Department for Transport

Appraisal and Modelling Strategy

Informing Future Investment Decisions

Moving Britain Ahead

April 2019

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Foreword

Last year we consulted on priorities for a new appraisal and modelling strategy. Our aim is to provide appraisal and modelling tools that are robust, flexible and easy to use, to support the policy and investment decisions which will be made over the next five years. We engaged with a wide range of people during the consultation and are most grateful to everyone who has participated so openly and constructively. Your input has been central to the development of the strategy presented in this document.

The feedback that we received throughout the consultation confirmed that there is a vital role for our guidance in providing a comprehensive, consistent and robust approach for assessing the impacts of transport investment. Respondents made it clear that we need to maintain the highly respected evidence base we already have. We also need to increase the scope and depth in some areas, notably to meet the needs and ambitions of local and devolved areas. Alongside this, we need to ensure that analysis can be delivered more efficiently and one of our immediate priorities for the strategy is to make our guidance more accessible and easy to use.

We cannot deliver the ambitions of this strategy alone. The development of a new strategy provides the perfect opportunity to review how we can work most effectively with others to develop the evidence base. We look forward to exploring opportunities for innovation and collaboration with you as we embark on delivering the priorities in this strategy.

Amanda Rowlatt, Chief Analyst

April 2019

Executive summary

Introduction

1 The Department for Transport's (DfT) mission is to create a safe, secure, efficient and reliable transport system that works for the people who depend on it; supporting a strong, productive economy and the jobs and homes people need. Through its Transport Investment Strategy, DfT has allocated more than £61bn in capital investment between 2015/16 and 2020/21, with an additional £2.6bn from the National Productivity Fund to support transport infrastructure and future transport technology.

2 It is essential that we have as full a view as possible about the impacts this investment will have on transport users, the economy, society and the environment. The Department's guidance on conducting transport analysis for the economic case, Transport Analysis Guidance (TAG) [1], interprets the needs of HMT's Green Book[2] on how central government departments conduct appraisal and evaluation in the transport context.

3 While TAG is a well-established and respected resource, changes in the appraisal environment - notably policy priorities driven by the Industrial Strategy and Transport Investment Strategy, institutional changes including greater devolution, increased uncertainty in the transport sector and a skills shortage in the appraisal industry - means it needs to adapt and evolve.

4 Last year we consulted[3] on priorities for a new Appraisal and Modelling Strategy with a view to gaining a better understanding of how these changes in the appraisal environment have impacted on our stakeholders' evidence needs and challenges faced when applying the guidance. A major part of developing the strategy was listening to our stakeholders and users of our tools and guidance through an extensive consultation exercise. The consultation ran from 19th June 2018 to 15th October 2018 and with help from stakeholders we held ten engagement events across England, yielding valuable feedback and opinion.

5 We received 74 formal responses to the consultation, 61 of which are being published with permission alongside this strategy in the interests of openness and transparency. In this spirit we are also publishing a summary of discussions at five expert-led theme workshops, an externally organised event to gather stakeholders' views and the results of an online TAG user survey[4].

[1] Please note that we are in the process of formally moving from the terminology "WebTAG" to "TAG".
[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf
[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716981/appraisal-and-modelling-strategy-consultation.pdf
[4] https://www.gov.uk/government/consultations/transport-appraisal-and-modelling-strategy-informing-future-investment-decisions

Strategic objectives

6 The aim of our Appraisal and Modelling Strategy is to provide robust, flexible and easy to use modelling and appraisal tools that can be used to inform the critical policy decisions which will be made over the next five years and beyond. We will seek to achieve this aim via the following broad objectives:

- Supporting transport analysis in a climate of devolved decision making, by facilitating promoters to prepare proportionate analysis in business cases and encouraging innovation where appropriate.
- Developing the transport analysis guidance and tools to provide the evidence base for transport investment decisions over the next five years, targeting the most significant evidence gaps and ensuring decision-makers are presented with the information they need;
- Working collaboratively with our partners and stakeholders to deliver the breadth of enhancements to the evidence base, methods and data.

Consultation themes

7 The consultation document presented five themes to frame the strategy:

- People and place: capturing the range of impacts relevant to transport policy – providing the evidence and tools to assess the impact of transport investment on people and how it affects their day to day lives;
- Reflecting uncertainty over the future of travel: tackling the challenge of accounting for a very uncertain future in forecasting and appraisal, including more thorough presentation of risk and uncertainty to decision-makers;
- Modelling and appraising transformational investments and housing: we must continue to develop our understanding of transport's impact on economic performance and its facilitation of housing growth;
- Supporting the application of TAG and making it more user friendly: tackling the tensions between continually improving methods in our guidance and making it more user friendly, developing a shared understanding of the role of TAG and promoting proportionate analysis in business cases;
- Developing and maintaining modelling and appraisal tools to meet user needs: developing the tools that we will require and need to address current and future transport challenges.

Priorities of the strategy

8 A key priority for the strategy in the shorter-term is to consolidate, strengthening the foundations of appraisal and increasing understanding and expectations of appraisal and modelling methods, whilst supporting stakeholders and enabling them to prepare efficient yet insightful appraisals in business cases. Building from this, the strategy outlines the research and development activities that we have identified to fulfil the strategic objectives for each theme over the five-year strategy period.

- **People and place**

  Consolidating the current framework to allow appraisals to better articulate the impacts of proposals on people, health and the environment. Potential research identified focuses on location attractiveness and urban realm (i.e. quality of the urban experience), expanding the evidence base for walking and cycling, social and distributional impacts and freight appraisal.

- **Reflecting uncertainty over the future of travel**

  Key aims are to facilitate a step change in presenting intelligent uncertainty analysis to decision-makers, develop a common understanding and guidance on this in the appraisal context, and provide a potential toolkit and case studies in TAG to help users.

- **Transformational investment and housing**

  The shorter-term priorities for this theme are to take stock of current methods, scope areas for development and provide case studies to allow a clearer understanding of the potential for wider impacts and to promote a proportionate approach to their appraisal. We are also working with other government departments to explore how we can best appraise cross-sectoral investments. Sustained activities will be to develop methods from a national and local perspective and work collaboratively with industry to open out supplementary economic modelling methods, including efficient methods for assessing the potential to unlock housing developments.

- **Supporting users of TAG and making it more accessible**

  We have identified several quick wins that aim to produce a marked improvement in the understanding and application of analysis for appraisal. This will take the form of more accessible information supporting TAG and improved signposting in TAG itself. Information-sharing and supporting our users is a fundamental part of this theme, with the introduction of an annual TAG conference and training events, and development of case studies aimed at demonstrating proportionality.

- **Modelling and appraisal tools**

  Strengthening existing guidance on current practice, introducing more detailed guidance on evaluation and enhancing guidance on model development, with an emphasis on a proportionate approach. We will review and seek to enhance our current forecasting capabilities, in particular freight modelling. Important elements are opening up our national models and exploring what use could be made of potential alternative techniques and innovations in industry.

Next steps

9 The immediate next steps are to draw up a more detailed work programme and identify the deliverables more precisely for our quick win priorities. We shall also begin scoping work for the various sustained activities to develop greater certainty as to what research and development activities we need to undertake to fulfil the strategy objectives.

10 We look forward to continuing discussions with our stakeholders as we embark on delivering the priorities in the strategy. To support this, we plan to hold an event to present the priorities in this strategy and discuss opportunities for working with others

to deliver. We are keen to continue discussions with a wide range of stakeholders and expressions of interest would be welcome from all parties. We also plan to launch an annual TAG conference later in the year.

11 We cannot deliver the ambitions in this strategy alone. The development of a new strategy provides the perfect opportunity to review our delivery approach focusing on how, with demands for both increased scope and depth of TAG, we can most effectively work with others to deliver. We have already identified or started work on a number of research projects with our partners and look forward to identifying other opportunities to collaborate. We also welcome organisations that are developing research in areas we have not identified as an immediate priority to come forward with their findings to strengthen the evidence base in those areas.

1. Introduction

Background

1.1 The Department for Transport's (DfT) mission is to create a safe, secure, efficient and reliable transport system that works for the people who depend on it; supporting a strong, productive economy and the jobs and homes people need. Through its Transport Investment Strategy, DfT has allocated more than £61bn in capital investment between 2015/16 and 2020/21, with an additional £2.6bn from the National Productivity Fund to support transport infrastructure and future transport technology.

1.2 It is essential that we have as full a view as possible about the impacts this investment will have on transport users, the economy, society and the environment. The Department's guidance on conducting transport analysis for the economic case, Transport Analysis Guidance (TAG), has been developed over many years, drawing on best practice in government, industry and academia.

1.3 Last year, we consulted on priorities for a new appraisal and modelling strategy, presenting an ambitious vision for developing the appraisal and modelling tools that underpin TAG over the next five years. Our aim is to enable the best investment decisions to be made by equipping those producing appraisals with the right tools, methods, knowledge and data to produce robust assessments of the wide-ranging impacts transport investment has. This strategy also aims to ensure that these impacts are presented clearly and imaginatively to decision makers, painting an informative and insightful picture of the outcomes of investment.

The appraisal environment

1.4 As described in the consultation document and evidenced in the responses we received, the appraisal environment has changed considerably over the past five years and continues to do so:

- The Government's Industrial Strategy[5] and Transport Investment Strategy[6] have shifted the focus of policy towards rebalancing the economy, supporting the creation of housing and improving the experiences of the travelling public. A core component of the Government's Industrial Strategy is creating the economic infrastructure to improve living standards across the whole country. This will mean investing in our transport network in different ways, most fundamentally by addressing the network's core capability - its condition, capacity and connectivity - but also improving the user experience and adapting the network to safeguard our environment and health.

[5] https://www.gov.uk/government/topical-events/the-uks-industrial-strategy
[6] https://www.gov.uk/government/publications/transport-investment-strategy

- There have also been a number of significant institutional developments including the emergence of Sub-national Transport Bodies (STBs) Transport for the North, England's Economic Heartland, Midlands Connect and Transport for the South East, along with more combined authorities and the creation of the National Infrastructure Commission. These institutions are changing the way in which policy is being developed, with an emphasis on prioritisation across sectors and meeting local aspirations.
- We are facing significant uncertainty in the transport sector as a result of changes in travel behaviour that are not fully understood and the development of new technologies.
- As our appraisal framework has become increasingly sophisticated, the demands on those applying it have increased. Despite an emphasis on proportionality in our guidance, it is clear that the application of this principle is not always straightforward. We are also aware that the scope and details of the guidance are not consistently understood.

1.5 The consultation recognised that TAG needs to adapt to keep up with demands for evidence to support policy priorities, meet the needs and ambitions of devolved and local areas and reflect the shortage of skills in the industry.

Consulting on the strategy

1.6 We endeavoured to meet and hear the views of a wide range of stakeholders during the consultation period and to this end organised a launch event; four regional events in Birmingham, Exeter, Leeds and London; expert-led workshops on priorities for each theme and an online TAG user survey. In total we met over 200 people, received 74 responses to the consultation and a further 90 people completed an online TAG user survey.

1.7 We are grateful for TfN's support co-hosting the regional event in Leeds attended by just under 50 people. We're also grateful to the following members of the Joint Analysis Development Panel for leading theme-based workshops: Professor Richard Batley, Institute for Transport Studies, University of Leeds (Reflecting Uncertainty over the Future of Travel), Professor Peter Jones, University College London (People and Place), Tom van Vuren, Mott MacDonald and Institute for Transport Studies, University of Leeds (Developing Modelling Tools that meet User Needs), Professor Tony Venables, Oxford University (Modelling and Appraising Transformational Investments and Housing). David Christie, Demand Forecasting Manager, Transport for London chaired two sessions of the workshop on Supporting the Application of TAG and making it more User Friendly.

1.8 Summaries of the workshop discussions, the results of the online TAG user survey, an externally organised event to gather stakeholder views and most of the consultation responses are being published alongside this strategy[7].

1.9 Our engagement throughout the consultation and the responses themselves revealed that, despite the changing appraisal environment, there remains a strong demand for a comprehensive, consistent and robust approach for assessing the costs and impacts of transport interventions. There is a growing demand for both

[7] 61 out of 74 responses are published alongside this document, and can be found athttps://www.gov.uk/government/consultations/transport-appraisal-and-modelling-strategy-informing-future-investment-decisions

wider scope and greater depth in appraisal and to meet this demand we believe we need to adopt different approaches to developing the evidence base and supporting the users of TAG. It is also clear from responses that a high value is placed on maintaining the highly respected evidence base we already have.

1.10 Central to this strategy is how we can work with our partners to identify opportunities for innovation and research to develop the evidence base collaboratively. To support this, we will make clearer the conditions under which we will accept new evidence, thereby enhancing transparency and encouraging innovation.

1.11 We are very grateful for all the positive, open and constructive contributions to the consultation. We have gained a much deeper understanding and appreciation of our stakeholders' evidence needs and the issues faced by those interpreting and applying TAG which are hindering the production of high quality appraisals. This strategy will only be successful if this two-way communication is maintained.

Building a strategy

1.12 While the consultation responses unsurprisingly contained diverse views on appraisal and modelling issues, there was a significant degree of consensus around the themes and high-level priorities. This was reflected in the regional events, theme workshop discussions and TAG user survey.

1.13 We held a workshop with the Joint Analysis Development Panel and a selection of key stakeholders and subject matter experts in November 2018 to discuss the views expressed in the consultation and emerging priorities for the strategy. This exercise helped to cement the foundations of the strategy, both in terms of the areas for the strategy to focus on and ways of working with others to deliver and make progress across the strategy with limited resources.

1.14 The principles we used to assess options for the strategy are discussed in more detail in Chapter 2 but were broadly based around the strength of support in the consultation, alignment with DfT's policy objectives, impact on appraisal outcomes and the costs and risks associated with delivery and timing.

1.15 The rest of this document describes how we have developed the strategy and presents the key priorities. We intend to review progress and the direction of the strategy each year as part of an annual TAG conference and look forward to continued close working and building new partnerships to deliver the priorities in the strategy.

2. Developing the Strategy

Introduction

2.1 This section describes:

- The strategic objectives that underpin the way we aim to take forward the development of transport analysis and our activities to support stakeholders over the next five years;
- How we used the consultation exercise to gather needs and opinions of our stakeholders across partners, industry and academia;
- How we have identified priority actions over the next five years in order to meet the strategic objectives.

Strategic objectives

2.2 The aim of this strategy is to provide robust, flexible and easy to use modelling and appraisal tools that can be used to inform the critical policy decisions which will be made over the next five years and beyond.

2.3 We will seek to achieve this aim via the following broad objectives:

- Supporting transport analysis in a climate of devolved decision making, by encouraging innovation and facilitating promoters to prepare proportionate analysis in business cases;
- Developing the transport analysis guidance and tools to provide the evidence base for transport investment decisions over the next five years, targeting the most significant evidence gaps and ensuring decision-makers are presented with the information they need;
- Working collaboratively with our partners and stakeholders to deliver the breadth of enhancements to the evidence base, methods and data.

Consulting on the strategy

2.4 We launched our consultation in June 2018 and it concluded in October 2018. We would like to thank all participants for their constructive feedback and considered responses. The consultation exercise yielded 74 formal responses and included a series of events across England, with representatives from across the UK. We held five regional stakeholder events, five workshops focusing on the individual themes

within the consultation and gathered feedback on our transport analysis guidance through an online user survey[8].

2.5 The consultation set out five broad themes:

2.6 **People and place**: capturing the range of impacts relevant to transport policy – cities and devolution are increasingly important dimensions of transport policy that require a fresh focus for certain aspects of our guidance. This theme is focused on community wellbeing and people's experience of the built environment.

2.7 **Reflecting uncertainty over the future of travel**: the future of travel is highly uncertain, largely due to a combination of technological and behavioural uncertainties. This theme focuses on encouraging greater prominence of uncertainty analysis to support decision making, including developing our understanding of emerging and future technologies that could fundamentally change the transport market.

2.8 **Modelling and appraising transformational investments and housing**: to support the Transport Investment Strategy and Industrial Strategy, we must continue to develop our understanding of transport's impact on economic performance and its facilitation of housing growth.

2.9 **Supporting the application of TAG and making it more user friendly**: we recognise a need to tackle the possible tension between continually improving methods in our guidance and making it more user friendly. This theme focuses not only on the accessibility of the guidance and DfT's role in supporting its users, but also on overcoming potential misunderstandings and misinterpretation of the role of the guidance and the Department's expectations of analysis used in business cases.

2.10 **Developing and maintaining modelling and appraisal tools to meet user needs**: given the challenges we are facing, different sources of evidence and modelling approaches may be needed to represent the transport market and undertake policy analysis in the future. This theme focuses on the tools that we will require and need to develop to address these challenges. It also examines areas of opportunity, such as harnessing the best of Big Data sources and exploring innovative approaches to tackle the more difficult issues.

Cross-cutting issues

2.11 Throughout the consultation, it became clear that there are several issues that cut across the central themes we have used to frame it. These provide important context and highlight the strategic reasons why we need to develop the evidence base to improve decision-making and meet the needs of stakeholders across the country.

Economic rebalancing and the provision of housing

2.12 The objective of the Government's Industrial Strategy is to improve living standards by increasing productivity and driving growth across the whole country. A core component of the strategy is creating the economic infrastructure that will enable this. Transport investment will also seek to support the creation of new housing. As the

[8] Published alongside this strategy is write-ups from the workshops, the TAG user survey and a majority of responses (60 out of 74), found here: https://www.gov.uk/government/consultations/transport-appraisal-and-modelling-strategy-informing-future-investment-decisions

Government's Housing White Paper[9] recognises, transport infrastructure is one of the keys to unlocking development and delivering places where people want to live.

2.13 While our appraisal and modelling techniques to measure wider economic impacts have evolved over the past five years, so too has the world around them. As described in the Transport Investment Strategy, we have made recent changes to strengthen our ability to measure a scheme's local economic impacts, assess the benefits of resultant housing growth and capture the structural changes in the economy which result from step-changes in capacity and connectivity. We also committed to develop a Rebalancing Toolkit[10], which we published in December 2017. This is designed to help authors of strategic cases assess how a programme or project fits with the objective of spreading growth across the country. The toolkit draws on evidence from the economic case and economic narrative as well as wider evidence to more clearly articulate how schemes will contribute to rebalancing. We recognise that it can be difficult to evidence how a scheme will drive regeneration and economic growth and Chapter 6 describes how this strategy will support local level analysis.

2.14 DfT development plans more generally will also focus on supporting promoters of schemes in preparing high quality strategic cases that link to the analysis in the economic case. It is important to have a clear understanding and narrative around a scheme's strategic objectives, and those being supported by the modelling and appraisal work undertaken in the economic case. This includes the rebalancing objective, and providing evidence that the proposed schemes will indeed achieve this objective and boost the prosperity of the UK's regions.

Sustainable, active and inclusive travel

2.15 DfT's aim is to make sure transport is safe, secure and sustainable, and to make sure that disabled people have the same access to transport as everyone else.

2.16 Active travel is part of the design of any sustainable transport system. The appraisal framework is based on the measurement of welfare as prescribed in HMT's Green Book. It provides for the measurement of the important impacts resulting from active travel such as public health due to increased physical activity, safety benefits through reductions in accidents, improvements to air quality and reductions in greenhouse gas emissions, and the improved journey experience of users (for example perceived safety through off-road cycle provision and maintaining good cycling infrastructure and facilities).

2.17 The Department has already published several tools to enable promoters of these schemes to do more efficient appraisals, such as the Active Mode Appraisal Toolkit in TAG[11] and the Propensity to Cycle Tool[12]. A programme of work is also underway to collect more evidence to feed into the appraisal framework, including evaluation of the Transforming Cities Fund, Bikeability and Cycle City Ambition Fund.

2.18 We have identified in this strategy the need to raise the prominence of existing methods in the guidance and to bolster the evidence in areas such as more detailed health appraisal and the ability to forecast demand when investing in active mode

[9] https://www.gov.uk/government/publications/fixing-our-broken-housing-market
[10] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/669043/supplementary-guidance-rebalancing-toolkit.pdf
[11] https://www.gov.uk/government/publications/tag-social-and-distributional-impacts-worksheets
[12] https://www.gov.uk/government/publications/national-propensity-to-cycle-first-phase-development-study

infrastructure. We are also proposing to develop appraisal methods to more accurately capture the benefits of cycling infrastructure.

2.19 The Department published the Inclusive Transport Strategy in July 2018, which aims to provide better connections and wellbeing for disabled transport users. From an analytical perspective, we have published an Inclusive Transport Strategy Monitoring and Evaluation Framework for this[13], which ultimately will provide valuable evidence for policy development and scheme appraisals. We also intend, if feasible, to develop a methodology to estimate the economic benefits of interventions that make transport more accessible.

People-centred business cases and distributional impacts

2.20 DfT is committed to placing people at the heart of decision-making on transport investments. The appraisal process plays a key role in making this a reality, viewing impacts from a welfare-based perspective and allowing the measurement of many distributional impacts of investments that affect people's lives.

2.21 This strategy recognises this commitment, and describes the continued research activities we plan to undertake in order to provide more detailed assessments of, for example, impacts on accessibility and urban realm. It also gives greater prominence to supporting distributional analysis and ensuring that the presentation of the economic case to decision-makers gives due weight to these considerations.

Increasing transparency and understanding for more efficient business case development

2.22 We recognise that, as our appraisal framework has become more sophisticated, the demands on those applying it have increased. Despite an emphasis on proportionality in our guidance, we are aware that the application of this principle is not always straightforward. We are also aware that the scope and details of the guidance are not consistently understood.

2.23 Increasing transparency and making TAG more accessible and user-friendly cuts across the entire strategy and we have dedicated a specific theme to these issues. Key to this is promoting a common understanding of the purpose of transport analysis, its role in decision-making, and supporting users to deliver robust yet efficient appraisals. As we have presented in Chapter 3, we have identified several quick wins that will seek to increase understanding of the application of guidance to transport studies, a key part of which is to directly support users through engagement events and training opportunities.

Uncertainty

2.24 We are facing significant uncertainty in the transport sector as a result of changes in travel behaviour that are not fully understood and the development of new technologies. Current technologies like mobile phones, social media and high-speed internet have changed how people interact with the world and have the potential to fundamentally change how people travel. Future technologies have the potential to impact travel behaviour further in ways we may not fully understand for decades to come.

2.25 As described in the consultation document: "A key benefit to developing a transport model is that it is a bespoke tool that may be used to analyse the performance of proposals under a range of different assumptions. They are tools that essentially give

[13] https://www.gov.uk/government/publications/inclusive-transport-strategy-monitoring-and-evaluation-framework

us a better insight into the most resilient solutions under different future scenarios and hence are in themselves crucial in testing the effects of uncertainty, rather than tools that specifically aim to reduce it to provide the most likely outcome." (DfT, 2018)

2.26 As a central theme of this strategy, we aim to support users in making the best use of modelling assets in order to understand the performance of proposed schemes in different future scenarios. Decision-makers view this as an essential role for analysis to provide a greater depth of understanding of potential impacts, rather than a single best prediction.

Freight

2.27 Nearly every product we buy will at some stage form part of the 1.7 billion tons of freight carried annually on the strategic road and rail networks[14]. The strategic road network carries a third of all traffic, and two thirds of all freight, on only 2% of the road network as a whole. By 2030, with unconstrained growth, rail freight has the potential to nearly double[15].

2.28 The government's rail freight strategy, published in September 2016[16], signalled the ambition to support a greater shift from road to rail. Each tonne of freight moved by rail reduces CO2 emissions by 76% compared to road so shifting more freight from road to rail has potential to make a real contribution to meeting the UK's emissions reductions targets, as well as improving safety by reducing lorry miles.

2.29 There is a clear emphasis to enable more efficient and connected freight movements in order to boost economic performance and reduce carbon emissions. The current appraisal evidence base specific to surface freight is relatively modest, as are the freight forecasting methods regularly employed in transport modelling. With the advent of maturing and emerging data sources, there is increased potential to enhance methods in this area, in order to support government policy.

Consultation responses

2.30 As noted above, we received 74 responses to the consultation in addition to feedback at the regional events and expert-led workshops for each theme. While the views expressed by stakeholders are unsurprisingly diverse, there is a large degree of consensus around the themes and high level priorities.

2.31 The consultation revealed significant support for TAG as an entity and respect for the evidence base it contains. The role TAG plays in ensuring consistency and comparability of appraisals is generally welcomed. However, in line with the drivers behind the consultation, there is a strong sense that TAG needs to adapt both to meet the needs and ambitions of devolved and local areas and to reflect the shortage of skills in the industry which can act as a barrier to high quality, innovative appraisals.

2.32 The consultation asked two questions on the themes and considerations for the strategy:

- 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?

[14] 2015 figure. DfT Table TSGB401 – Domestic Freight Transport, by Mode
[15] National Policy Statement for National Networks, December 2014
[16] https://www.gov.uk/government/publications/rail-freight-transport

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

2.33 While respondents had different views about which of the themes were the most pressing priorities, there was strong support for each of the five themes in the consultation. Almost without exception, respondents welcomed the theme "Supporting the application of TAG and making it more user friendly". A number of respondents suggested that rebalancing should be a theme in its own right; others thought that issues around sustainability, freight and evaluation should be covered more holistically. We agree on the importance of all these issues and have described above and in Chapters 4-8 how these cross-cutting issues are being addressed through the strategy.

2.34 Respondents presented many useful considerations for informing the scope and priorities of the strategy, many of which we have incorporated into the criteria used to produce a shortlist of options and that are outlined in the following section. Suggestions included focusing on developing the evidence base where it will have the greatest impact on appraisal and prioritising making TAG more user friendly. Respondents were divided between those who thought that developing evidence and methods to support the appraisal of transformational investments is paramount and those who noted that these represent a relatively small proportion of what TAG is used for. There was a message from a large number of respondents that we need to maintain the evidence base we already have, with some suggesting this should be a greater priority than expanding the evidence base.

2.35 Importantly, a note of caution was sounded on the ability of practitioners and industry to incorporate large numbers of enhancements to the guidance in a short space of time. We agree that the phasing of any changes will need careful thought and discussion.

2.36 The following table provides a brief summary of the key points made in the consultation.

Theme	Issue raised
People and Place	• Valuing the attractiveness of locations and urban realm • Development of public health valuation and active mode appraisal • Improvement of methods for landscape and environmental appraisal • Development of valuation of journey improvements: appraisal in land use change, resilience, reliability and freight • Maintenance and enhancements specific to the evidence base on values of time and its application in appraisal • Increased focus on people-centred business cases • Development of evidence and methods of measuring social impacts
Reflecting uncertainty over the future of travel	• Better understanding of the key uncertainties transport faces • General support for the use of scenarios in modelling and appraisal, although the details and scenarios themselves need to be thoroughly considered and proportionate

Theme	Issue raised
	• Provision of an 'uncertainty toolkit', to help business case developers account for it efficiently in their appraisals • Earlier use of strategic or simpler models • Alternative approaches such as analytical methods for vision-based decision processes • Update evidence and guidance for measuring optimism bias
Modelling and appraising transformational investments and housing	• Greater emphasis should be placed on the strategic case regarding local impacts and rebalancing • Developing a new approach and methods to appraise transport as part of a package of wider cross-sector investments, with particular emphasis on housing • The usefulness and limitations of the methods used to measure transformational impacts should be clarified • Clarifying the pre-conditions required for transformational impacts • Ability to capture transformational effects robustly and consistently, focusing on the development of supplementary economic modelling • Review existing methods for agglomeration, land value uplift, additionality, and moves to more or less productive jobs
Supporting the application of TAG	• Clarifying the role of TAG and increasing understanding of requirements for a non-technical audience • Understanding the flexibilities in the guidance and how to develop proportionate analysis • Provide more case studies (this is a cross-theme suggestion) • DfT-led training courses and support • Making the guidance more accessible • Clarification of various technical aspects within the guidance
Developing and maintaining modelling and appraisal tools to meet use needs	• Understanding proportionality in modelling • Maintaining and enhancing current methods and evidence • Review existing guidance and tools • Development of wider techniques and encouraging innovation • Explore new and emerging data sources • Improving access to DfT models and data • Use of models to test uncertainty • Better links from evaluation back into appraisal evidence • Freight modelling

Table 1 Summary of core consultation responses by theme

Identifying priorities

2.37 We organised five theme workshops for experts to discuss the main challenges and priorities for each of the consultation themes. These workshops were well attended and led by the following members of the Joint Analysis Development Panel: Professor Richard Batley, Institute for Transport Studies, University of Leeds (Reflecting Uncertainty over the Future of Travel), Professor Peter Jones, University College London (People and Place), Tom van Vuren, Mott MacDonald and Institute for Transport Studies, University of Leeds (Developing Modelling Tools that meet User Needs) and Professor Tony Venables, Oxford University (Modelling and Appraising Transformational Investments and Housing). David Christie, Demand Forecasting Manager, Transport for London chaired two sessions of the workshop on Supporting the Application of TAG and making it more user friendly.

2.38 In the interests of openness and transparency, summaries of the discussions at these workshops, written by the expert lead or an external attendee, have been published alongside this strategy[17].

2.39 Following the close of the consultation, we held an all-day workshop with the Joint Analysis Development Panel and key stakeholders including TfN to discuss the views expressed in the consultation and identify emerging priorities.

2.40 Bringing together the responses to the consultation, expert-led theme workshops, TAG user survey, feedback at engagement events and the Joint Analysis Development Panel workshop, the broad criteria used to develop a shortlist of priorities were:

- **Does it support the Department's policy objectives including the aims of the Industrial Strategy?** These include the creation of a stronger, cleaner, more productive economy; supporting the creation of housing; helping to connect people and places, making journeys easier, modern and reliable and making sure transport is safe, secure and sustainable.
- **What is the strength of consultation support?** Based on consultation responses and feedback from engagement events, what is the strength of stakeholder support for different priorities?
- **Will this make TAG more transparent and user friendly?** Will it make TAG more accessible and easier to interpret and apply? Will it increase understanding, for example, of proportionality and flexibility? If it increases appraisal work, how can the burden be minimised?
- **What impact will it have on the appraisal?** Will it have a significant impact, either in terms of magnitude, greater robustness or providing new insight into outcomes of value to decision makers?
- **Can we work collaboratively to deliver?** In order to achieve the ambitions of this strategy and meet the needs of stakeholders, we need to leverage ways of developing methods and guidance collaboratively in order to provide results that are beneficial to all.

[17] https://www.gov.uk/government/consultations/transport-appraisal-and-modelling-strategy-informing-future-investment-decisions

Scope of the strategy

2.41 The Department for Transport uses the Five Case Model for transport business cases, as recommended by HM Treasury. This means that the decision to invest in a transport project is considered from five perspectives: strategic fit, value for money, financial affordability, commercial viability and management achievability. This allows comprehensive and comparable assessment which helps us to prioritise our resources. It also ensures a wide range of options are considered and assessed proportionately at different stages of project development.

2.42 Decision-makers consider the evidence in all five cases when making a decision. TAG provides advice on how to conduct a transport appraisal with a view to providing an assessment of the potential impacts of transport investment. It primarily focuses on providing information for the economic case, although other analytical information produced can feed into the other cases where appropriate.

2.43 As part of the theme to make TAG more accessible, we will endeavour to clarify the distinction between the information that is within the economic case and DfT's decision-making process more generally. We will also promote work to better align the strategic and economic cases and support local level analysis.

3. Priorities of the Strategy

Meeting the strategic objectives

Maintaining TAG and supporting its use to get the best appraisals

3.1 Preparing analysis of a future transport system and the potential impacts of planned interventions provides a significant challenge to promoters and modelling and appraisal practitioners. Feedback from the consultation frequently referred to this challenge as the biggest problem with transport appraisal, before considering new methods or evidence to grapple even more complex and uncertain challenges.

3.2 We have therefore chosen to make it an immediate priority in this strategy to make TAG more accessible, to ensure the provision of tools and evidence satisfy the immediate needs of business case developers, and that the role of TAG in the appraisal process is more clearly understood. These quick wins aim to ensure that transport models used in business cases are fit for purpose, recognising the wider resources constraints in the sector.

3.3 We also recognise that increasing understanding of the requirements of transport analysis should not be constrained to changing the guidance in TAG. As part of these immediate priorities, we shall increase the provision of bespoke training and continue to engage with and seek views of stakeholders to undertake these improvements collaboratively. We shall also aim to increase knowledge-sharing by providing improved feedback on analysis undertaken and providing more case studies to guide those undertaking similar analysis.

Updating and expanding the evidence base

3.4 In parallel with the immediate priority to consolidate and facilitate current practice, we have also identified the need to update the evidence base to ensure more robust and defendable models and appraisals are produced. We have identified 21 sustained development activities from the consultation and scoping these will provide a better view on what can be achieved within different timescales. The next chapter describes what these are more specifically. Some elements of these improvements are already being undertaken by the Department; other areas will be scoped in the first two years of the strategy, with these work plans being undertaken across the period of the strategy.

3.5 The three broad priorities for developing the evidence base are: better understanding and reflecting uncertainty, understanding cities and projects that increase the spatial capacity of cities, and urban realm. These align with our themes of people and place, transformational schemes and housing, and uncertainty. The theme on developing modelling and appraisal tools and methods cuts across all three.

3.6 The majority of consultation responses agreed that addressing uncertainty is very important but found it difficult to offer concrete practical suggestions. This is a very difficult area to tackle successfully and has broader implications outside of transport

appraisal and TAG. This strategy outlines work we shall take forward on improving how uncertainty is accounted for in transport appraisal and how TAG and the tools provided alongside it may assist, such as an uncertainty toolkit and improvements in how to present uncertainty consistently in business cases.

3.7 To understand cities and projects that increase spatial capacity of cities increasingly requires a multi-sectoral approach with spatial modelling. This again can be exceptionally challenging, particularly when attempting to forecast the attribution of transport investment to changes in land uses and activities, in a context of investment in other sectors. Nonetheless, it is important to continue to develop these methods due to the importance of understanding how schemes can facilitate economic growth and the provision of housing. We shall continue to work with industry to improve the evidence and provide more clarity on the validity of these methods. We also recognise the clear need in identifying where schemes are transformational or are not, and the need for a consensus and shared understanding on the methods used to assess impacts on the economy.

3.8 Urban realm and other elements of people and place and the environment in which people live and work is an important gap which may be limiting the appraisal of certain types of scheme. We propose to scope and bring forward these elements to broaden appraisals and better understand and account for these impacts.

3.9 Other broad priorities include: distributional impacts, forecasting active modes, reliability, value of travel time in congested conditions, productive use of time, and wellbeing.

3.10 Due to limited resources we have not been able to prioritise everything put forward by respondents. Where options have not been identified as a quick win or sustained development activity below, it does not necessarily mean we consider them to be of low value and would be happy to discuss opportunities to collaborate on these options as well as priorities. We will continue to review priorities openly with stakeholders through routine engagement with all stakeholders, including the Joint Analysis Development Panel, and events such as the annual TAG conference.

Working with others to deliver the strategy

3.11 As mentioned above, we are aware that we will need support from various partners and stakeholders to deliver the ambitions of the strategy. A central aim of this strategy is to build guidance in a more collaborative fashion and to ensure that the guidance and tools work for those who use them.

3.12 The following chapters describe where we have already identified collaborative opportunities in a number of areas. We also encourage other organisations or institutions to approach us should there be scope for valuable joint research in the future. This will allow us to develop shared understanding of the guidance alongside new approaches and evidence.

3.13 Areas for improvement that have not been explicitly prioritised in this strategy may need to be addressed in specific circumstances. We encourage research and development by our external stakeholders. Should the need arise, we also encourage those collecting alternative evidence and developing methods, where adequately quality assured, to contact the Department if it would be valuable to add to or amend TAG or the TAG Data Book. To support this, we will make clearer the conditions under which we will accept new evidence, thereby enhancing transparency and encouraging innovation.

3.14 As well as the connections we have already made, we shall explore other possibilities when presented with a research problem to ensure sufficient resources can be assembled to deliver.

3.15 We are keen to work more closely with sub-national and urban bodies, support their strategic modelling work and examine the scope for research that meets mutual needs. For example, we are developing our relationship with Transport for the North, with whom we share common appraisal and modelling challenges and also share potential solutions, such as increased data gathering and sharing.

3.16 We are already working across government with Departments including the Ministry of Housing, Communities and Local Government (MHCLG) and the Department for Environment, Food & Rural Affairs (Defra) in developing the guidance and see potential in reaching out to wider institutions and the international community, such as the International Transport Forum. We are also interested in leveraging potential academic resource, through engaging with research councils and potentially sponsoring PhD theses or making use of academic secondments.

Key priorities and milestones

3.17 Reflecting on how specific priorities are to be delivered, we have categorised them into the following groups:

- Quick wins: A series of development activities with clear deliverables which we have identified as the greatest priority, which we are able to do now, and are to dedicate resources to achieve in the next two years;
- Sustained development activities: Research and development activities that will seek to improve appraisal and modelling evidence and methods over the period of this strategy. This will include scoping these areas of work in the short to medium terms, with a view to delivering guidance or tools within a five-year time frame;
- Areas for further consideration: Research activities where we have not identified specific deliverables. Whilst in our broader activities and engagement we liaise with industry and research institutions on such issues, we shall keep more of a watching brief and potentially reassess their priority during the course of the strategy.

3.18 Where we have not identified a development area as a priority, as described in this strategy, DfT is open to private innovation in appraisal and modelling practice. We invite stakeholders to do so and to share their experiences. Particularly where there may be concern regarding how such analysis might be received, where methods are not necessarily aligned with current technical specifications in TAG, DfT can offer support during the appraisal specification and development process. Guidance for this is already in place, in the Transport Appraisal Process unit of TAG[18].

3.19 The box below adds a description, for each activity, on how we intend to make progress, through scoping studies, research and development, and by delivering new tools or updates to the evidence base and the TAG guidance.

[18] https://www.gov.uk/government/publications/webtag-transport-appraisal-process-may-2018; see section 2.12.

How we are going to deliver

We have categorised our planned development activities into the following types:

Scoping/Reviewing: development areas where it is necessary to take stock of current practice and evidence in order to determine the best route for research and the potential provision of guidance

Research: specifically identified area of research aimed at improving the evidence base or modelling and appraisal practice

Deliverables: specific deliverables that we aim to achieve, including new or updated guidance and the production of tools or publications

Support and training: engagement activities to provide user support in the understanding and application of guidance

Collaborative: Areas of development that we plan to take forward in direct collaboration with our partners

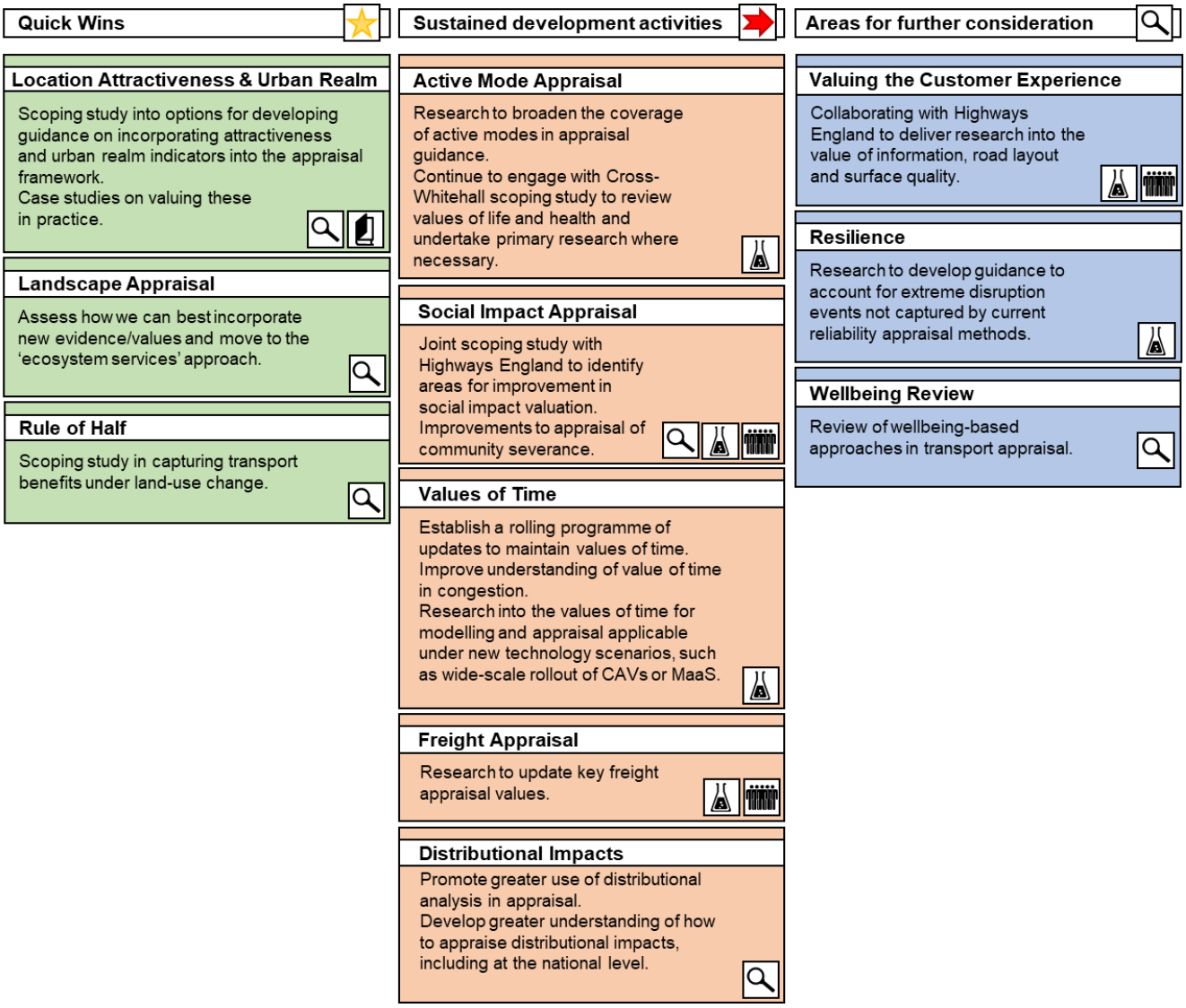
3.20 This section provides a summary of the development activities we plan to undertake in each theme. Please note that a summary of priorities across all of the themes is presented in Annex A. Chapters 4-8 of this document provide a more detailed narrative and reasoning behind why we have selected these priority areas, and how the consultation has highlighted the need to develop those areas we have chosen.

3.21 Recognising that priorities may change within the lifetime of the strategy and that early research results may have implications for subsequent work, our intention is to review and update stakeholders on our progress annually. This will take the form of a DfT-led conference, where we can update users first-hand regarding the latest developments and updates, and to support the appropriate interpretation of TAG and facilitate best practice analysis used in transport business cases.

People and Place: capturing the range of impacts relevant for transport policy

3.22 The theme of people and place fits strongly with the Department's objectives to ensure transport is safe, secure and sustainable, and to help to connect people and places, balancing investment across the country. It received strong support from our stakeholders in the consultation. The activities we have identified fit strongly with the strategic objectives of this strategy, particularly focusing appraisal on sustainability and liveability, to provide a greater pool of evidence to support devolved decision-making.

3.23 The priorities for this theme are presented below:



3.24 The objective of research and development on these priorities is to enhance the evidence base to facilitate more refined appraisal of sustainable transport schemes, putting people and the environment at the centre of such assessments. Key areas we have identified include landscape valuation, the liveability of place including urban realm and community severance impacts, and building on our ability to assess active mode improvements.

3.25 We are undertaking the scoping of a joint research programme with Highways England, focusing on improving these and other elements of social impacts, and as part of the strategy we wish to raise the prominence of distributional impact appraisal, which can be fundamental to investments in our towns and cities.

3.26 We are also aiming to bolster current methods that focus on transport user benefits, by undertaking research into how to use the current framework in the case of land use change, and looking into improving the dimensions of values of time to better understand the value people derive through decreased congestion, and in the future what the impacts might be of new technology on the transport network, such as Connected and Autonomous Vehicles and Mobility as a Service ride-sharing models.

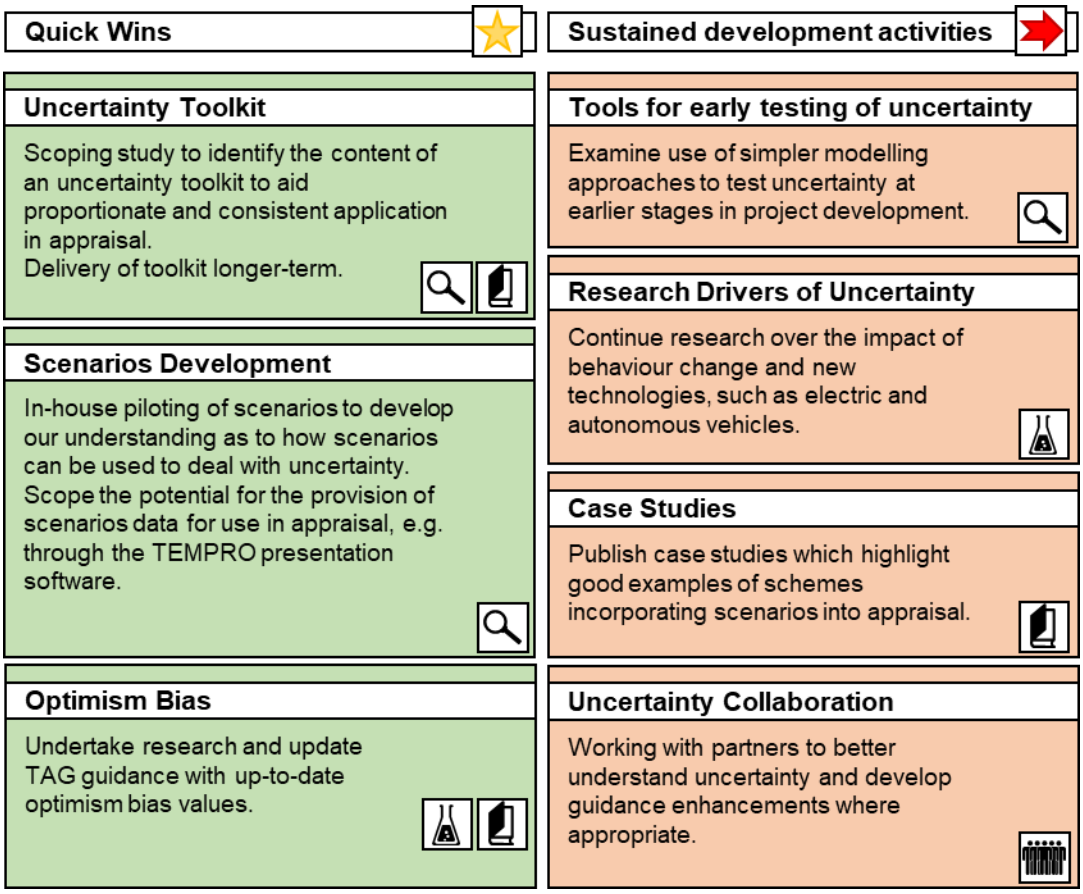
3.27 Finally, we shall explore filling the gaps in some of the evidence and methods, with a view to advancing appraisal of freight movements, how to better measure

improvements in network resilience, and working with our partners to better understand the impact of journey quality for road users.

Reflecting Uncertainty over the Future of Travel

3.28 It is unsurprising that the consultation found strong support for considering uncertainty in appraisals more thoroughly than we currently collectively do. Decision-makers and the wide variety of stakeholders impacted by transport investment are indeed calling for better storytelling on how investments might perform in a range of different potential futures. This cuts across all our strategic objectives and is necessary so that DfT can ensure the most robust and resilient investments are made.

3.29 The priorities we have identified in this theme are below:



3.30 Much of the focus of the shorter-term activities we have identified are aimed at getting a better grasp of the uncertainties in the current evidence and framework and, building on the scenarios in Road Traffic Forecasts 2018[19], piloting an approach to testing a set of common scenarios on key investments in DfT's portfolio.

3.31 The suggestion of an uncertainty toolkit received considerable support. This is to support our strategic objective of providing promoters with the means of undertaking analysis proportionately and efficiently. We intend to carefully scope and develop the toolkit and do this in collaboration with the end users to more tightly define what it shall aim to achieve and to ensure that it is fit for purpose.

[19] https://www.gov.uk/government/publications/road-traffic-forecasts-2018

3.32 We shall also consider how best to incorporate uncertainty analysis into our existing tools and products, most notably the travel demand forecasts provided by the National Trip End Model[20]. This data set provides travel demand projections for use in appraisals across the country. Providing more scenarios of these data, including clear guidance on how they are expected to be used, would provide greater consistency in appraisals.

3.33 In the longer term, we shall continue to develop the evidence base to ensure that we can reflect the potentially very different future world when forecasting using models. This will require a more flexible use of models and sensitivity tests, and our aim is to provide some real evidence and insight to help guide this analysis.

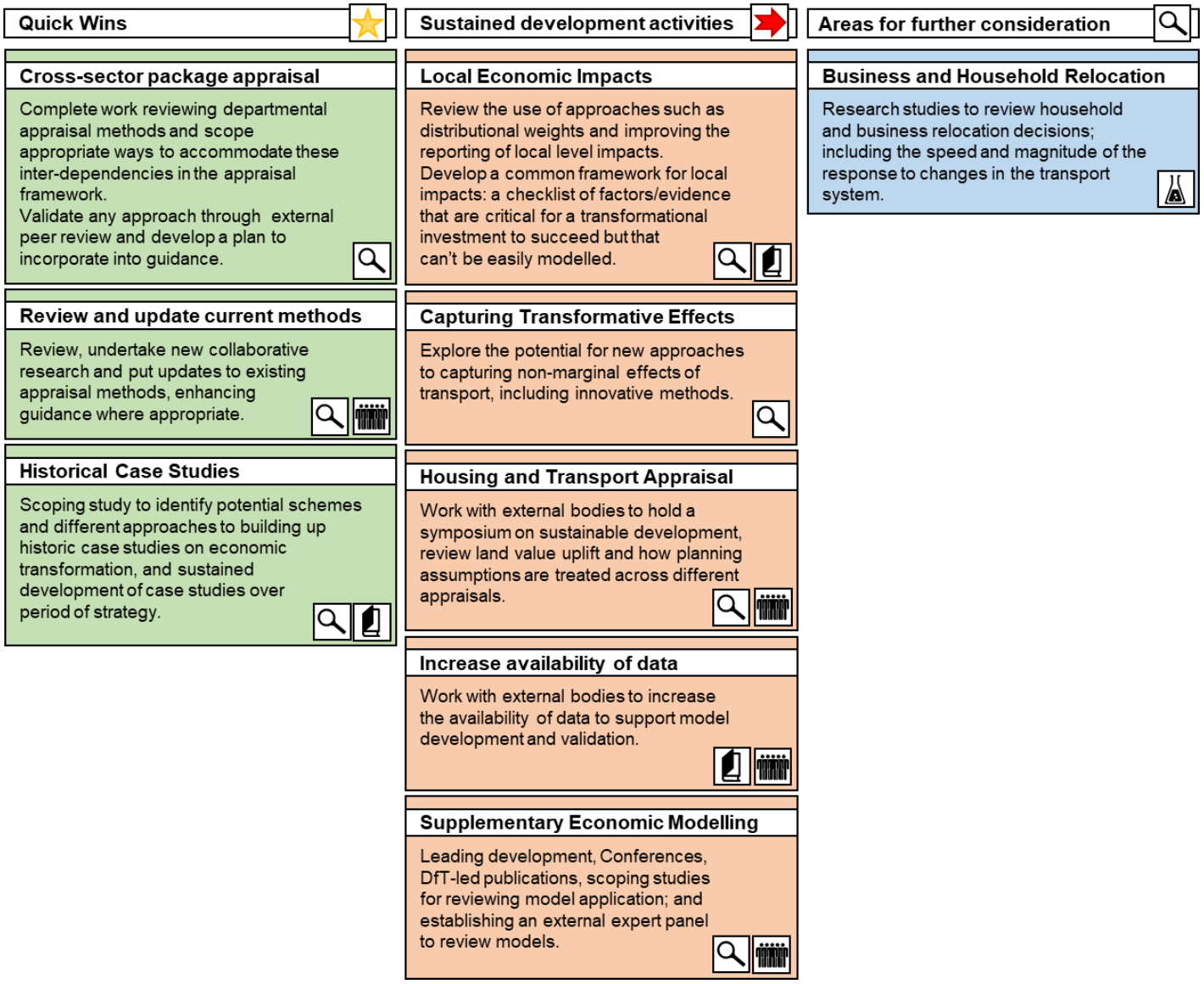
3.34 Case studies were enthusiastically supported in the consultation. Again, with the intention of supporting the users of TAG, we intend to publish a set of case studies so that people can gain a deeper insight into what can be achieved proportionately. To this end, we shall also examine how more simple or aggregate models may be used at earlier stages in project development in order to make quicker and more informed decisions regarding what might be the most appropriate sort of investment. It is acknowledged that a careful balance needs to be struck where simpler models, from a traditional perspective, may not perform well where complex changes to the transport system may occur or need to be considered.

Modelling and Appraising Transformational Investments and Housing

3.35 Supporting economic growth is a primary objective of DfT since transport investment can play a key role in delivering this. With schemes of such magnitude, we also need to understand how investment in other sectors can work together with transport schemes to maximise these outcomes. This was also reflected in the consultation, where stakeholders agreed with the fundamental importance of this theme, and require a greater understanding of these impacts and how to measure them, particularly where these methods are new or innovative.

3.36 The priorities we have identified in this theme are presented below:

[20] Through the TEMPRO software, available at: https://www.gov.uk/government/publications/tempro-downloads



3.37 In the next two years we are committed to maintaining and developing a robust appraisal framework to measure the wider impacts of transport investment and supporting measures. We shall review current methods and draw up a programme of work aimed at developing the evidence base and forecasting methods. This includes using evaluation to build the evidence base to examine aspects such as agglomeration impacts. We are also working across Government to better understand the connections between transport and other sectors when devising policies or schemes aimed at economic growth and rebalancing.

3.38 As a by-product of our engagement with stakeholders attempting the measurement of wider impacts, we shall also develop a set of case studies in order to increase understanding of when this analysis is applicable and the magnitude of impacts that might be expected. Crucially, we must work with stakeholders and partners undertaking supplementary economic modelling in order to develop a shared understanding of how these innovative methods may derive the impacts on jobs and housing that are vitally important to such investments. Through the collection of this knowledge, further research and evaluation evidence, we shall also endeavour to make more data available to users in order to produce more refined and consistent appraisals.

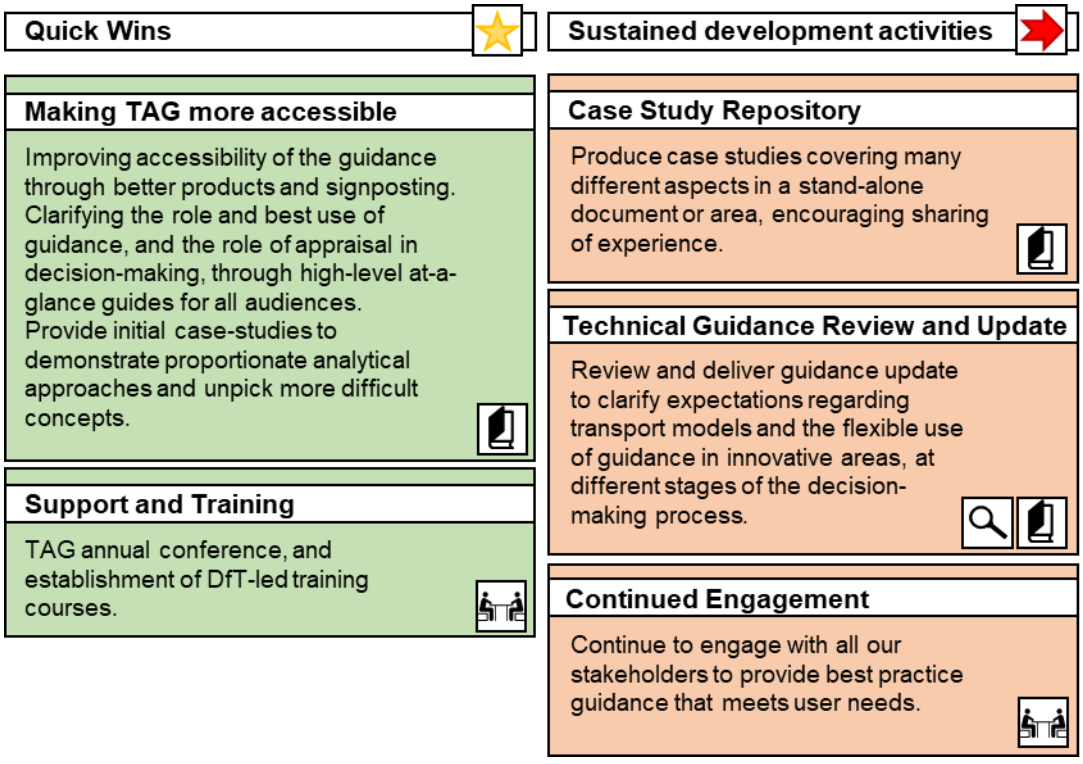
3.39 In line with our strategic objective of supporting stakeholders in the development of efficient and robust analysis, our longer-term work will focus on capturing local economic impacts and facilitating their reporting in the economic case. We shall develop a common framework for this and examine approaches such as distributional weights in appraisal, with the objective of improving local reporting.

Supporting the Application of TAG

3.40 As previously described, the consultation responses revealed that in the majority there is significant support for TAG as an entity and respect for the evidence base it contains, and the fairness and consistency it allows. However, there is a strong sense that TAG needs to adapt, both to meet the needs and ambitions of devolved and local areas and to reflect the shortage of skills in the industry which is often acting as a barrier to high quality, innovative appraisals.

3.41 We shall adapt the guidance in light of stakeholder needs and continue to develop guidance on analytical methods to ensure they are fit to address future challenges. There is also a clear signal that more prominence and clarity is required as to the understanding of the status and purpose of TAG and how to best use it to produce the most suitable analysis.

3.42 The priorities we have identified largely reflect this, as presented below:



3.43 Over the next two years, the focus of this theme will be to improve the accessibility of the guidance so that its purpose and intentions are clear, and so users can access the information they need more easily. This will involve accessible, high-level "Go-To" guides for the general reader, clarifying its connection to the decision-making process and to other cases within the transport business case. A large part of this will be in converging to a common understanding on proportionality in analysis, the importance of using analysis to understand the transport problem early on in the

appraisal process and how guidance may apply to more strategic tools that aim to provide insight for regional planning (over specific models used to assess impacts for full and final appraisals). Again, users have called for case studies to further increase understanding of this, which we shall continue to develop across the period of this strategy.

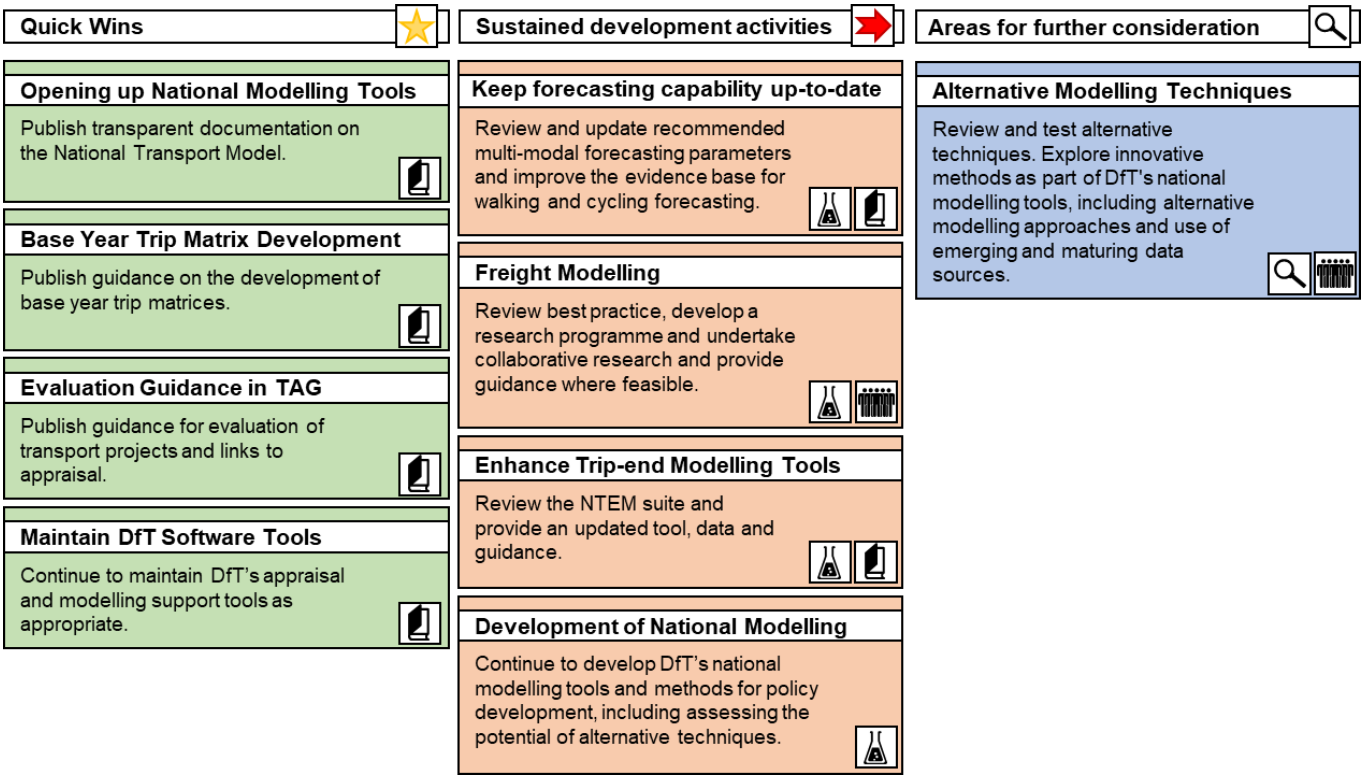
3.44 A quick win that is perceived to be very valuable to DfT and many of its stakeholders is the establishment of greater support and training opportunities, the highlight of which we plan to set up an annual TAG conference. This is so users can hear first-hand about upcoming developments in guidance and be guided on how to prepare high quality analysis for business cases. We shall also continue to engage with our stakeholders more generally on how guidance is used and may continue to be improved.

3.45 In the medium-term we shall undertake a technical review of the guidance, with a particular view of ensuring that the guidance on modelling methods reflects contemporary practice and ensuring that it is clear and accessible enough to be interpreted in a proportionate manner, particularly where alternative approaches are being implemented.

Developing and maintaining modelling and appraisal tools to meet user needs

3.46 For the majority of large-scale transport appraisals, transport models form the centrepiece of the analysis used to inform the economic case in the business case. It is therefore vital to continually reflect on current practice and to research and develop methods, evaluation evidence, guidance and tools used across the industry. This is so we can develop robust whilst proportionate appraisals, particularly where new and complex challenges may be a feature of transport in the future. That said, it is also important that we do not lose sight of the importance of refining the tools that we currently have, making sure the right tools are developed and easier to deliver, and building analytical capability generally across the sector.

3.47 The priorities we have identified in this theme are presented below:



3.48 The core short-term improvement to modelling guidance we have identified is the introduction of a guidance unit on techniques to build base year trip matrices. These are fundamental to a model's performance and its results used in appraisal, and fills a considerable gap in common practice guidance. This will include addressing the emergence of big data sources such as mobile network data into guidance, which is currently an omission. We are currently undertaking this work and are using a collaborative approach with a series of workshops with expert stakeholders.

3.49 We also aim to provide more detailed guidance on best practice in evaluation of transport projects. Evaluation information and the attribution of impacts back to specific investments will bolster the evidence base and provide assurance, or highlight development needs, for the assumptions and parameters used to forecast future impacts. Again, this is fundamental to the accuracy and quality assurance in all appraisals.

3.50 Alongside this, in the medium-term we shall also undertake bespoke investigations aimed at ensuring that the parameters used in models, such as expected sensitivities to time and cost changes, are up-to-date and fit for purpose. This will also include exploring how we may improve the provision of travel demand forecasts and improve the existing methods in the National Trip End Model and its presentation in the TEMPRO software.

3.51 We intend to lead by example by making our national transport modelling tools more transparent to our stakeholders, as requested in responses to the consultation. We shall do this by undertaking extensive stress-testing and back-casting on the National Transport Model, used to produce the National Road Traffic Forecasts, and publish our findings in a transparent manner, highlighting the purposes of the model and potentially those areas the model is less suited to.

3.52 We have also identified that freight modelling practice is currently a relative weakness in common practice. We intend to work with our partners to draw up a programme of work to address the shortcomings in methods and the availability of data. This is important for many potential policy purposes, particularly on the environment and road maintenance requirements, as well as being considered more accurately in scheme appraisals.

3.53 We are continuing to develop a new national transport model, in addition to developing our rail, aviation and maritime models. Besides enhancing the Department's capability to test national policy and to produce more refined regional traffic forecasts, we shall also explore wider considerations and techniques to reflect on how we might address the complex challenges brought about by new technologies and uncertainty regarding changing travel behaviour. From this context, we can review the opportunities presented by alternative approaches and data, before considering any additions to guidance that users may require.

Detailed consultation responses and description of priorities

3.54 Chapters 4-8 of this document gives detailed consultation responses on each theme, which have been summarised briefly in this section. In these chapters we address the issues raised by stakeholders during the consultation and describe our proposed actions, based on strategic objectives and the criteria established for prioritisation, as set out in Chapter 2.

4. People and Place: capturing the range of impacts relevant for transport policy

Findings from the consultation

4.1 This theme centres around ensuring that the fundamental building blocks of our appraisal approach are as robust, up to date and fit for purpose as possible. This includes the wide range of social, economic, environmental and distributional impacts currently referred to in TAG as possible new impacts to explore in order to meet the emerging appraisal challenges of tomorrow.

4.2 The question posed in the consultation document was:

- What should be our priorities for improving the appraisal of people and place and why? Please select up to three areas.

4.3 As well as the numerous written responses received, a number of consultation related events were hosted during the consultation window, by the Department as well as third parties. Most notably, the Department hosted an expert workshop which was chaired by Professor Peter Jones of University College London, and an externally organised one-day seminar on Transport Investment Appraisal was held in London. Both of these events attracted industry-leading experts and high-profile academics in the field of transport appraisal, and are published alongside this strategy[21].

4.4 This theme is inherently broad and cross-cutting in nature and as such attracted substantial commentary from a wide variety of stakeholders. Generally speaking, across respondents there was broad support for all the items in the 'long-list' of potential improvements that we consulted on. There were, however, a number of areas which featured more prominently than others in respondents' feedback.

4.5 The main messages emerging from the consultation were:

- There was almost universal consensus that a step-change in the ability of appraisals to **capture location attractiveness impacts**, with a particular focus on valuing the **urban realm**, was needed. These impacts represent changes in the quality of places in which people live, work and enjoy their leisure time. Importantly, they are not included in conventional estimates of transport user benefits, which are based on accessibility as opposed to attractiveness. Some respondents argued that compared to the strong, established literature on valuing 'traditional benefits' such as journey time savings, the evidence base for valuing (and monetising) place effects is much less developed.
- Many respondents argued that the current guidance does not do enough to **capture the benefits of using active modes**, citing impacts such as a reduction

[21] https://www.gov.uk/government/consultations/transport-appraisal-and-modelling-strategy-informing-future-investment-decisions

in morbidity, better journey quality and productivity improvements at work. There were also concerns raised that the current appraisal guidance does not account for the health dis-benefits associated with increased car use. A number of stakeholders expressed a wish to take forward research to develop the evidence base for active mode appraisal, in order to capture more of these benefits. More generally, there were numerous calls for a more holistic approach to representing public health, environmental and wellbeing effects. There were also calls for more comprehensive active mode appraisal and forecasting tools (see chapter 8 for more detailed plans on this).

- **Valuing journey improvements** in conventional transport appraisal received attention from most respondents but there was significant variation in suggested priorities.
- A small number of respondents specifically supported the idea of **a rolling programme of values of travel time savings (VTTS)** updates.
- There was much wider support for a renewed focus on the **customer experience, journey quality and reliability**. Several responses suggested that improved valuation guidance would be beneficial, to facilitate conducting appraisal under conditions where there is widespread mobility as a service (MaaS) and/or roll-out of connected and autonomous vehicles (CAVs). In particular, the appropriate values of time and journey comfort attributes in such a scenario are highly uncertain with no commonly accepted values in circulation.
- A large number of respondents recommended a much greater focus on **valuing travel time reliability, particularly for freight travel**. At the theme workshop, there were also calls to better account for the wider socio-economic context and impacts of freight travel, beyond the pure efficiency of transit.
- There was significant interest in better **capturing resilience and network disruption impacts in appraisal**. Respondents on this topic generally felt that established tools, usually designed for assessing 'typical' day-to-day variability in journey conditions, do not apply in these more extreme circumstances. Promisingly, some respondent told us they have developed proportionate 'off the shelf' toolkits to assessing these impacts.
- There were a range of responses and workshop comments on **specific environmental and social appraisal challenges** such as dealing with high air pollutant concentrations, carbon valuation, landscape appraisal, mental health impacts of noise, and the values applied to human life and health impacts (e.g. the value of a prevented fatality (VPF) and value of a life year (VOLY)). All respondents who focused on **landscape appraisal** were supportive of the drive to apply natural capital and ecosystem services-based approaches to appraisal. Only a small number of respondents expressed an appetite for improved tools to help assess **air quality impacts** at a local level where pollutant concentrations are high and in exceedance of legal limits, as suggested in the consultation.
- **Appraisal methods for the future**, which primarily concerns the application of the so called 'rule of a half' estimate of welfare change, is a highly technical area of potentially narrower direct appeal. However, it was strongly advocated by a number of stakeholders across the public and private sector, including academia. Some respondents were concerned that the majority of scheme appraisals, which are premised on fixed land use, could be biased. Many took the view that the DfT

should take the lead in this area, and bring forth standard approaches in TAG for appraisal under land use change.

- There was also notable enthusiasm amongst a number of public sector stakeholders for progressing the application of **person-centred business cases** to support decision making.

Taking things forward

4.6 This section sets out high-level plans for how we are taking forward our strategy in this area, set out according to sub-topic within the people and place theme.

Valuing Location Attractiveness

4.7 There is a clear appetite for the Department to develop national guidance on valuing these impacts and a sense that it would be very useful for effective business case development. Therefore, we plan to commission a scoping study into valuing location attractiveness impacts in economic appraisal. This will allow us to definitively establish the current state of the art and practice, consider whether any short-term additions to guidance would be appropriate and target future research.

4.8 An essential part of this, recognising the feedback from stakeholders, will be ensuring any guidance developed is accompanied by proportionate tools to support its application.

Public Health and Wellbeing

The over-arching framework

4.9 We feel that TAG already provides a robust framework for presenting advice spanning a number of seemingly disparate impacts in one clear, succinct business case for decision makers. Working within the constraints of the HMT Green Book, there is no scope to take up multi-criteria decision analysis (MCDA) (as suggested by small number of respondents) and a summative welfare-based appraisal must be the basis for value for money assessments which inform the economic case.

4.10 Furthermore, the overall case for investment is equally informed by the strategic, commercial, financial and management cases. The decision maker has discretion to weigh up the different components of each case according to their judgement, so for example a scheme with a strong BCR could be rejected if there were concerns about the environment or safety. These judgements are outside of the scope of our appraisal guidance.

4.11 We are appreciative of respondents' concerns around a perceived lack of attention paid to health and wellbeing effects, noting again that appraisals are based on a summation of welfare. We will continue to develop the evidence for appraising specific impacts, within the over-arching Green Book framework, to ensure our appraisal of social and environmental impacts remains as robust and comprehensive as possible. Much of this work, such as reviewing evidence on air quality and noise, will be in collaboration with other Government departments such as Defra and the Department of Health and Social Care (DHSC).

Active Modes

4.12 We aim to keep the appraisal framework for active modes up to date. This includes continuing to maintain and improve the Active Mode Appraisal Toolkit and the Propensity to Cycle Tool. We will commission research to improve active mode appraisal methods where appropriate. This could cover better appraisal of cycle lane infrastructure appraisal, forecasting active travel trip generation and active travel health benefits. We will collaborate with stakeholders to pool evidence.

4.13 On valuing potential health disbenefits for schemes that shift active mode users onto other modes, it is important to note that that the current guidance in TAG Units A4.1 and A5.1 demonstrate how one may appraise the dis-benefits of inactivity, given a demand forecast for walking and cycling modes, their abstraction from mechanised modes and hence potential changes in physical activity. However, the scope of analysis and modelling tools available will impact on the precision of forecasting changes in activity. We recognise the significance of this issue to stakeholders, and intend to include consideration of this issue in the planned further work on active mode appraisal mentioned above, as well as in clarifying the possibility of undertaking this routinely in analysis as part of the work on making TAG more accessible.

Landscape appraisal

4.14 Since the consultation, the Department has completed the research into incorporating an ecosystem service-based valuation of landscape impacts into TAG. This report will be published soon, and suggests a number of ecosystem services for immediate incorporation into TAG, such as carbon sequestration (reducing greenhouse gases in the atmosphere), recreation, vegetation, mitigation of noise and air pollution and visual amenity. However there remain a number of areas for further research, such as biodiversity, viewsheds (the areas visible from a given location) and cultural heritage.

4.15 We are in the process of considering what improvements can be made to TAG in the short term in light of this report. However, landscape is likely to always remain a contentious area for monetisation. The resulting guidance will therefore need careful consideration and the associated methods may be relatively complex, requiring thorough examination and analytical assurance.

4.16 Furthermore, we recognise concerns around the robustness of the indicative monetary landscape values in the Department's supplementary VfM guidance[22] and will work on bringing forward a refined approach to implementing these values in appraisal which is better aligned to approaches used elsewhere for environmental valuation such as in the Natural Capital Accounting work led the Office for National Statistics and Defra.[23]

Valuation of life and health and environmental externalities

4.17 As noted in the consultation document, the DfT is collaborating with other government departments to undertake research into updating the value of a life year used to appraise impacts on the quality and length of life. We will continue to engage with this and ensure the findings are implemented in our appraisal guidance where appropriate.

[22] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/627487/value-for-money-supplementary-guidance-on-landscape.pdf
[23] https://www.ons.gov.uk/economy/environmentalaccounts/methodologies/principlesofnaturalcapitalaccounting

4.18 Similarly, we acknowledge the concerns and recognise the validity of some of the arguments put forward around valuing externalities of transport, carbon appraisal approaches and noise impacts. We are therefore engaging and taking steer from the relevant government departments (most notably Defra for noise and air quality and Department for Business, Energy and Industrial Strategy (BEIS) for carbon) in updating the evidence base for appraisal across government and that it is ensured that the programmes of work they lead reflect, as far as possible, the specific challenges and concerns of the transport sector.

Valuing Journey Improvements

4.19 As set out in the consultation, the Department has identified values of time and journey comfort attributes with MaaS and/or CAVs as a clear priority for developing the evidence base. We will therefore take forward an initial scoping study to review the latest available evidence and inform future research, with a view to providing practical national appraisal guidance in the medium term (2 years).

4.20 The Department is currently working closely alongside Highways England who are undertaking research into valuing various aspects of the customer experience for road travel, such as road surface quality, road layout and the provision of information. We will ensure the findings of this are considered for inclusion in TAG in due course, with substantial progress expected before the end of 2019. At the expert workshop, there were calls to develop the evidence base for customer experience on public transport, such as revisiting rail crowding curves or developing similar estimates for bus. We plan to collaborate with the relevant public sector stakeholders, including the Department's ALBs, to commission a short scoping study to ascertain what further work may be possible in this area.

4.21 We agree with the support for a renewed focus on reliability, particularly for freight, and will work with Highways England to improve our freight appraisal guidance. This will follow on from research carried out last year, which suggested a number of areas for improvement including better data on the freight market, estimates of the value of time and reliability by class of freight, and improved modelling tools. This will also consider the wider socio-economic context and impacts of freight travel.

4.22 Following the significant number of responses on resilience, we will consider the case for developing or adapting a valuation toolkit for use in national appraisal guidance.

Appraisal Methods for the Future

4.23 As is well known, and noted in the handful of responses on the issue of applying the rule-of a half in economic appraisal, the conventional fixed land use approach to appraisal is liable to be imprecise when land use changes are in fact expected.

4.24 The Department is aware of a number of possible approaches to this problem that have been proposed in academic literature and applied in practice, and recognises the desire for central guidance and consistency. We do not wish to stifle innovation in the development of these emerging techniques, but we also recognise the concern raised that the lack of clear TAG guidance means scheme promoters can face uncertainty over whether such methods will be accepted by decision makers at DfT.

4.25 We believe that this issue will be of critical importance to a number of high profile investments coming to key decision points over the next 1-2 years, so will commission expert advice on how to best make changes to TAG which are robust and proportionate. Longer term, we will take forward the research identified as necessary by this scoping work and strive to establish a standard, robust and accepted approach in TAG.

People-Centred Business Cases

4.26 These involve using different metrics and presentation techniques to explain who is affected by schemes and how they are affected on an individual level. For example, time saved per trip, cost per person, or number of people affected. Respondents thought this can help provide a better presentation of key social and distributional impacts at the relatable, user level to decision makers. We agree with this, as set out in the consultation, and will continue our project to develop approaches for building People-centred business cases. We will bring forward any necessary guidance changes arising from this work in the shorter term.

Social impacts

4.27 We are also collaborating with Highways England to review the social impacts guidance. This work will review recent literature, identify evidence gaps and make recommendations for changes to guidance and/or further research. The key topic areas covered will be physical activity, severance, journey quality, access to services and security.

4.28 Although not a major aspect of the consultation document, we also plan to consider implementation of research recently concluded by Highways England and UCL to update guidance for valuing community severance. This work developed willingness-to pay-valuations, derived from a mix of stated and revealed preference surveys, for different road crossing types. Taking this forward well help improve the case for schemes which reduce severance.

5. Reflecting Uncertainty over the Future of Travel

Findings from the consultation

5.1 The focus of this theme in the consultation was on the challenge of incorporating significant uncertainty around the future of travel into our modelling and appraisal approaches. Changes in behavioural, technological and societal trends make the future of travel arguably more difficult to predict than ever before and we need to update our modelling and appraisal methods to reflect this.

5.2 The questions asked in the consultation document were:

- What should our priorities be for improving our understanding and treatment of uncertainty in modelling and appraisal, and why?
- 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?

5.3 The consultation included a workshop on this theme, summarised in notes published alongside the strategy[24],attended by a cross-section of academics, practitioners and public-sector officials that discussed how uncertainty could better be incorporated into the analysis of transport schemes. The various regional events also yielded valuable feedback.

5.4 The main ideas shared in response to the consultation questions are summarised below:

- A strong recommendation for DfT to do more work to **understand the known uncertainties that transport faces**. The key uncertainties that were most commonly mentioned were new technologies, demographic trends, population trends, climate, changes to policy and freight. It was suggested that the Department could carry out research in these areas or look at international examples to understand how these trends may affect transport.
- Respondents highlighted the difference between **exogenous and endogenous uncertainty**. Government has control or influence over a large amount of the potential uncertainty surrounding the future of travel. Guidance in future should reflect the difference between this endogenous uncertainty and the exogenous uncertainty outside of government's control.
- There was general support for the **use of scenarios in appraisal**. Respondents said that scenario analysis should be proportionate to the size and complexity of a

[24] https://www.gov.uk/government/consultations/transport-appraisal-and-modelling-strategy-informing-future-investment-decisions

scheme and that additional scenario analysis would need to be balanced with less focus elsewhere.

- It was suggested that **providing common scenarios through DfT datasets** (i.e. the National Trip End Model data in the TEMPRO software) could reduce the burden on scheme promoters of additional analysis and provide a consistent set of scenarios which are comparable across schemes. This would enable the Department to easily compare outputs from our portfolio to enable better decision making. However, respondents also identified the need to model scheme-specific scenarios and that this should be encouraged.
- The proposal to develop an **'uncertainty toolkit'** was widely supported in principle. Clearer guidance on how to deal with uncertainty and implement scenarios was seen as a positive step. There were several responses recommending that a priority for the Department should be to take firm ownership of common uncertainties and provide leadership on the appraisal of uncertainty. However other respondents wanted the toolkit to be less prescriptive and to give scheme promoters flexibility to apply the tools to best suit their needs.
- Additionally, many respondents reiterated that they would like a set of **case studies** to go alongside any new guidance or 'toolkit' to provide a better understanding of the application of scenario analysis.
- Whilst there was strong support for the use of scenarios in appraisal, a key concern for many respondents was the increased level of analysis that would be required if scenario analysis became compulsory for schemes. The use of **simplified models** was commonly suggested as a way to reduce the potential strain on schemes. This would need to be included in guidance for schemes to understand the level of analysis required for a proportional approach.
- There were two main approaches advocated for in developing simpler models. The first would seek to reduce the complexity and granularity of our existing models to try and reduce costs and run times. The second was to create simplified meta models which would sit below a main model and could be run, quickly and cheaply. These meta models would be calibrated to the main model but would sacrifice complexity and precision in order to deliver a greater breadth of analysis.
- **Presenting uncertainty** to decision makers was viewed as a challenge which should be carefully considered. It was recommended that there needs to be a balance between transparency around the way uncertainty has been dealt with and simplicity in the presentation of results. Suggestions included replacing the idea of a 'core' scenario with several equally plausible scenarios, using graphics to communicate ranges or including additional scenarios in Appraisal Summary Tables.
- **Other ways of addressing uncertainty** were identified in the consultation responses. Some respondents argued that analytical methods for vision-based decision processes, whereby the Department or devolved authority sets a strategic vision for the desired level of demand and pursue policies in order to achieve that, would be a major step forward.
- Additionally, some respondents advocated an approach which incorporated Adaptive Flexibility. Under this approach schemes would incorporate more flexibility in their design and planning which would allow for schemes to be

tailored if volume or type of demand is sufficiently different to that assumed in the initial appraisal. Decisions could then be taken at multiple stages rather than at one decision point at the beginning. This would build resilience to future uncertainty and allow for schemes to respond flexibly to "unknown unknowns" as they are revealed. A similar approach was also recommended in the recent Commission on Travel Demand report [25].

- There was a general feeling that an update is required to the **optimism bias** guidance. Several respondents felt that it is not always used appropriately at the moment and has the potential to provide business case users with a false sense of security. There were suggestions that there is scope to collect and share more data on the contribution of changes to outputs and scope to capital cost changes to determine capital cost uncertainty.
- **A better link between appraisal and post-scheme evaluation** was suggested as a technique to reduce uncertainty and improve forecasts. It was proposed that current modelling approaches should be evaluated to see how well they have produced forecasts so that adjustments can be made to produce more robust estimates in the future and improve current modelling. Some responses also recommended a more continuous approach to assessment than what is required by the current strategic-outline, outline and final business case approach.

5.5 There were many useful points raised by respondents during the consultation process and we are very grateful for the many thoughtful and well evidenced responses we received. There was significant support for an increased focus on uncertainty in appraisal and we were provided with numerous proposals for how best to do this. We are eager to take many of these proposals forward in our strategy.

Taking things forward

5.6 We will continue to carry out research into areas of uncertainty where possible, working with colleagues within the Department to produce research on key behavioural and technological trends. This will help us understand these trends and better understand the drivers of uncertainty in these areas.

5.7 In the short term, however, there is considerable inherent uncertainty around future behavioural and technological developments which we need to take into account in our strategic forecasts and scheme appraisal. We need to accept this high degree of future uncertainty and ensure uncertainty analysis is provided to decision makers to help them understand it.

Uncertainty Toolkit

5.8 The idea of an 'uncertainty toolkit' was popular and we will continue to work on the best way of providing additional support for uncertainty analysis. An objective for our work going forward will be to achieve the appropriate balance between providing an appropriate level of guidance whilst still enabling schemes to have a suitable amount of flexibility.

5.9 The current guidance covers several aspects of uncertainty analysis throughout TAG (for example, evidenced uncertainty ranges around the key inputs into models and

[25] http://www.demand.ac.uk/wp-content/uploads/2018/04/FutureTravel_report_final.pdf

around key appraisal values). A toolkit would bring together key considerations around the treatment of uncertainty in one place and provide a systematic approach to uncertainty analysis, including its presentation to decision-makers. This should give practitioners more certainty around the Department's expectations and encourage users to make the analysis of uncertainty a core part of their analysis.

5.10 Given the wide support for an Uncertainty Toolkit, we will commit to producing a prototype over the next two years. As there was less agreement as to what the toolkit should cover and the level of ownership that DfT should take around national level demand, we will begin this piece of work by developing a scoping study to determine what is best to include in the toolkit.

5.11 Different respondents used different definitions for “scenarios” when responding to the consultation. These ranged from more modelling focused scenarios where demand is adjusted upwards or downwards by some measure, to scenarios which are essentially a set of different inputs and assumptions to represent a different future, to more narrative based scenarios used in scenario planning. These different types of scenarios all represent different potential futures, but they are arrived at in very different ways. We will endeavour to make TAG clearer in terms of definitions of uncertainty and scenarios used within modelling and scheme appraisals.

5.12 Given the support for scenario planning in the consultation responses we shall also work up guidance within TAG (and perhaps the toolkit) on effective scenario planning throughout the appraisal process and how this could feed into the economic case. The scoping study will try to find a balance between giving schemes the flexibility to explore their own uncertainties and maintaining comparability across schemes.

5.13 Considerable demand was identified for case studies in the application of scenarios and uncertainty analysis. We agree and recognise that a key element of understanding and undertaking uncertainty and scenario analysis well will be for DfT and the wider industry to share good and poorer practice examples. We shall include this as part of the toolkit or in accompanying guidance.

5.14 We agree with the consultation respondents who identified the presentation of uncertainty analysis to decision makers as a key challenge in this area. Uncertainty analysis usually provides more complex results to decision makers and there is greater need for clear presentation to deliver a clear message that decision makers can act on. We aim to provide guidance on presenting uncertainty analysis to decision makers. We also want to increase the prominence of scenario results within the business case and how the results are presented to senior decision makers. We will review how uncertainty analysis is presented to decision makers in order to ensure it has the appropriate impact.

Optimism Bias

5.15 We have recently begun a research project aimed at improving the evidence base for optimism bias. This will look in detail at historical evidence regarding cost overruns on different types of projects and different areas of cost, including maintenance and operating costs as well as capital costs. We shall also work to ensure that guidance reflects best practice to ensure that the uncertainty within cost estimation is well understood and explored appropriately in appraisals.

Proportionate uncertainty analysis

5.16 In order to facilitate more uncertainty analysis, the consultation respondents were clear that simpler models would be required in order for this analysis to be proportionate and cost effective, particularly earlier in the project lifecycle. Transport models provide decision makers with vital information to make key decisions but can often be costly to run and take significant time which restricts the number of model runs promoters are able to do. We will investigate the potential for simpler meta models that pivot off a main model to deliver outputs for uncertainty analysis. There is a trade-off between model simplicity and the accuracy of modelling results, we therefore need an approach that can balance the need for sophisticated and detailed modelling of schemes with the need to investigate key uncertainties.

5.17 It will be important that simpler modelling approaches can be justified where they are used, demonstrating that they can still provide results suitable for informing discussions around the resilience of transport schemes to future uncertainty. We anticipate that, if simpler models provide a way to do uncertainty analysis more efficiently, guidance may be required in future on how to validate these models so that decision makers can still have confidence in the results.

Provision of scenarios for wider use in appraisal

5.18 One simple way of enabling scheme promoters to do more uncertainty analysis in appraisals would be to update the TEMPRO software to allow for different scenarios to be incorporated, rather than just one forecast as currently. The Road Traffic Forecasts 2018 included a range of seven different demand scenarios. Separately we are piloting a set of common scenarios to appraise major projects across modes. We aim to achieve greater consistency in the use of scenarios across strategic forecasts and appraisal going forward. These scenarios could be incorporated into an updated TEMPRO, which could serve as a useful off the shelf resource for scheme promoters to use to cover national level uncertainties.

5.19 We are looking to provide more significant updates to NTEM over the period covered by this strategy and these are covered in detail in section 8.

Alternative Methods

5.20 Some respondents argued in favour of vision-led approaches to decision making. These are more about envisaging a desired future and providing the policies and investment to meet the vision, rather than analysing individual schemes or packages against a counterfactual position, as in the appraisal framework. These are issues that we will consider and engage on over the longer-term, considering how appraisal and modelling guidance can support different decision-making processes that incorporate more flexibility. As described in Chapter 2, however, the broader decision-making process and approaches beyond the recommendations in the HMT Green Book are beyond the direct scope of this strategy.

5.21 We are also currently working closely with colleagues in the Department improve the way in which we make decisions under uncertainty as part of the “Future of Mobility” programme which will cover some of the issues addressed in the consultation responses in this area.

6. Modelling and Appraising Transformational Investments and Housing

Findings from the consultation

6.1 This theme is focused on identifying and capturing in appraisal the impacts of interventions by government that trigger substantial amounts of private investment and may thereby result in significant changes to the spatial distribution and structure of a local economy. As outlined in our guidance, these impacts are not relevant to every scheme, but only to schemes where there are robust theoretical and empirical reasons to expect them. As emphasised by the responses, the size of an investment is not a pre-requisite for whether it will or will not have transformational impacts, but a myriad of other factors are.

6.2 The questions posed in the consultation document were:

- What should our priorities be for improving the modelling and appraisal of transformational investments and housing and why? Please select up to three.
- What transformational impacts do you currently find it difficult to represent in appraisal? What are the barriers to their inclusion and how would you suggest these are overcome whilst maintaining a consistent and robust approach?

6.3 The consultation included a workshop, summarised in notes published alongside the strategy[26], attended by a cross-section of academics, practitioners and public-sector officials that discussed the evidence for the transformational effect of transport improvements and techniques for predicting and valuing their impacts. Numerous useful points were also made at the regional engagement events which were broadly echoed in the responses themselves.

6.4 The main messages emerging from the consultation responses are broadly as follows:

- Developing a new approach and methods to appraise transport as part of a package of **wider cross-sector investments** was the area mentioned by the largest number of respondents. In particular, respondents highlighted the need for better tools to appraise schemes which have low benefits when considered individually, but are an integral part of a wider package of investment. Respondents proposed that we should consider the cumulative, programme-level impact of an investment as well as the individual-level impact. There were also suggestions to look at better integrating different departmental appraisal guidance

[26] https://www.gov.uk/government/consultations/transport-appraisal-and-modelling-strategy-informing-future-investment-decisions

to ensure the additional impacts of individual components are captured but not double-counted.

- A large number of respondents cited difficulties with **appraising schemes involving both transport and housing**. One was the suggestion that the appraisal framework struggles to capture the benefits of development based around sustainable forms of transport. Another was the difficulty faced in demonstrating the dependency of development. Thirdly, respondents argued that the land value uplift methodology does not fully capture changes in welfare, having potential distributional implications for investment. Fourthly, several responses highlighted the need for more of a focus on common land use planning assumptions and constraints, and how these feed into appraisals and inform decision-making.
- There was agreement that more needs to be understood about the **pre-conditions required for transport investments to have transformational impacts**. There was strong demand for more case studies of historical and current transport interventions to both assess the accuracy of appraisal methods and understand the conditions under which transport investments have transformational impacts. There was also strong support for more evaluation of historical and current transport interventions, to gather evidence and assess the accuracy of appraisal methods. There was support for the development of a common framework to assess local economic impacts, although some cautioned that high levels of uncertainty and differences in local economies meant such an idea was not feasible. It was suggested that we could develop a checklist of factors that cannot be explicitly captured in appraisals but are necessary for an intended transformational investment to succeed.
- Respondents argued that current appraisal and modelling methods are unable to capture **non-marginal effects** generated by transformational investments and that a whole new approach is required. In particular, respondents argued that the modelling of future demand is based on current behaviour and so cannot predict the effects of large or structural changes.
- Suggestions were made to **review specific existing methods** such as those for agglomeration effects, additionality, and moves to more or less productive jobs. In addition, there were suggestions to develop new approaches to assess a scheme's impact on international competitiveness.
- In terms of **Supplementary Economic Modelling** (SEM), there was support for the use of more high-level modelling earlier on in the decision-making process; for example, at the options assessment stage. It was proposed that the Department should take more of a leadership role in the SEM area by promoting transparency, building knowledge through conferences and providing an expert panel to review models. Views were more mixed around the consultation document suggestion that the Department should develop an in-house SEM. It was recommended that progress was required to increase the availability of local-level data, such as inter-regional trade statistics and local authority planning data, and that this was acting as a barrier to new entrants and inhibiting innovation in SEM.
- From a strategic standpoint, some respondents felt that greater emphasis should be placed on the **strategic case**, and particularly on local economic impacts. It was argued that the current appraisal methods make it difficult to capture the

benefits of schemes that aim to rebalance economic activity to more deprived areas, despite this being a key government policy objective.

- Some respondents felt that there is a need for greater clarity about **when wider impacts appraisal should be applied**, to ensure that it is being used proportionately and consistently. It was felt that at the moment it may not be applied consistently across schemes, but instead in some cases only included where the economic case would otherwise be weak. This was part of a wider point made about the need for greater guidance on proportionality across TAG.

6.5 Overall, a large and diverse number of suggestions were made for improving the modelling and appraisal of transformational investments. Many were in-line with those included within the consultation document but there were several more novel ones too. Taking forward these ideas will be constrained by timings and resources, but it is important to make progress in this high-profile policy area.

Taking things forward

Better appraisal of cross-sector packages

6.6 Given that transport investments alone will not generate transformational change and that there are an increasing number of funding pots for cross-sector packages of investments, we agree that more needs to be done to improve our appraisal approach in this area. Work is ongoing to develop advice on how to capture interdependencies in transport scheme appraisal - both with other transport schemes, and with non-transport interventions. We have also begun working with MHCLG and BEIS to better align our different appraisal approaches and clarify the differences and overlaps between them. We will carry on with these two workstreams over the next two years and will consider how to have the outputs reviewed by external experts. However, we feel that more could be done on the issue of the appraisal of cross-sector packages and we intend to explore this further.

Improving our appraisal of transport and housing

6.7 Capturing the housing impacts of transport investments remains a key strategic objective of the Department and concern of respondents. We will review the difficulties around the appraisal of schemes that promote sustainable development. We will investigate whether there are benefits specific to development planned around public transport and active modes of travel which our appraisal methods are potentially not fully capturing. We plan to host a symposium on sustainable development and transport with academics, to discuss the best way forward. However, it may be the case that the challenges with promoting sustainable development go beyond our appraisal framework.

6.8 We will review the difficulties with applying the criteria for dependent development. We have also commissioned a research project into large-scale dependent development. This will look into the issues around appraising schemes which are large enough to have a non-marginal impact on wider land values.

6.9 Several respondents raised issues with the land value uplift methodology. We are currently reviewing the issues around it with MHCLG, and looking into whether it

could be improved by incorporating distributional weights and removing distortions associated with movements in interest rates and the business cycle.

6.10 Assumptions about the planning system have a critical role to play when considering packages of transport and housing. We will work with others to review how planning assumptions are currently incorporated into appraisal, and whether this approach is consistent and robust across different types of investment.

Improving our understanding of transformational impacts

6.11 A lack of case study and evaluation evidence is both restricting an understanding of the conditions under which transport schemes as parts of cross-sector packages are likely to have transformational impacts, and preventing ex-ante appraisals and modelling from being validated. We intend to work with others to produce a series of case studies both to look at the impacts of historical transport investment with economic transformation objectives, and to clear up areas where there is a lack of clarity around how the guidance should be applied, including the appraisal of cross-sector packages of investment. For the latter, we will build on the housing case studies that we published earlier this year. Our first step will be to internally produce a scoping study to identify suitable areas and schemes for this work.

6.12 Building on recent academic literature[27], we intend to explore commissioning econometric studies to evaluate the impact of historic interventions and welcome others also undertaking work in this area. As part of this work we will look specifically at how to improve our approach to appraising non-marginal changes, and at evidence that can be used to validate the outputs from SEM. We plan to commission a study looking into the factors affecting business and household location decisions, including the speed and magnitude of the response to changes in the transport system. We hope that this evidence can then be used to help us sense-check the outputs of SEM when they are presented in business cases. We also intend to work with the academic groups to improve our understanding of the relationship between transport investment and productivity.

6.13 Respondents raised the need to develop a checklist of wider factors that are critical for a transformational investment to succeed but that can't be easily modelled. The establishment of a common framework to assess local economic impacts was also raised. We believe these are important aspirations. We will build the evidence base on the conditions for transformational investment to succeed through evaluation and case studies. We hope in the future to be able to incorporate these conditions into our guidance, to give us more confidence in appraising transformational schemes and cross-sector packages. However, we recognise that there will always be uncertainty around the impact of transport investments and that it will take time to build up this evidence base.

6.14 Improving productivity growth is an important objective for both the Department and wider Government. We have recently begun a research project to re-estimate agglomeration elasticities with key external transport bodies, agencies and other government departments included on the project board. This is due to report in 2019. We aim to use this to address some of the issues with the existing agglomeration effects methodology and will focus on heterogenous effects. A light-touch research project has been commissioned on the moves to more productive jobs methodology

[27] For example, Gibbons et al. (2018), "The Spatial Impacts of a Massive Rail Disinvestment Program: The Beeching Axe" http://cep.lse.ac.uk/pubs/download/dp1563.pdf

to explore what more should be done in this area. We agree that more also needs to be done to improve the evidence base on additionality and international competitiveness but do not have the capacity to focus on this area over the next 12 to 18 months.

Improving Supplementary Economic Modelling (SEM)

6.15 The recent update to TAG explicitly allows SEM to be undertaken to assess impacts not captured by standard TAG methods. However, much still needs to be done to improve confidence in the outputs of such modelling. We believe that there needs to be innovation both in the development of these models but also new thinking around when it is appropriate to apply them. For example, more simple, high-level modelling earlier on in the options development and decision-making process is likely to be as, if not more, useful than more complex forms of modelling late in the decision-making process. Equally, models could be used to answer the question of "What would need to happen to achieve a range of different outcomes?", rather than just to predict a single new state of the world.

6.16 In the short term, we aim to play a leading role in promoting transparency and building knowledge around SEM. We intend to promote knowledge-sharing across models developed for different schemes through a SEM-focused conference to give practitioners the opportunity to discuss modelling techniques and learn from each other. We will look to set up a panel of external academics to undertake rigorous reviews of current models, focusing on their theoretical and methodological robustness. We will consider commissioning a study to review SEM used overseas and the lessons that can be learnt from its application for domestic schemes. In addition, we will publish a note outlining more concretely the Department's views on the current state of SEM, its potential applications, and what we perceive as 'fit for purpose' modelling.

6.17 Over the longer term, more work needs to be done to validate models against real-world data, to ensure that they are robust enough to be used in decision-making. This will include using evidence built up from case studies and evaluations, as discussed above. We will review potential barriers to entry into the market for providing SEM, to ensure that we are creating the right conditions for competition and innovation to occur. As part of this, we will look into what data are currently available and where the gaps are that are inhibiting both the development of new modelling techniques and validation exercises. For example, the need for regional input-output data and detailed, historical generalised cost data were issues highlighted by respondents. Where important data are missing, we will look into working with the Office of National Statistics and other relevant agencies to fill these gaps. More broadly, we will work to ensure that we, our delivery partners and decision-makers are acting as intelligent customers for SEM, to encourage modelling that is robust, evidence-based, and used at the right stage in the process.

A greater emphasis on local impacts

6.18 In accordance with the HM Treasury Five Case business case model, decision-makers should consider not just the economic but also the strategic case (along with the other three cases) when considering potential investments. The recently updated wider economic impacts guidance explicitly allows for the estimation and inclusion of

local economic impacts in a business case. They should be reported in the economic case but may also be referenced in the strategic case. However, these must be consistent with the analysis underpinning a national-level Value for Money appraisal in the economic case. Over the next year, we will do more promote to stakeholders the parts of the guidance that explicitly relate to local economic impacts.

6.19 Several respondents mentioned that it is difficult to capture strategic rebalancing objectives using current appraisal methods including the land value uplift methodology, as discussed above. We will look further into this issue and consider whether more could be done to improve the use of distributional weights, incorporating market failures such as structural unemployment, and improve the reporting and communicating of local level analysis. We will need to ensure that any new approach is compatible with the principles underpinning HM Treasury's Green Book guidance.

7. Supporting the application of TAG

Findings from the consultation

7.1 The focus of this theme is on supporting the user to apply the guidance in a proportionate and flexible manner that is suited to the analysis being undertaken. It also focuses on the interpretation of guidance and how DfT can support the user to deliver high quality analysis that supports decision-making at all levels in the appraisal process.

7.2 In addition to feedback at the regional engagement events, the consultation included two workshops and a bespoke user survey[28],aimed at understanding the opinions of our stakeholders and what they would like to see in terms of clarification, future enhancement, and making the guidance more accessible.

7.3 The questions posed in the consultation document were:

- What are the main barriers and challenges to applying TAG? How do you think these could be overcome?
- What more could be done to articulate the flexibilities in TAG and support scheme promoters apply the guidance which reflects the specific circumstances of each project?
- How can we improve the way in which TAG is presented? Why? We are particularly interested to hear about how we can improve accessibility and clarity of the guidance.

7.4 The main messages emerging from the consultation responses are broadly as follows:

- **The role of TAG** requires some clarification, regarding what is expected of analysis throughout the appraisal process. This encompasses issues such as being clearer on the links to decision-making, that TAG is a support tool that provides evidence for the economic case for investment, and does not impose a restriction on the decision-maker that is based solely on economic costs and benefits. It should also be clearer that the framework does not disadvantage schemes aimed at different modes; for example, a summary of how active mode appraisals derive significant benefits to public health and journey quality, where journey time savings are often unimproved and indeed not the purpose of the intervention.
- Users feel they need greater support in **understanding the flexibilities** they may employ in analysis and the **proportionate use of guidance** to complete it. To some degree, this can be clarified within the guidance or through supporting documents. It also highlights a crucial practical issue of doing the analytical work

[28] https://www.gov.uk/government/consultations/transport-appraisal-and-modelling-strategy-informing-future-investment-decisions

under constrained resources. Users need to know what they produce will be acceptable; a better definition of proportionality is required. There was also a feeling that TAG is trying to capture projects at all levels of scope. For instance, innovation should be encouraged for larger scale strategic models and planning, whereas projects of limited scope may benefit from a clearer, more economical approach.

- **Case studies** and worked examples came up frequently in the responses. These could improve understanding in many ways. It is felt that examples would aid the user in understanding some of the more technical aspects of the guidance. It was also felt that the important principles of proportionate and flexible use of the guidance could be demonstrated through examples. For example, where have lower-specified models been used to derive a suitable basis for a final appraisal, and where have innovative techniques not listed in the guidance been implemented to add value for decision-making? Users also requested that poorer practice as well as good practice could also be presented, so that practitioners can take a balanced view when specifying models and appraisals.
- There is a general feeling, supported by evidence, that **TAG is not well understood by a non-technical audience**. The intention of the restructure of the guidance in 2014 was to provide guidance for the Senior Responsible Officer and Technical Project Manager, both giving an overview of the requirements of modelling and appraisal when seeking central funding. These are both underutilised and not prominent enough. Many consultation responses suggested that more success could be achieved to access and communicate with this audience via several potential methods, including higher-level brochures and a more prominent link to the strategic case.
- There were significant perceived advantages of more **DfT-led training opportunities** and provision of support. In many responses and workshops, it was felt that seminars and even a conference leading up to TAG releases would benefit the understanding of users on both the technical detail and the expectations of how to approach appraisal in a proportionate manner. DfT often contribute to existing fora and conferences, but it was felt that more formal DfT-led set pieces would benefit the industry.
- **Making the guidance more accessible** was also a frequent issue in responses and covered in particular detail at the TAG theme workshops. The provision of signposting in the guidance was the most common, which would allow users to more easily navigate through to the guidance they require. "Go-To" guides for those with a narrower interest would also be of use, to better target the relevant guidance for the scope of the analysis. Other suggestions focused on the presentation of the guidance and the appearance of the web site, which has scope for improvement.
- **Clarifications in the technical guidance** were also mentioned. In the appraisal guidance, it was felt that improvements could be made in the areas of wider impacts and distributional impacts guidance to increase understanding and allow more efficient application. For modelling, there was a general call to make the guidance easier to follow and applicable in different cases, for example the use of non-static equilibrium models as part of the appraisal, and keeping up-to-date on advances in the field of data. As a principle, it was felt that users could be given more confidence to build methods not necessarily aligned to what is written in guidance, and to innovate where appropriate to do so.

7.5 The Department is very grateful for the constructive responses on what can often be an emotive topic. The user survey provided some evidence to support the sentiment that TAG is a well-respected resource in the industry, which many users find relatively easy to apply and appreciate its nuances and flexibilities. We value the constructive nature of the feedback and agree with the majority of points raised on how the appraisal guidance can be made more accessible and more clearly articulate its status and the expectations of the Department from analysis used to inform decisions when allocating central funding for transport investment.

Taking things forward

7.6 Many of the issues raised in the consultation relate to the status of TAG, how it may be used proportionately where resources and skills may be constrained, and where it may be used flexibly, where innovative approaches may be sought to challenging complex problems.

7.7 TAG is constantly evolving, where new modelling methods and valuations emerge. The intention is to continue to strengthen the evidence base so that scheme promoters have access to as wide an array of evidence and methods as possible in order to present the benefits of investment. It is worth emphasising at this point the importance of the quality of the model and appraisal specification as set out in the Appraisal Specification Report[29]. This is important in defining and agreeing the proportionality of the analysis being undertaken for the problem at hand. Guidance on this is available in The Transport Appraisal Process Unit in TAG[30], and the Department will endeavour to increase the prominence and strengthen this guidance to make the scope of the analysis clearer. As identified through the consultation, this may take the form of easier to access Go-To guides or more prominent higher-level brochures that are outside of the technical pages.

7.8 Whilst the Department accepts that individual technical aspects of the guidance may be made clearer and easier to follow, we also see clarifying the guidance in the whole as a shorter-term objective, which we will endeavour to achieve over the course of the next two years. This will centre around how it is used by different types of reader, with the objective of achieving clarity and consistency as to its status and how transport analysis is viewed by the Department and its decision-makers. For instance, senior officials are keen to convey the message that modelling and the appraisal process is invaluable in articulating a scheme's potential impacts, and the wealth of intelligence it conveys when considering investment options in often complex cases.

7.9 Models are arguably best used as tools for exploring uncertainty in the local and national context to ensure the right proposals are being brought forward to tackle local and regional transport problems. The holistic nature of the appraisal framework is well suited to give this view, and it should be emphasised that the summary of value for money in the benefit-to-cost-ratio metric is of use, but seen as only one piece of information to sit alongside the other key impacts that schemes deliver. This includes linking the economic case more strongly with the strategic case, and how

[29] It is also important to emphasise the guidance on the Proportionate Update Process. This allows the user access to the most up-to-date evidence, but allows flexibility and proportionality when deciding on updating analysis to the latest values. It is not expected that analysis needs to be continually updated where the impact of updates will not be material to the result, and where there is doubt, sensitivity tests are a more economical way of addressing this. The TAG Orderly Release Process is intended to facilitate this process, whereby forthcoming changes to guidance are released well in advance of its their introduction into the guidance formally.

[30] https://www.gov.uk/government/publications/webtag-transport-appraisal-process-may-2018

schemes may deliver key objectives for which they are intended. For example, objectives such as facilitating economic growth, improving public health, improving opportunity for more vulnerable members of society, and improving the local environment.

7.10 The Department is committed to consolidating this emphasis. This may be achieved by increasing the clarity of how value for money is assessed using the results of the appraisal in different contexts. We agree that a good way to do this would be to present case studies where different aspects of a scheme's potential impact and worth may be emphasised alongside first-order welfare-based transport user benefits. We will also prepare short, visual "brochure"-style high-level summaries of the appraisal process to aid the understanding of non-technical users.

7.11 We also recognise the need to make guidance as useful as possible in the context of devolved decision-making. We aim to make the guidance clearer in this respect, along with the aforementioned improvements in the articulation of how value for money evidence is used in decision-making.

7.12 As well as sharpening the guidance itself, we see a fundamental part of this as continual engagement with our regional stakeholders. As well as providing periodic training and conferences on TAG, we will continue to work with these authorities to provide support and advice on how to apply and interpret the guidance in TAG to their scheme appraisal and strategic modelling applications.

7.13 As further explained in the modelling tools theme, as part of this continued engagement, we also intend to adopt a more collaborative approach to research and the development of modelling methods and guidance. This is an important way to support innovation in transport analysis, and encourages more flexible and insightful ways of analysing transport problems. Similarly, we shall continue to engage with other government departments to ensure that, where relevant, appraisal techniques are suitably joined up, such as MHCLG and housing appraisal.

7.14 As a final point on proportionality, we also intend to review the technical aspects of the guidance to clarify how to best achieve high analytical assurance, whilst accommodating flexible and proportionate analytical approaches. This will involve better articulation around suggested standards and criteria. Links to evidence on good and poor standards would be of use, which is again where case studies may help reader's understanding of how to decide on a good model specification and when model development and calibration efforts can be concluded, given the scope of the problem the analysis is addressing.

Making TAG more accessible

7.15 As well as making the improvements already mentioned, it was made clear from the consultation that more can be done to increase the general accessibility of guidance. This will ensure that users can quickly access the material they need. This is also something we shall strive to improve over the next two years.

7.16 Responses to the consultation were relatively mixed when opining on the detailed nature of the technical guidance. Some users find that the guidance can be too detailed in places, which can form a barrier to understanding, particularly for those less experienced or less familiar with TAG and modelling methods more generally. Other users warned against cutting back on this detail, since it is the culmination of often decades of best practice research that practitioners find useful to have and use

in their model design. There is clearly a tension between these views; we shall take the opportunity to review the detailed aspects of the guidance and continue to engage with smaller groups of stakeholders with a range of experience to seek an appropriate balance.

7.17 One method of addressing the accessibility of the guidance, as supported by a significant number of consultation responses, is to provide better signposting to the relevant pieces of guidance. This can take the form of simple flowcharts to act as a boilerplate at the top of the guidance structure, allowing users to access what they need quickly. This can also be supported by short "Go-To guides", which can be stand-alone documents that users of a particular interest can access.

7.18 For example, those undertaking appraisal of a cycling scheme could benefit from a short document signposting them to the relevant guidance and expected standards, potential sources of data and tools available from the Department, and the presentation of case studies, specific to cycling. In this example, such a guide can clarify the importance of physical activity and journey quality in cycling appraisals, linking to that guidance, and promoting the use of the Active Mode Appraisal Toolkit, and the Propensity to Cycle Tool, both freely supplied by the Department[31]. We intend to maintain and develop the Propensity to Cycle Tool so that it becomes increasingly effective as a tool for planning cycle networks.

7.19 Respondents also suggested that the web site itself could be significantly improved, allowing better search facilities and areas to exchange ideas and experiences (e.g. "WikiTAG"). We acknowledge these suggestions, but also must acknowledge that there are some constraints to what we can do quickly in this area, largely due to the way publications are required to be handled on GOV.UK. We shall continue to work with our Web Publishing team to think of how we might be able to innovate within this environment. We therefore see this as a potentially longer-term objective beyond the two-year period.

Providing training and support

7.20 We very much appreciate that the support that users need goes beyond the written guidance. TASM (the Transport Appraisal and Strategic Modelling team in DfT which is responsible for TAG) and the embedded analysts in policy teams across the Department support scheme promoters by giving advice on model development and the presentation of appraisal results in business cases. This can be crucial in interpreting the guidance appropriately and specifying a proportionate approach to the analysis. Again, the Appraisal Specification Report, and the associated thought process, should be emphasised as a fundamental step in the appraisal process, where a commonality of agreement is sought on the methods to be employed.

7.21 We shall establish an annual TAG conference, which will allow users to hear about forthcoming guidance updates first hand, to hear about ongoing research studies to improve modelling and appraisal techniques, and to learn about applying the guidance in their specific contexts. This can also be a forum to share experiences and innovation, fostering a collaborative approach to guidance development.

[31] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/760092/active-mode-appraisal-toolkit.xlsx Active mode appraisal toolkit.
https://pct.bike/ Propensity to Cycle tool.

7.22 As well as a conference, the Department is also keen to provide learning and development opportunities for modelling and appraisal practitioners, and senior responsible officers. We shall develop plans to roll these out over the next 12 months, and will work with stakeholders and training suppliers to consider how best to meet user needs.

8. Developing and maintaining modelling and appraisal tools to meet user needs

Findings from the consultation

8.1 This theme centres around ensuring that modelling techniques used in appraisal are current and robust, and that this is reflected in the Department's guidance and tools that it provides to users.

8.2 Along with aspects of the other themes, this theme also presents the significant challenge of ensuring that modelling techniques remain valid in a future world that is inherent with unprecedented uncertainty. Models need to be the right tools for the job, and make the best use of current and emerging data sources in their design. The methods themselves may also need to adapt and innovate according to the complexity of the issues being examined.

8.3 Findings from the consultation reflect this sentiment, highlighting the need for collaboration across industry and the leadership role the Department has to play in facilitating robust outcomes and decision-making. Responses also recognised the significant practical challenges to delivering analysis at a highly sophisticated level, and the need to strike the right balance to make analysis proportionate to the decisions that need to be made. This highlights the key tension when developing tactical models to support specific project funding.

8.4 The questions posed in the consultation document were:

- What should our priorities be for improving the development of modelling and appraisal tools, and why? Please select up to three.
- How can we best encourage innovation whilst maintaining a consistent and robust approach?
- What new and emerging techniques and methods should we potentially explore and what specific problems might they solve?

8.5 The main messages emerging from the consultation responses are broadly as follows:

- **Proportionate modelling** for the purpose at hand and TAG's perceived role was a feature of several consultation responses and particularly at the theme workshop. This links to both perceptions around restricting innovation and the requirement to comply to boundaries set out in guidance. Respondents considered there to be merit in being clearer as to the role of guidance for more strategically-oriented models, used earlier in the appraisal process or for planning purposes and option sifting, and for models used by devolved authorities. Also at the workshop it was highlighted that appraisal specification reporting and agreement is underutilised and that it should be made more prominent and more

strongly encouraged. On the other hand, users raised that modelling for final scheme appraisal is a resource-intensive activity. Guidance could be clearer, for example through higher-level advice or the use of case studies, on how analysis for projects may be more streamlined, and what proportionality means in these cases. Respondents also cautioned, however, about "dumbing down" guidance for what is inherently a complex problem.

- **Maintaining and enhancing current methods and evidence** is a common issue that has been raised. This ranges from making sure the evidence base is up-to-date for our current assumptions and recommendations for modelling and appraisal, to preparing ourselves for more uncertain future challenges. Areas for immediate development that were mentioned were, for example, freight modelling, active mode forecasting and wider impacts. Respondents were keen to have the guidance and tools in place to help get these forecasts right. There are also calls to have better acknowledgement of alternative existing practices such as micro and meso-scale modelling in addressing issues of resilience and disruption on networks. Encouragingly, there is promising scope for the Department to undertake research and develop methods and guidance in a more collaborative fashion, by continuing to engage with our ALBs and regional partners and to leverage other opportunities where common interests are shared (such as research institutions, software developers and wider stakeholders).
- Some users also encouraged the Department to **review its existing tools and guidance** to ensure they are still current, fit for purpose and the most useful they can be. For instance, reviewing the appraisal tools of TUBA, COBALT and WITA, and potentially working with software suppliers to build them into existing processes more smoothly. NTEM and TEMPRO were seen as key products, the use and clarity of which could be improved. Areas of guidance also highlighted were a review of TAG Unit M4 to better articulate expectations of uncertainty analysis, and the variable demand modelling guidance in TAG Unit M2, which should be reviewed and updated to reflect practical considerations as well as a wider array of methods in which VDM may be constructed.
- **Development of wider techniques and encouraging innovation** was of keen interest to several respondents. This links to the real and perceived role of TAG to encourage innovation where appropriate, rather than being seen to hinder it and set analytical development down similar paths (readers may wish to refer to numerous references to this in TAG, particularly §3.1.4 of Guidance for the Technical Project Manager[32]). Besides this principle, many respondents felt that it should be a role of the Department to research and collaborate with industry to prepare analysis for future difficult problems, such as the impact of technology on transport operations and travel choice, and predicting how people might change their behaviour in future society. For example, methods such as activity-based modelling were seen by some as a potential way forward, though some were less enthused by this practice. Either way, the challenge is to define how TAG plays a role in this, if only to appear more open to these approaches. Supplementary economic, LUTI and dynamic modelling was also highlighted as being a particular weakness or challenge to the industry and requires more guidance or clarity on their use. Again, the context of use of these models is fundamental - there are key differences between their use in planning against deriving impacts for specific

[32] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/712692/tag-tpm-guidance-technical-project-manager-may-18.pdf

appraisals. As a broad principle, several respondents made very useful suggestions about how the Department could encourage innovation beyond TAG, through a more collaborative approach, and potentially new funding opportunities and competitions.

- As well as developing specific techniques, it was felt that the Department had a role to play in **emerging and maturing data sources**. Many users expressed a desire to use such data in order to increase the exploratory power or efficiency of existing models, and potentially opening up the possibility of new ways of modelling certain problems. As well as updating guidance in recognition of this, there may be scope to consider access and availability of data sources and undertaking a deeper exploration of their potential.
- Several respondents suggested that **improving access to DfT models and data** would potentially provide significant opportunities to model developers. Respondents specifically nominated the NTM, the NTEM suite, and the Department's aviation models in this regard. The key suggestion here was that this may be useful for regional and devolved authorities to use the tools or adapt their outputs for more bespoke local forecasts. Access to NTEM and opening out the data within the models would also potentially help authorities better understand the assumptions made in the models and allow more tailored trip generation, particularly when undertaking scenario analysis. In general, it was felt that it would be beneficial to have more transparency around these national models.
- Although identified as a theme in its own right, it is worth mentioning that **uncertainty** was a key issue raised in the context of the modelling theme. Indeed, the two are very much inter-related. Responses centred around the use of scenarios, with potential enhancements to guidance and the provision of tools to facilitate this analysis. Some responses also highlighted that articulating uncertainty in models in a transparent and confident way is also very important for using models more wisely in the context of decision-making.
- **Evaluation** was also a general theme of several respondents. It was felt that this is often neglected, but that it is crucial in understanding outturn impacts and our ability to forecast them. It also is crucial in informing modelling and appraisal methods within TAG. The most prominent area where this is required was suggested as in forecasting and appraising wider economic impacts.

Taking things forward

8.6 This section sets out high-level plans for how we are taking forward our strategy in this area, from maintaining and developing existing tools and evidence, to considering tackling difficult future challenges in modelling. As has come out strongly from the consultation and our engagement with stakeholder partners, we intend to take a collaborate approach to research and guidance development to try and advance methods and encourage innovation where appropriate and feasible, whilst recognising the needs of regions and local areas.

Encouraging innovation

8.7 There is significant overlap between this theme and the theme on making TAG more accessible. It is clear that for the respondents on this theme, the practical implementation of their work in scheme appraisals and strategic planning was of primary concern, particularly in the case of greater clarity being sought from users as to the meaning of the term 'proportionality' and how it applies practically in modelling applications. Whilst some users are looking for a more streamlined approach to achieve acceptable models for use in the final stages of appraisal, other users are perceiving restrictions of such an approach, and the current articulation of the guidance, on more complex strategic planning applications of transport models (and occasionally land use models).

8.8 The overarching tenet of TAG is to provide guidance to users to produce analysis that is fit for the purpose for which it is intended, and proportionate to that requirement. However, there is a tension between these different types of modelling applications: one size doesn't necessarily fit all.

8.9 We take it as a fair criticism from several respondents that more clarity is required to allow for accurate but streamlined approaches to modelling and appraisal for business cases, but also clarity to allow for flexibility for more innovative approaches where it is appropriate to do so - most likely when looking at strategies or the development of programmes. We shall aim to achieve this in the next two years, using the methods identified in Section 7. This is in line with *§*7.3 of the consultation document. It is very important to the Department and industry more broadly that guidance is used so as to not preclude innovative techniques where it is appropriate to use them, whilst giving confidence to those who wish to apply the guidance expediently that their analysis is robust.

8.10 The Department continues to engage with authorities who are developing excellent examples of innovative approaches to modelling in order to develop their strategies in an uncertain future. We will continue to do so in order to support and learn from these developments.

Developing methods and the evidence base

8.11 As described in the consultation document, we are committed to producing a new guidance unit on base year matrix building in transport models. There was significant support for this from practitioners before and during the consultation. This is a fundamental feature of models and forms the foundations for forecasting, hence is arguably one of the biggest sources of uncertainty in an appraisal, and guidance on this development process will be of significant benefit to the quality of models.

8.12 As stated in §8.17 of the consultation document, this work builds on previous research done by the Department on the current state of the art of building base year matrices, and how to harness the potential of new and emerging data sources such as mobile network data. We are preparing for the new unit to be released in TAG's May 2020 release, and shall publish it in advance of this as a forthcoming change to guidance, in line with TAG's orderly release process[33].

[33] https://www.gov.uk/government/publications/change-management-in-webtag-the-orderly-release-process

8.13 We suggested that freight modelling was another important area where the state of the art needs significant improvement, as well as guidance on how to undertake it. The consultation has revealed support for this from several stakeholders. We are under no illusion that there is a quick remediation to this. We intend to work with our partners such as Highways England in order to develop a programme for development of these methods. We shall first review current methods and data sources available and critically review tools such as the Great Britain Freight Model in order to improve national and regional forecasting methods. The programme will also include the implications for guidance and local scheme appraisals, focusing on what will be proportionate to include in those models, and how these may be potentially informed by the national tools.

8.14 Active mode schemes were mentioned by some respondents, with a call for greater clarity on their appraisal. As described in the People and Place theme, we are continuing to work with other government departments on aspects of the framework directly relating to active modes such as health and journey quality. We acknowledge that demand forecasting for cycling in particular is difficult and requires bespoke approaches to assess, and that current recommendations for this can be updated in TAG. For reasons of proportionality, it is not expected that multi-modal models are generally used for this purpose. We will consider developing a research study aimed at improving this element of forecasting, again collaborating with partner organisations, such as Transport for London, who have relatively advanced modelling capability in this area.

8.15 As previously mentioned, we wish to make the guidance as accessible as possible to users and provide clarity on proportionate use of models in scheme appraisal and strategic applications. As stated in §9.28 of the consultation document, we shall undertake a review of the guidance to seek further areas of improvement to promote its flexible use and that it is applied in a proportionate way. As part of this we will ensure that it is joined up with other guidance from other government departments and external sources, and provide more meaningful acknowledgement of how other tools may be used in appraisal. This could include techniques such as micro and meso-scale dynamic models for assessing network resilience.

8.16 As described in §9.19 of the consultation document, as part of maintaining the evidence base, we will undertake a review of the recommended modelling parameters within the guidance. This is with the view of ensuring that forecasts from modelling are in-line with current evidence. We will also ensure that the VDM guidance sufficiently reflects the uncertainty around these and the implications for the interpretation of demand model realism testing.

8.17 As described in §9.21-22 in the consultation document, we will continue to maintain and update the appraisal evidence base. Users praised the data book, introduced into TAG in 2013, as a valuable source of these data. We will also maintain and develop our supporting software tools of TUBA, COBALT, WITA, DIADEM and TEMPRO where appropriate. As part of our general review we shall also look at opportunities for enhancing these tools, for example in the case of TEMPRO expanding the software to account for multiple scenarios. We are nearing completion of the next version of WITA, which shall be released early in 2019.

Rail-specific enhancements

8.18 Our evidence base in TAG for rail forecasting is largely based on the Rail Demand Forecasting Estimation (RDFE) study. This improved our framework by incorporating the relative rail travel patterns of people in different types of employment and fits the

historical data better. We are seeking to improve upon it by testing further hypotheses about other factors that may be affecting rail passenger demand into the future, including changing working patterns. We are also developing an approach to calculating elasticities that can be easily duplicated as new data becomes available, so that the elasticities can be updated on a more regular basis to reflect the latest rail travel behaviour.

8.19 In addition, we continue to undertake research jointly with the Passenger Demand Forecasting Council (PDFC). This group includes Train Operators, Network Rail and the Rail Delivery Group (RDG). The work programme includes research on unplanned disruptions and demand forecasting focused on the North.

Building momentum for evaluation

8.20 We welcome consultees' views that more evaluation is required and that its results should be used to provide better evidence for appraisal and modelling. We have increased our commitment to evaluation in recent years and plan to further build momentum in this area.

- The Department's latest Monitoring and Evaluation Programme[34] was published in February 2018 and provides a summary of the Department's priority monitoring and evaluation projects and their status.
- We are building on our report on 'Strengthening the links between appraisal and evaluation' in 2016[35] by piloting how to develop an Appraisal Handover Pack for a road scheme to ensure that modelling assumptions and associated analysis of uncertainty can be understood in subsequent evaluation work.
- We updated TAG guidance for the technical project manager in December 2017 to recommend the use of Appraisal Handover Packs.
- We have scoped an approach for measuring the economic performance impacts of road enhancements and will draw conclusions and next steps with this workstream in 2019.

8.21 In the coming year we will develop a TAG unit on evaluation to offer guidance on planning for evaluation at appraisal stage. We will also aim to publish an example Appraisal Handover Pack that can show good practice in this area.

8.22 We will continue to conduct proportionate evaluation to provide evidence about the effectiveness of the Department's activities, both for the purpose of accountability and to inform future decision making. As part of this work, we will identify where evaluations can be used to fill key evidence gaps in appraisal approaches. It is important to recognise however, that the process of creating and compiling ex-post evaluation datasets of the scope, scale and consistency necessary to revise guidance is challenging and will be a long-term undertaking for some classes of scheme.

34 https://www.gov.uk/government/publications/dft-monitoring-and-evaluation-programme-2017
[36] https://www.gov.uk/government/publications/uk-port-freight-traffic-2019-forecasts

Exploring wider techniques

8.23 The third question we asked in the consultation concerned new and emerging techniques. Acknowledging that some practitioners are using techniques not included within TAG, this strategy will focus on how these techniques and data sources might be applied to inform tools for national policy testing primarily, such as agent-based simulation approaches. From this more informed viewpoint, we can subsequently assess any potential guidance we might give in TAG on these approaches, if appropriate. As stated in §9.13 of the consultation document, this will also include engagement with the research community and holding workshops to steer the direction of potential exploratory work.

8.24 We acknowledge that the use of land use and dynamic economic models is more prevalent than is reflected specifically in guidance. Section 6 describes the use of these and similar models to derive valuable information for the economic appraisal. These models are just as valuable, if not more so, in the wider context of strategic planning. As a way of encouraging innovation, and to promote a culture of best practice in the use of models in general, we will consider what role the Department has to play in providing guidance in TAG on the use of these models in the strategic context, as well as strategic transport models in general.

National Modelling Tools

Highways and multi-modal modelling

8.25 In 2018 we took delivery of a recalibrated National Transport Model, to a 2015 base year. We are currently undertaking a work stream with the intention of making this model much more transparent to our stakeholders. The emphasis of this work is to test the model through techniques such as stress-testing and back-casting, in order to fully understand the strengths and weaknesses of the model. This is intended to make the articulation of model uncertainty more refined, and to allow transparency as to the analytical assurance of different types of analysis required of the model. We have also commissioned a peer review of the model, which we shall publish, in order to better describe how the model operates and provide assurance as to its quality.

8.26 The consultation document described the progress we are making on constructing a new National Transport Model in PTV VISUM, which is due to be delivered in the second half of 2019. This will significantly enhance our forecasting capability and will provide more detailed assessment of parts of the national road network.

8.27 As supported by the number of consultation responses on the topic, we recognise that the National Trip End Model (NTEM) is the most important tool that we provide to modelling practitioners. As described in §9.9 of the consultation document, we will establish a programme of work to enhance our demand forecasting capability and tools. There are several potential areas to enhance which we will need to decide how to prioritise. These include improving forecasts of car ownership in the National Car Ownership Model, making the scenario development process in the Scenario Generator more accessible, and enhancing the trip end model to include more explanators for forecasting future trips. A key question here is how to forecast trip ends more accurately where travel behaviour is changing.

Rail

8.28 We are working jointly with RDG and PDFC to develop a new forecasting model for estimating how many people travel on each train, including the demand responses to timetable changes and levels of crowding. The model will be built in a scalable way so that it will be easily developable in the future.

8.29 We will also improve the Rail Emissions Model (REM) based on direct measurements of emissions from trains and linking those to engine performance and geographical context. This will help make our appraisals of the impact of rail schemes on air quality much more accurate.

Aviation

8.30 Following the publication of aviation forecasts in October 2017 and the use of these forecasts in support of the recent Airports National Policy Statement, we are starting the process to update and further develop the aviation model. We intend to undertake a number of significant model updates over the next two to three years in advance of the next set of UK aviation forecasts. We intend to discuss our modelling approach with stakeholders in the first half of 2019.

8.31 The model development programme will not be finalised until after discussion with stakeholders, but a number of areas have already been identified as needing development. Some areas have been identified as a result of an internal review, some as a result of external criticism and some simply due to the need to reflect the circumstances of a changing world. Examples of these areas are:

- Reviewing and updating the econometric inputs which form a critical role in the production of aviation forecasts. They determine the extent to which changes in forecast economic activity and air fares result in changes in forecast aviation demand. This process is modelled in the National Air Passenger Demand Model which forms part of the broader aviation model.
- Reviewing and updating the logit choice models within the National Air Passenger Allocation Model. As well as incorporating the latest data, this will also consider different forms of nesting, whether fares can be a significant explanatory factor and the role of frequency.
- Update the parameters within the Fleet Mix Model, making use of newly obtained and more detailed datasets.
- Reviewing and simplifying the existing code within the model, to help the model run more easily and to improve ease of maintenance and assurance.

Maritime

8.32 We published port freight forecasts in January 2019[36]; the previous forecasts were published in 2007. These forecasts were the first produced using our own in-house model, which has been developed over the past few years.

8.33 The aim is to now have a regular process of publishing updated forecasts and future work will seek to improve and enhance the forecasting methodology.

8.34 The immediate next step will be to collect user feedback to better understand the forecasts are used and how they could be improved for users. Initial engagement

[36] https://www.gov.uk/government/publications/uk-port-freight-traffic-2019-forecasts

suggests that some further breakdown of categories would be useful (for example, Ro-Ro split into accompanied and unaccompanied trailers).

8.35 This user feedback will then be used in the development of the next set of forecasts, which will involve:

- Testing the accuracy of the models and investigating the use of alternative methods for producing the short and long-term forecasts;
- Reviewing the tools in the forecasting model, such as the treatment of uncertainty;
- Developing the methodology for the forecasting of passenger in the near future.

Access to DfT models

8.36 We acknowledge the requests of several users for better access to the Department's models and data. As part of this strategy, we will consider the options for improving access to the models and the associated potential benefits and associated issues. For example, for those wishing to build knowledge in these models to potentially enhance modelling for more local purposes, we may in part address this by holding bespoke courses for our stakeholders, including webinars or similar formats. As described, we have also begun to open up the current version of the National Transport Model through much more transparent documentation and details of its performance under various tests. We are keen to set an example in this regard and be transparent about its potential shortcomings when applied in certain contexts, as well as its positive capabilities.

8.37 We shall explore our options for how we might consider providing models to stakeholders. We already provide several models with the intention of facilitating more expedient development of scheme models, in particular the generic variable demand model, DIADEM.

8.38 Whereas we can open up the models through better documentation and education, simply sharing the core DfT forecasting models in their current form is not a straightforward matter. This is due to various commercial issues, and that they require significant specialism to operate and understand effectively, which DfT cannot directly support. That said, there may be various model components which we could consider making more widely available, such as the National Trip End Model for use in scenario testing. This will need to be supported by further guidance on its use and the principles of trip generation more generally in TAG. As a general principle, we are developing new national modelling functionality that could be more amenable to be shared through more modern software platforms or web-based services.

8.39 We propose that if there is sufficient need from our stakeholders that we explore this issue in more detail. This may begin though a workshop to discuss what we may potentially offer, and what the genuine user requirements are in order to judge whether it is of sufficient value for money to pursue further.

9. Next steps

Continuing engagement

9.1 We look forward to continuing discussions with all our stakeholders as we embark on delivering the priorities in the strategy. To support this, we plan to hold an event to present the priorities in this strategy and discuss opportunities for working with others to deliver. We are keen to continue discussions with a wide range of stakeholders and expressions of interest would be welcome from all parties.

9.2 The Joint Analysis Development Panel has played an influential role in the development of this strategy and we are grateful for their advice and strategic direction. We will continue to work closely with the panel as we tackle some of the more challenging priorities and review progress across the strategy.

Delivering the strategy

9.3 The development of a new strategy provides the perfect opportunity to review our delivery approach focusing on how, with demands for both increased scope and depth of TAG, we can most effectively work with others to deliver. This includes working closely with colleagues across DfT to promote consistent communication of the role of TAG and expectations of analysis. It also includes continued close working with colleagues across government to better align our different appraisal approaches and clarify the differences and overlaps between them.

9.4 We have already identified or started work on a number of research projects with our partners. This includes joint research on social impacts and freight modelling and appraisal with Highways England, and TfL/TfGM on active mode appraisal. We have recently begun a research project to re-estimate agglomeration elasticities with key external transport bodies, agencies and other government departments included on the project board. More broadly, we are liaising with stakeholders including TfL and TfN on modelling, data and appraisal methods and scoping areas for collaborative working. To support collaborative working, we will make clearer the conditions under which we will accept new evidence, thereby enhancing transparency and encouraging innovation.

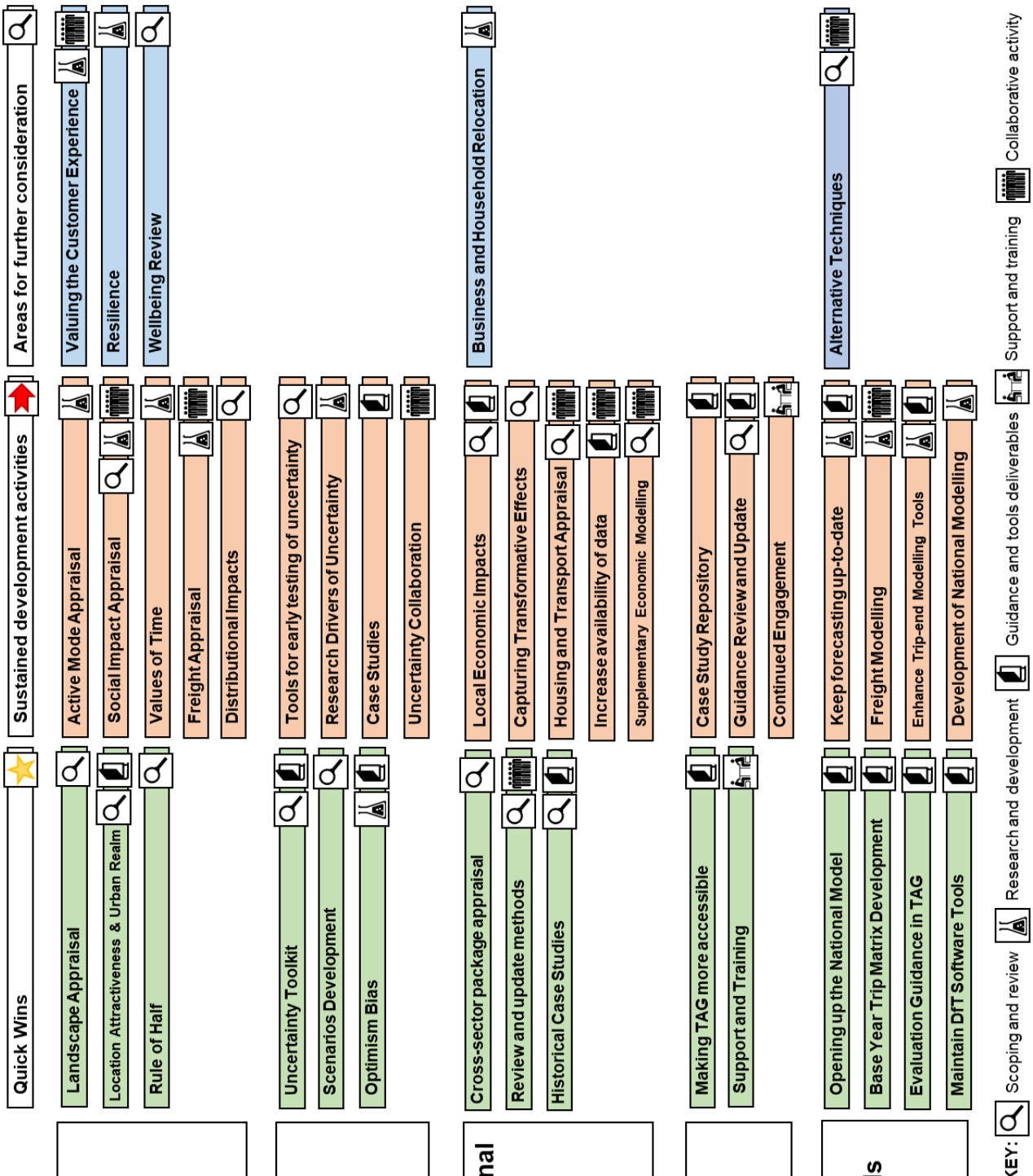
9.5 We are keen to identify other opportunities for collaboration on research. We will continue to talk to the academic sector, including the research councils, about our research priorities, ensuring a shared understanding of evidence and gaps. As part of this we hope to identify aspects of the strategy that could potentially be taken forward as MSc or PhD topics.

9.6 As described in Chapter 7, we will be holding our inaugural TAG conference later this year. This will provide an opportunity to update stakeholders on progress, raise awareness of recent and forthcoming changes to the guidance, share best practice

and review the latest research. Our intention is that this will also include sharing of experience of using TAG and broader application and innovations from our stakeholders. Furthermore, we will continue to attend and present at conferences, seminars and discussions.

9.7 Routine feedback and questions are always welcome via TASM@dft.gov.uk.

Annex A: Full summary of priorities



Annex B: Full list of consultation questions

Prioritisation

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?

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

People and Place: capturing the range of impacts relevant to transport policy today

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

Reflecting uncertainty over the future of travel

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

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??

Modelling and appraising transformational investments and housing

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

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?

Supporting the application of TAG

8 What are the main barriers and challenges to applying TAG? How do you think these could be overcome?

9 What more could be done to articulate the flexibilities in TAG and support scheme promoters apply the guidance which reflects the specific circumstances of each project?

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

Developing modelling and appraisal tools that meet user needs

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

12 How can we best encourage innovation whilst maintaining a consistent and robust approach?

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