

3.5 EVIDENCE AND METHODOLOGY

Headlines

- An evidence-based approach has been adopted to assess and compare transport policy options, drawing on evidence of real past and proposed future interventions across the UK, and modelling work using a range of analytical tools. A very wide range of costs and benefits have been taken into account.
- Understandably, evidence is not available for all interventions on the policy menu; nor does the evidence cover every circumstance in which an intervention could be implemented. This is particularly true in growing and congested urban areas and their catchments; but the evidence is sufficient to draw some useful strategic conclusions.
- No assessment is able to capture all the costs and benefits of a transport policy and present them in monetary terms. Impacts on the environment, journey time reliability and some GDP effects are therefore not captured in the typically used benefit:cost ratios (BCRs) that result from the NATA^a appraisal process, but are assessed qualitatively.
- For the purposes of this study, the best available evidence has been used to attempt to estimate the value of these previously uncaptured effects, and in some cases, a judgement on the magnitude of environmental effects has been made using evidence on environmental valuation. This has allowed the overall value for money of interventions to be compared.
- Some impacts remain unquantified, such as trade and dynamic effects.

^aSee: www.webtag.org.uk

INTRODUCTION

5.1 The purpose of this chapter is to provide more detail on the significant quantity of evidence that has been drawn on to reach the conclusions and recommendations in this volume. In addition, more detail is provided on the approach taken to the assessment and comparison of interventions explored and how the various metrics can be interpreted. This chapter:

- sets out the process of cost-benefit analysis and the role it plays in decision making and prioritisation;
- outlines the range of evidence that has been drawn on and how the GDP and full welfare impacts of different options in different places have been estimated;
- offers some insight into how the evidence can be interpreted; and
- concludes with what this evidence can tell us, and what it cannot.

COST-BENEFIT ANALYSIS AS A DECISION MAKING TOOL

5.2 By relying on evidence of the likely returns of transport spending, it is possible to build an understanding of:

- where and under what conditions different interventions are able to offer benefits that exceed the costs; and
- which policy options are likely to be the best.

5.3 Cost-benefit analysis (CBA) has long been used by government and business as a way of measuring the impact of taking action, relative to ‘doing nothing’, (see Figure 5.1). By assessing the costs and benefits in a consistent and transparent way, options can be compared and government is able to allocate its funds to the projects that offer the best returns.

Figure 5.1: Cost-benefit analysis as a decision-making tool

In the transport context, cost-benefit analyses are carried out for all major transport projects. The impacts of an intervention are assessed against a ‘do nothing’ reference case to allow an assessment to be made of the benefits and costs of action relative to what would otherwise be likely to happen.

In 1998, the UK Government introduced its formal appraisal process, the New Approach to Appraisal (NATA). This sets out guidance on how a transport project requiring government funding should be appraised against the five government objectives for transport: environment, safety, economy, accessibility and integration. The purpose is to assess the overall value for money of the intervention after all impacts have been accounted for.

Impacts are assessed and presented in monetary terms where a robust valuation evidence base exists, for example the value of time to a range of transport users and vehicle operating costs. Where this is not possible, as for some environmental effects, impacts are assessed qualitatively by experts in the field. Overall impacts are summarised and presented consistently in an appraisal summary table.

To reflect the evolving nature of transport appraisal, four cost-benefit measures are referred to throughout this study, all of which express estimated benefits of a proposal per pound of government expenditure. If the ratio is, say, 2.5 then £2.50 of benefit is achieved per £1 of public funds invested. An intervention with ratio of 5:1 would offer double this welfare return.

5.4 The metrics used in this volume are set out in Figure 5.2.

Figure 5.2: Metrics used throughout this volume

The metrics below have been relied upon throughout this volume and they vary according to the impacts that are monetised and reflected. This study takes the view that the conventional BCR as generated from the NATA process is the most certain measure, but that it is incomplete. The value for money assessment is the most complete ‘single measure’ of transport’s impact on the UK, as it incorporates the fullest possible estimate of a proposal’s economic and environmental impacts. However, those estimates are more uncertain than the conventional BCR because the evidence base is relatively new, and some of the effects are inherently hard to monetise. The metrics are:

- **Conventional benefit:cost ratio (NATA BCR):** the benefit:cost ratio set out in DfT’s appraisal guidance (New Approach to Appraisal^a). The main effects that are monetised in this BCR are: changes to the overall costs of travel, the value of changes to travel times, safety benefits, and the financial costs (including optimism bias) of doing the project, including impacts on taxation revenues. This does not yet include a number of GDP impacts, and in this analysis does not put a monetary valuation on environmental benefits.^b Instead, the BCR sits within a broader assessment framework that uses qualitative estimates of environmental and social impacts.
- **GDP per pound:** the contribution to GDP that can be achieved per pound of government money spent on the intervention. It is a narrower metric than welfare because it only focuses on the impacts on the economy. It does not therefore include benefits for non-work/leisure travel, for example. In addition to the GDP impacts already captured in appraisals – such as changes in the costs of travel to business and freight – this assessment also includes impacts on the wider economy that are not currently estimated as part of conventional appraisals, such as agglomeration, labour market impacts, competition effects and reliability. Such effects have been indicatively estimated for this study based on the developing ‘state of the art’ guidance on how to assess these impacts from DfT.^c
- **Wider benefit:cost ratio (BCR):** this adds the ‘missing’ GDP effects into the conventional BCR.
- **Value for money (VfM) BCR:** the most complete metric used in this analysis. For decision making, all impacts on society should be considered, but only some can be presented in money terms. The value for money assessment, is broader than the three previous metrics, incorporating most significant environmental effects into the monetised assessment by relying on recent valuation evidence. Environmental effects estimated in this way are carbon (using Defra guidance), air quality, noise and landscape (using published DfT and Defra research).

For example, a new piece of transport infrastructure may offer say £3 of GDP per pound; have a wider BCR of 5 i.e. offer £5 of welfare for every £1 of cost (higher than GDP per pound because this captures a broader range of benefits than just GDP); but after environmental effects are accounted for, the VfM BCR may be 4 (i.e. overall welfare return is £4 for every £1 cost).

It has not been possible to provide VfM BCRs for all the interventions considered by the study, so in such cases a qualitative assessment has been carried out, highlighting the likely implications for value for money.

^a For more detail see www.webtag.org.uk.

^b Though recent developments in appraisal guidance will lead to future appraisals, capturing the value of changes to carbon emissions and noise.

^c *Transport, wider economic benefits and impacts on GDP*, DfT, 2005.

SOURCES OF EVIDENCE FOR THE STUDY

5.5 A wide range of evidence from a range of sources has been drawn on, including broader academic literature. Evidence from real existing and proposed schemes in the UK has been used heavily. However, the evidence available does not cover some policy options so additional evidence has been generated from a range of modelling sources. This includes national transport modelling for the year 2025, rail network modelling for the year 2026, aviation and ports modelling for 2030, limited modelling in the West Midlands and a strategic modelling case study of South and West Yorkshire. The full range of sources is listed in Figure 5.3.

Figure 5.3: Sources of cost-benefit analysis

- **DfT's value for money assessments: a sample of projects submitted for ministerial approval over the last two years including public transport interventions and strategic and local roads.**
- **A case study of South and West Yorkshire using the South and West Yorkshire Strategic Model (SWYSM) exploring a range of illustrative interventions; and an illustrative intervention in the West Midlands using the Policy Responsive Integrated Strategy Model (PRISM).**
- **Transport for London analysis and business cases.**
- **Air Transport White Paper and Ports Policy Review analysis on the costs and benefits of increasing ports and airports capacity in the period to 2030.**
- **National Transport Model strategic modelling of road pricing and strategic road investment in 2025.**
- **Strategic modelling of inter-urban variable capacity rail enhancements using the PLANET suite of models for 2026.**
- **Sustrans analysis of walk and cycle interventions.**
- **High Speed Line Study – Summary Report.^a**
- **A review of the literature on step-change measures in the UK and overseas.**

In total, the database of evidence contains relatively detailed information on the returns of over 170 interventions, plus a range of additional evidence from external sources and modelling.

^a High Speed Line Study- Summary Report, published October 2004. Available from www.dft.gov.uk.

5.6 The strategic modelling work has been discussed and reviewed by a number of expert academics in the field and more detailed reports on this analysis, including a description of the methodology used, are published alongside this report.

5.7 Unlike a detailed CBA, strategic modelling provides an earlier stage of analysis. It assesses the returns from improvements to particular transport corridors without specifying precise routes. This is a tractable way of conducting strategic assessments, but can only ever provide a high-level assessment of some of the environmental and social impacts involved; and it adopts rules of thumb for high-level costings. Nonetheless, it does form a useful source of analysis where detailed appraisals are not available and can help guide policy makers towards areas where more detailed appraisals are likely to be worthwhile.

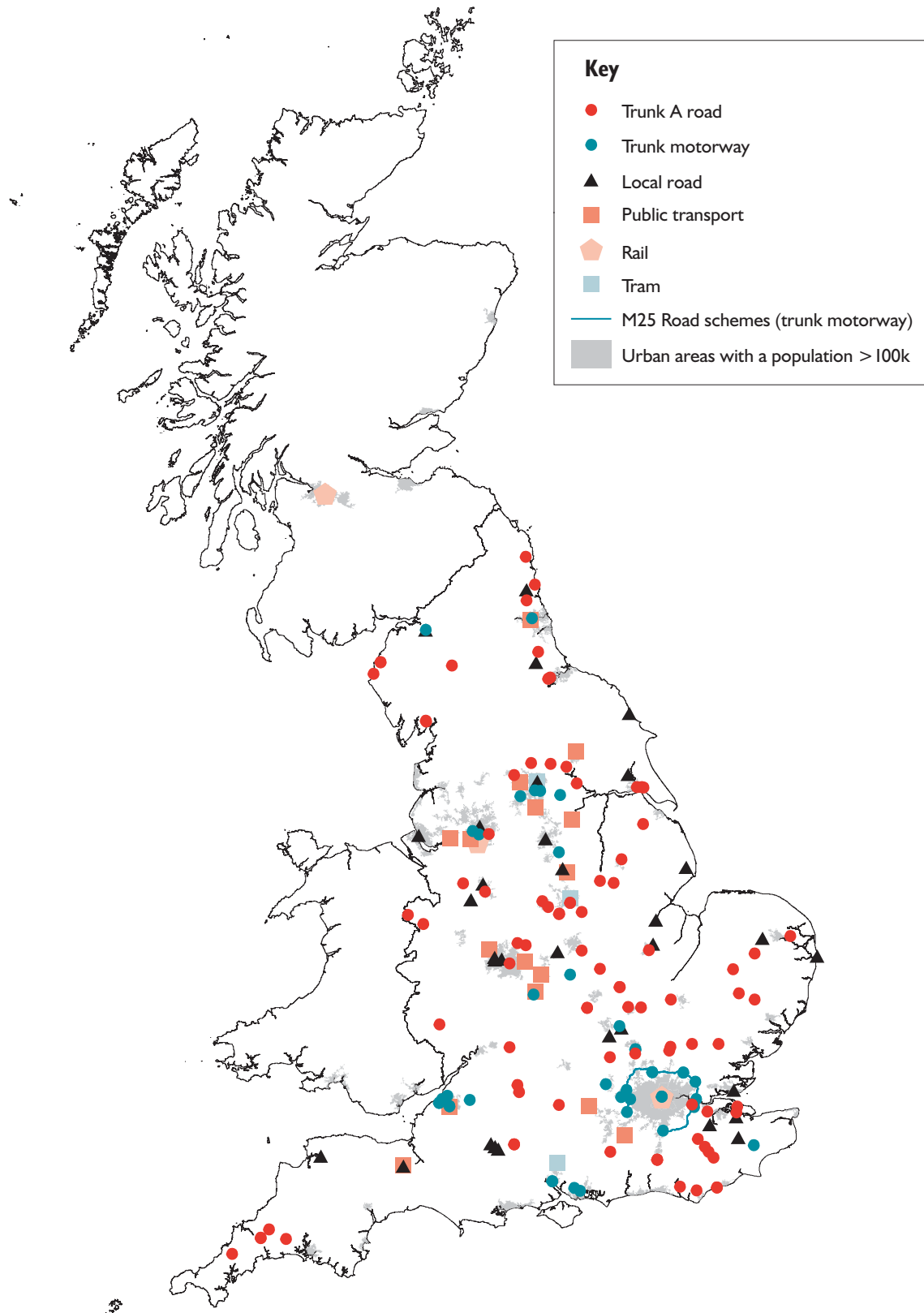
5.8 Relying on detailed appraisals of particular interventions provides important insights; but it is important to bear in mind that it does not allow a comparison of a full range of options for each transport challenge. The case study of South and West Yorkshire goes some way to rectifying this, as described more fully in Chapter 3.4, as it has compared a fuller range of illustrative options in a particular area.

5.9 However, there are some types of options on which the evidence is very limited, including:

- rail freight: options for urban, inter-urban and surface access links;
- the impact of different types of road pricing on the case for additional infrastructure. The evidence is emerging for the strategic road network, but there is still much to do in understanding the impact in urban areas and on public transport needs; and
- the full range of interventions in growing and congested urban centres, for example urban traffic management or bus measures.

5.10 On balance, the evidence is considered sufficient to provide a guide as to the range of returns from different types of options; and to highlight the gaps that should now be a priority for transport strategists to fill. The evidence available covers a broad range of locations across the UK, as shown in Figure 5.4.

Figure 5.4: Location of interventions in the evidence base



Source: DfT.

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INTERPRETING THE EVIDENCE

5.11 To make maximum use of the wide range of evidence available in comparing policy options and informing the strategic transport priorities, it is important to fully understand its wider context, strengths and limitations.

5.12 As described in Figure 5.1, the purpose of transport appraisal is to assess the full range of costs and benefits of each transport intervention consistently and comprehensively. Four key metrics have been relied on for this study to allow the relative magnitudes of different impacts to be demonstrated. Of greatest importance for the decision-making process is the notion of value for money – as captured by the VfM BCR because this reflects the broadest possible range of impacts, including environmental effects and impacts on the economy that are not currently captured in appraisals.¹

5.13 But even this measure does not capture all of the impacts of transport interventions. Importantly, at present there is no methodology for estimating the benefits of increased trade and attracting more globally mobile investment. These are particularly likely to be prevalent for some inter-urban links and international gateway options. In addition, dynamic impacts are also not captured in current appraisals. Such dynamic effects are likely to be notable where, for example, transport is constraining growth and interventions are able to support urban areas as innovation centres; or where they provide reliability improvements that allow further consolidation of just-in-time supply chains; or open up new trading opportunities that extend the reach of markets to provide increased economies of scale in production. Unlocking even small scale improvements to the growth rate will cumulate to provide significant benefits through time. So, although uncertain, where current ‘missing’ GDP impacts have here been estimated, if anything, they are likely to be underestimates.

Uncertainties of course remain

5.14 In many ways, the ‘missing’ GDP impacts are less well understood than the assessment of the value of time saved that forms the bedrock of conventional appraisal, so it is only right that they are separately identified. At the same time, care must be taken not to apply a higher standard of proof to new appraisal developments than to more familiar methods. For example, with current data and analytical tools, there remains much uncertainty around the modelling and appraisal of freight benefits that are incorporated in transport assessments. This area is evolving and will improve as more evidence comes to light of freight responses to transport interventions and their value.

5.15 Not only are there uncertainties around the ‘missing’ GDP estimates, there are also uncertainties around the estimated environmental impacts. There are two aspects of this uncertainty. Firstly, the appraisal information available from real interventions contains detailed assessments of the environmental impacts, but it is not monetised at the scheme-specific level. Therefore, best available evidence must be relied on to estimate the magnitude of these effects, for example, Defra guidance on the value of carbon emissions, and landscape values from the then ODPM.² Secondly, given the nature of the strategic modelling of a range of interventions, detailed assessment of environmental impacts is not possible. But, it is possible to draw from the experience of real interventions to estimate the indicative magnitude of such effects. For example, with strategic road widening, estimates have been made of the extent and type of landscape affected and carbon impacts have been estimated based on the changes in road use.³ The assessment is therefore generic rather than scheme-specific.

¹ For more detail, see separate paper *Transport demand to 2025 and the economic case for road pricing and investment*, DfT, 2006.

² Eftac and Entec 2002 *Valuing the External Benefits of Undeveloped Land: A Review of the Economic Literature*. A Report for the Office of the Deputy Prime Minister, London, 2002.

³ For more detail see *Transport demand to 2025 and the economic case for road pricing and investment*, DfT, 2006.

5.16 Likewise, where scheme specific costs have not been available, as for the strategic modelling of interventions, assessments have been made on the basis of evidence of the costs from real schemes. For example, for strategic road widening, average costs per lane kilometre have been estimated from real strategic road widening schemes, including land costs and optimism bias.

5.17 These estimates significantly improve the evidence for this study but as highlighted throughout this volume, for actual funding decisions, there is no substitute for detailed scheme assessment.

5.18 Given the long-life nature of transport investments, appraisals must be carried out on the basis of expected travel patterns and demands. Inevitably, looking to the longer term there are uncertainties over the variables that determine travel demands. These uncertainties are likely to impact on the most appropriate timing and scope of an intervention and the funding decision-making process must be robust to the possibility that the future may look different to that projected.

5.19 This study has also made use of the returns possible from some private sector investment but because these are privately funded, the BCR as defined is not available.⁴ Information on scheme costs, user benefits and, in the case of airports, carbon impacts is available and is discussed.

WHAT CAN BE INFERRED FROM THE ANALYSIS IN THIS VOLUME

5.20 The metrics discussed are able to tell us a significant amount about the returns on investment. The reason for relying on metrics is to allow a transparent and consistent comparison to be made across the range of interventions for which evidence is available. The information that can be inferred from the analysis in this volume is a strategic assessment of:

- whether there are transport schemes that justify their costs and so provide net economic benefits;
- the nature of economic welfare and GDP returns that are available on transport projects (though some effects are missing); and
- clues as to the types of projects that offer the highest returns, subject to missing benefits, missing projects and limited analysis of packages.

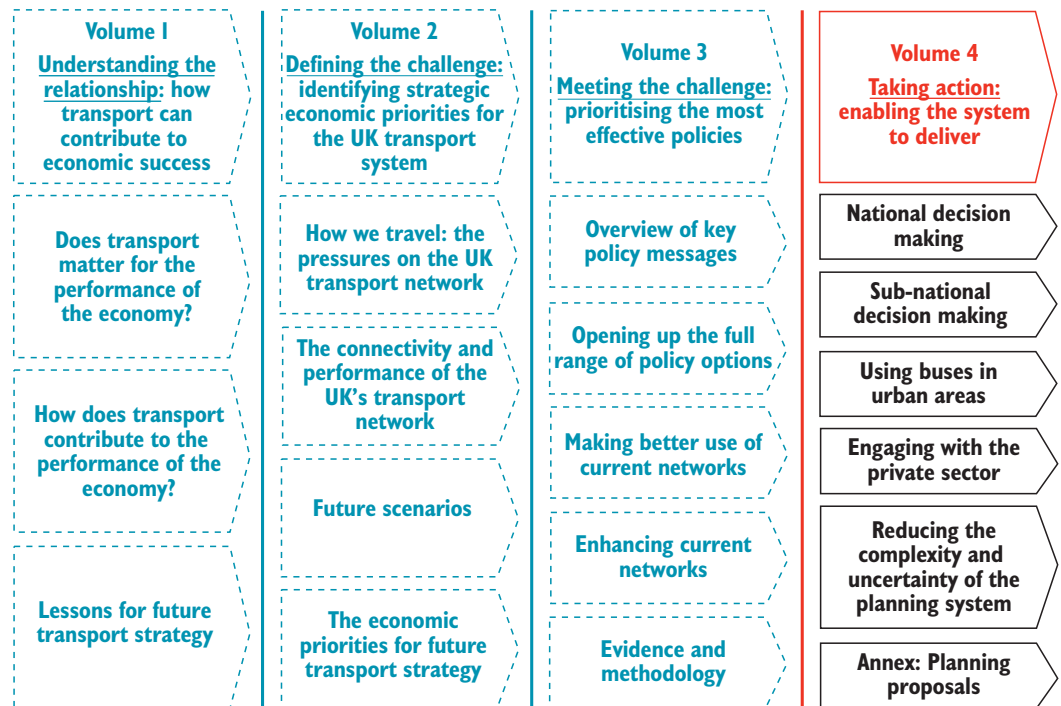
5.21 It does not:

- justify proceeding on any individual project – detailed cost-benefit analysis within a robust prioritisation process would be needed; or
- provide any accurate and scheme-specific estimations of the wider economic benefits.

⁴ The BCR has been defined to represent the welfare returns per pound of government funds.

4

TAKING ACTION: ENABLING THE SYSTEM TO DELIVER



INTRODUCTION

Policy making and delivery chain

1 Volume 3 set out an analysis of which type of policies are likely to be most effective at meeting the strategic economic challenges facing the UK's transport system.¹ Volume 4 considers whether changes to the policymaking and delivery chain for transport policy can be made to ensure that it delivers these policies effectively and in a responsive manner, to maximise the impact of public and private investment on the transport sector.

2 Inevitably, this study can only focus on a small number of issues and can only make high-level recommendations, given their complexity. The five issues covered in this volume are:

- chapter 4.1: How the UK's approach to national decision making might adapt to meet the challenges facing the transport sector;
- chapter 4.2: How sub-national oversight of transport policy might also adapt to the changing challenges facing the transport sector;
- chapter 4.3: How to ensure that the conditions are right for the bus sector to play an important role in supporting the success of the UK's growing and congested urban areas;
- chapter 4.4: As the market for infrastructure projects evolves, how best to continue to engage the private sector in successfully delivering value for money through appropriate risk transfer; and

¹ The economic challenges facing the UK's transport system were identified in volume 2.

- chapter 4.5: Whether the planning system for major transport projects enables the public and private sectors to bring forward projects aimed at addressing transport bottlenecks, whilst balancing the environmental, economic and social impacts. In light of responses received from stakeholders, this chapter sets out an in-depth analysis of the system and makes detailed recommendations for significant reforms. Further detail on those recommendations can be found in the annex.