifying significant areas for collaboration in developing future scenario travel matrices, and how they should be most effectively applied. Moving towards a more balanced consideration of scheme performance across a range of scenarios is often referred to as a 'vision-and-validate' approach, in contrast to the traditional 'predict-and-provide' approach in which capacity is provided to accommodate a narrow central estimate of future demand. We would welcome a move to such an approach.
- b. **Examples of best practice presentation/visualisation** – One of the challenges associated with assessing a scheme against a wide range of scenarios is that decision-makers need to come to an overall view based on a range of numbers. This is particularly acute if different levels of benefit, associated with wider impacts and land-use change, are being considered. Clearly the way to improve this process is through high quality, insightful data visualisation. If the Department could publish successful examples of best practice in the presentation and visualisation of uncertainty, this would be very welcome to help provide value and insight from the analysis. This could include graphs, colour coded tables or infographics.
- c. **Guidance on trade-offs between model complexity and scenario analysis** – Plans made at project inception to run many scenarios and sensitivities are often de-scoped due to the time taken to run the analysis through complex transport models (and in some cases land-use models). To make better use of scenario analysis, we believe better



consideration needs to be given to simplified models or meta-models more adapted to exploration (simplified representations of detailed models, calibrated to a detailed model where possible). Indeed, such models may be all that is needed in early stages of assessments. As well as enabling a wider range of scenario analysis, using simplified models can also help to provide insight and reduce confusion that often arises from 'model noise'. Alongside guidance on scenario analysis, we would welcome guidance regarding the Department's appetite for use of less complex models, and the types of calibration and validation that would be required to build confidence in their use.

Consultation Question 5: *What do you see as the main challenges to adopting a more sophisticated approach to uncertainty in Business Cases and what suggestions do you have for overcoming these?*

50. The key challenges identified to adopting a more sophisticated approach to uncertainty in Business Cases are listed below.

- a. **Which scenarios to design the scheme for** – Business case development requires a scheme to be designed for a certain level of future capacity. Whilst the 'predict-and-provide' approach steers decision makers towards providing the minimum capacity required to deliver the central demand forecast, the 'vision-and-validate' approach might lead decision makers to favour schemes that future-proof the network to scenarios with higher levels of demand. This issue could be amplified where it is expected that there could be high levels of induced demand from land-use change in response to the scheme. Furthermore, schemes are rarely tested against a 'bad day' scenario in which there is significant network disruption due to roadworks or extreme weather. There is a risk that designing schemes for the central scenario lead to capacity that is rapidly congested and lacks resilience to disruption. Alternatively, interventions, programmes and even portfolio level investment could be considered in the context of a number of carefully selected future scenarios (that best test objectives and economic narrative) and then should go through a process of evolution / optioneering so that the interventions have an optimal design considering all possible future scenarios.
- b. **Policy uncertainty** – A major area of future uncertainty in travel demand is Government policy, including fuel taxes, fares policy, road pricing and land-use planning policy. Whilst we recognise the political sensitivities associated with some of these issues, relatively clear guidance on scenarios for these issues would be welcome. For example, there is a high-level commitment to stop sales of purely fossil-fuelled vehicles by 2040 – to what extent should this be taken into account in highway modelling? DfT and the regions should work in partnership using exploratory tools best suited for developing policy. This policy exploration could help frame some of the future scenarios used for modelling and appraisal of interventions.
- c. **Uncertainty relating to different results from different tools** – A two-tier modelling system remains the preferred approach to: firstly explore economic narrative (upper-tier, dynamic land-use); and secondly check operational performance and provide a robust economic case (lower-tier, detailed transport model). There are challenges associated with both transferring aggregate and abstract transport supply models from the lower-tier to the upper-tier, and transferring travel matrices from the upper-tier to the lower-tier. Uncertainty arises in the need to demonstrate that the two modelling tiers have similar traveller responses. TfN have significant lessons learnt in the challenges likely to be faced and as part of the 'one voice' proposition is developing the Analytical Framework to represent the entire North, cascading forecasts down into satellite conventional transport models to check operational performance and provide a robust economic case.

Consultation Question 6: *What should our priorities be for improving the modelling and appraisal of transformational investments and housing and why? Please select up to three.*

51. We propose that a transformational investment can be defined as one which:

- a. is designed to achieve a set of specific strategic goals, leading to a vision of the future to be validated by modelling and appraisal;
- b. changes behaviour in a significant way, creating new opportunities and shaping new markets rather than fixing existing market failures⁵;
- c. delivers step-changes in connectivity, leading to step-changes in the levels or patterns of transport demand; and
- d. changes the patterns of economic activity and development, such that Supplementary Economic Models are needed to assess impacts (such as TfN's Northern Economy and Land-Use Model – NELUM).

52. The three areas identified for improvement are listed below.

53. **Data availability for SEMs** – As noted in the consultation, Supplementary Economic Models (SEMs) are particularly data-hungry. The consultation rightly recognises inter-regional trade data and spatial planning data as two key areas where Central Government could take a lead in coordinating standardised, regularly updated national datasets. We would also like to highlight the importance of regional and national time-series datasets, making use of modern data synthesis techniques where observed data is not available. Key examples are listed below.

- a. Accessibility: Historical accessibility datasets, comprising of road, rail, bus, light rail and walk travel times at a spatially disaggregate level (e.g. LSOA geographies).
- b. Households: Synthesised datasets on household and housing characteristics (household structure, income, occupation, housing type etc.) at a spatially disaggregate level (e.g. LSOA geographies).
- c. Businesses: Synthesised datasets on employment and business characteristics (sector, skill level, average wages, commercial property type etc.) at a spatially disaggregate level (e.g. LSOA geographies). The Health and Safety Laboratory's National Population Dataset⁶ (NPD) is one potential source of this data, synthesised from sources such as the Inter-Departmental Business Register (IDBR) and the property datasets from the Valuation Office Agency.

⁵ UCL, Institute for Innovation and Public Purpose, The economics of change: Policy and appraisal for missions, market shaping and public purpose, July 2018

⁶ HSE's Health and Safety Laboratory (HSL) National Population Database (NPD) for use in transport modelling, 2004 to 2018

54. These datasets could have a wide range of uses to help improve the evidence on the wider economic impacts of transport, as listed below.

- a. *Statistical analysis* – Many important statistical studies of wider economic impacts⁷ from transport have used cross-sectional data. However, the impacts of new transport investment are by their nature causal and dynamic, involving feedback loops and endogenous effects (e.g. relating the income and displacement, i.e. gentrification). It is possible that cross-sectional analysis is inappropriate for estimating the dynamic impacts of a new transformational transport scheme. It should therefore be a high priority to develop time series data for any new statistical studies on wider impacts, such as the forthcoming agglomeration elasticities project. As a case study, the Department could consider the University of Leeds Land Value Uplift study⁸ TfN is currently co-funding with West Yorkshire Combined Authority. This project is developing cross-sectional Hedonic Pricing and Geographically Weighted Regression models for the property market and comparing these to a time-series Difference-In-Difference analysis over a smaller study area.
- b. *Dynamic calibration of SEMs* – SEMs are often criticised for a lack of detailed calibration and validation, in contrast to transport models where there are rigorous requirements for calibration and validation. As SEMs are often dynamic models, which use feedback loops and small time-steps, a key way to test and calibrate their performance would be to produce historical time-series datasets to enable a ‘back-casting’ exercise. By either illustrating that the models reproduce the time-series data well, or by calibrating their parameters to match the time-series data more closely, this would help to build confidence in their use for modelling and appraisal.

55. Commitment to improve confidence on appraisal with land-use change

– This priority is closely linked to priority 1 under ‘People and place’. If we are able to develop a standardised system for appraising changes in place attractiveness that avoids double-counting impacts, it would follow that we can begin to use SEMs in transport appraisal with more confidence. We would encourage the Department to continue to evolve the WebTAG guidance in this area as the evidence base and levels of confidence improve. Ideally this would lead to ‘Level 3’ benefits or dis-benefits (i.e. with land-use change) being viewed with less caution by decision-makers. Publication of case studies in which SEMs have been used and properly considered in the economic case would be a welcome step forward, as it would give scheme promoters and practitioners more confidence to invest time and effort in developing this area of transport appraisal.

⁷ Nellthorp, J., Johnson, D., Ojeda Cabral, M. and Laird, J. (2016). Transport and Land Value Uplift: Evidence and Implications for Appraisal, Modelling and Strategy. Report to WYTRIF. Leeds: ITS.

⁸ Reference TBA



56. **Continuation of research into agglomeration with renewed ambition** – It is important that the Department continues its paused research into agglomeration and ensures that this study retains its ambitious objectives to broaden and deepen the evidence base, particularly around:

- a. agglomeration over longer distances and for polycentric regions;
- b. dynamic effects based on analysis of time-series data if possible; and
- c. specialisation vs urbanisation effects, which may be particularly relevant for industrial clusters in the north of England.

57. Our answers to question 1 on the overall priorities of the consultation are particularly relevant to this theme. 'Rebalancing the economy' and 'Employment and skills' effects are key missing impacts of transformational schemes not adequately considered by this consultation.

Consultation Question 7: *What transformational impacts do you currently find it difficult to represent in a scheme appraisal? What are the barriers to their inclusion and how would you suggest these are overcome whilst maintaining a consistent and robust approach?*

59. Challenges TfN has experienced include the items listed below.
60. Promoting transformational schemes which have a relatively limited conventional transport case, but a stronger strategic and wider economic case. Improved confidence in the estimation of 'Level 3' impacts would enable these schemes to be considered on a fairer basis against more incremental schemes with a stronger conventional economic case.
61. Developing exploratory Land Use Transport Interaction (LUTI) models that balance detailed representation with model runtimes that allow many scenarios and scheme variants to be tested. We believe we have arrived at a reasonable compromise, but further work is required to optimise this balance.
62. Feeding transformed, re-distributed travel markets taken from our Northern Economy and Land Use Model (NELUM), down into our conventional transport models, because traditional trip-end modelling imposes constraints to the base year, based on the Furness process. Further work is required to understand whether a new approach trip distribution estimation may be required to properly integrate land-use and transport models.
63. Incorporating spatial planning data and modelling structural changes to land use in conventional transport models. Most modelling techniques involve pivoting off a previous year but this is not applicable if the change in land-use is structurally different from the previous year. This may also be an issue for LUTI models. Seeding future year distributions into the previous year used as a pivot has had some degree of success.
64. Developing models that can represent long-term, sequenced programme and portfolio level investments. Conventional tools are designed for single major scheme assessment. However, programme and portfolio level investment can feature a single opening year due to restrictions of model runtimes. Use of the exploratory tools to optimise the sequence according to which interventions are operational should help overcome this.
65. Reducing dumbing-down effects associated with averaging over limited traveller segments. Moving to dynamic models with multiple feedback loops for a variety of traveller and business responses should be better than equilibrium models that aggregate many responses into a single time-step. This will also help model positive or negative feedback loops, for which suitable restraints are necessary.
66. Reducing dumbing-down effects associated with averaging over space and time, including weather and seasonal scenarios. Most benefits are likely to be captured in the highest levels of congestion. Using averages that smooth away peaks of congestion are likely to dumb-down responses and underestimate benefits that might be skewed toward busier periods. This also affects the representation of the customer experience.



67. Current WebTAG parameters and outturn elasticities used to calibrate transport models are expected to have been collated from more marginal cost changes, although the precise origins may not be known. This may underrepresent the responses for large cost changes represented in transformational change.



Consultation Question 8: *What are the main barriers and challenges to applying WebTAG? How do you think these could be overcome?*

Consultation Question 9: *What more could be done to articulate the flexibilities in WebTAG and support scheme promoters apply the guidance?*

69. We have opted to answer these two questions together as the main barrier we have experience in applying WebTAG is the lack of flexibility, perceived or otherwise. The key issues are listed below.
70. **WebTAG compliance** – The Department has been clear that there is no such thing as ‘WebTAG compliant’, meaning that robust analysis of scheme impacts will always be considered, regardless of whether it is explicitly described in WebTAG or not. This message is welcome, but experience suggests this is not widely understood, either inside or outside the Department. Rigidly adhering to WebTAG is likely to be the lowest cost and safest option for most scheme promoters, which is a key reason why most business cases are developed in this way. As discussed above, if the Department could publish examples of business cases that have used modelling and appraisal creatively, including how the Department assessed the robustness of the analysis, this would be a welcome addition to the guidance.
71. **Innovation** – In addition to providing a degree of consistency, it is important that WebTAG stimulates innovation in transport modelling and appraisal. There is a risk that a set of guidance that is perceived as prescriptive stifles innovation and prevents the industry from making progress in developing robust new tools and techniques. We would like to see a section of WebTAG that sets out the department’s position on using innovative approaches (e.g. big data, machine learning) in business case development, including regular public updates on key innovations that have been developed by scheme promoters and practitioners around the country.
72. **Non-technical explanations of novel techniques** – Related to the ‘People and place’ and ‘Modelling and appraising transformational investments and housing’ themes, we believe there would be significant benefit in developing materials for senior decision makers explaining novel techniques, such as appraisal with land-use change. Key to this would be a non-technical explanation of the evidence suggesting that conventional transport user appraisal misses important impacts. It is also worth referring back to our first priority under the ‘Reflecting uncertainty over the future of travel’ theme, where we suggested that materials should be developed to help decision makers look beyond the central scenario.

Consultation Question 10: *How can we improve the way in which WebTAG is presented? Why? We are particularly interested to hear about how we can improve accessibility and clarity of the guidance.*

74. Our assessment of the key improvements is listed below.

75. **Proportionality** – We would welcome clearer guidance on what level of analysis is proportionate at different stages of scheme development for different types of scheme. Risk aversion can sometimes lead to doing more than is required in some areas and less in others. This applies to modelling and appraisal, and both economic and strategic cases.

76. **An 'at a glance' leaflet on WebTAG** would be welcomed. It is important not to underestimate how simple and visual end users would like this to be. Even the highest tier of WebTAG is too detailed for some end users.

77. **Examples and case studies** – As noted above, a greater range of case studies and examples of best practice would be warmly welcomed by TfN and our partners.

78. **Consistency with business case guidance outside WebTAG** – There are a number of guidance documents that relate to business case development but sit outside WebTAG. A key example of this is the Value for Money Framework, which includes language that is inconsistent with the Wider Economic Impacts guidance. For example, it uses the terms 'established', 'evolving' and 'indicative' impacts seemingly in place of 'level 1', 'level 2' and 'level 3', although it is not clear whether there is a one-to-one correspondence between these.

Consultation Question 11: *What should our priorities be for improving the development of modelling and appraisal tools and why? Please select up to three.*

80. Our assessment of the key improvements to national modelling and appraisal tools are listed below. This response could include answers to many of the questions in this response, so the list below reflects areas largely not covered elsewhere. The answer to Question 2 is particularly relevant to this question.
81. **Breaking down model siloes** – National models do not take a consistent approach across different modes of transport. For example, NTEM and the NTM are primarily focussed on forecast trip ends for highway modelling, with little regard of rail demand, whereas EDGE uses an elasticity-based approach to produce more robust forecasts of rail demand, but it is more difficult to incorporate these forecasts into a multi-modal model. There is no national-level model that can be used to thoroughly understand the competition between modes in future (i.e. one that doesn't just assume fixed costs). We would welcome a programme of work within the NTEM/NTM framework to explore modal competition in more detail.
82. **Support strengthening links with evaluation** – We support efforts to ensure modelling and appraisal tools are continually improved based on evaluation of existing schemes. Our suggestion above on helping to make time-series data available would be one important step to doing this.
83. **Improve data and model interoperability** – For example, work with CLG and partners to allow more regular NTEM planning data updates, as well as wider national datasets making more use of data synthesis to add intelligence.
84. **Making tools more readily available** – One of TfN's aims is to make the Analytical Framework modelling and appraisal tools more readily available to our partners to help provide consistent quality and a fair approach across our region. We would welcome collaboration with the Department on this to share learning and best practice.

Consultation Question 12: *How can we best encourage innovation whilst maintaining a consistent and robust approach?*

Consultation Question 13: *What new and emerging techniques and methods should we potentially explore and what specific problems might they solve?*

86. We have opted to answer these two questions together. The key issues are listed below.
87. **Support 'agile' by allowing models to develop through scheme development** – As noted above, it is important that model development is proportionate to the stage of scheme development. At TfN we try to use agile model development techniques from the software development industry. This means that our models are never truly 'finished' but are always improving through iterations that incrementally add value. It makes sense for these iterations be aligned to the various stages of scheme development, so that models become increasingly robust and sophisticated as the scheme approaches investment decision. We suggest that recognition of this as a valid approach within WebTAG would be a helpful way to support innovation.
88. **Scenario and sensitivity analysis** – One way to enable novel techniques to be introduced into business cases is to present them alongside conventional techniques as a sensitivity test. It is clear that the Department is increasingly interested in scenario and sensitivity analysis, and we believe there is a clear synergy between this position and fostering innovation. However, it is important that, as new techniques are improved and confidence in their robustness increases, we do not continue to relegate them to sensitivity analysis. Our responses above on the need to increase confidence in 'Level 3' benefits are an illustration of this risk.
89. **Share best practice through examples** – As noted throughout this response, publication of examples of best practice in innovation would help to build the confidence to be creative in modelling and appraisal. We believe that there is already a considerable amount of innovation going on in the industry, and that communicating this more widely would be an excellent first step to fostering innovation more widely.



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