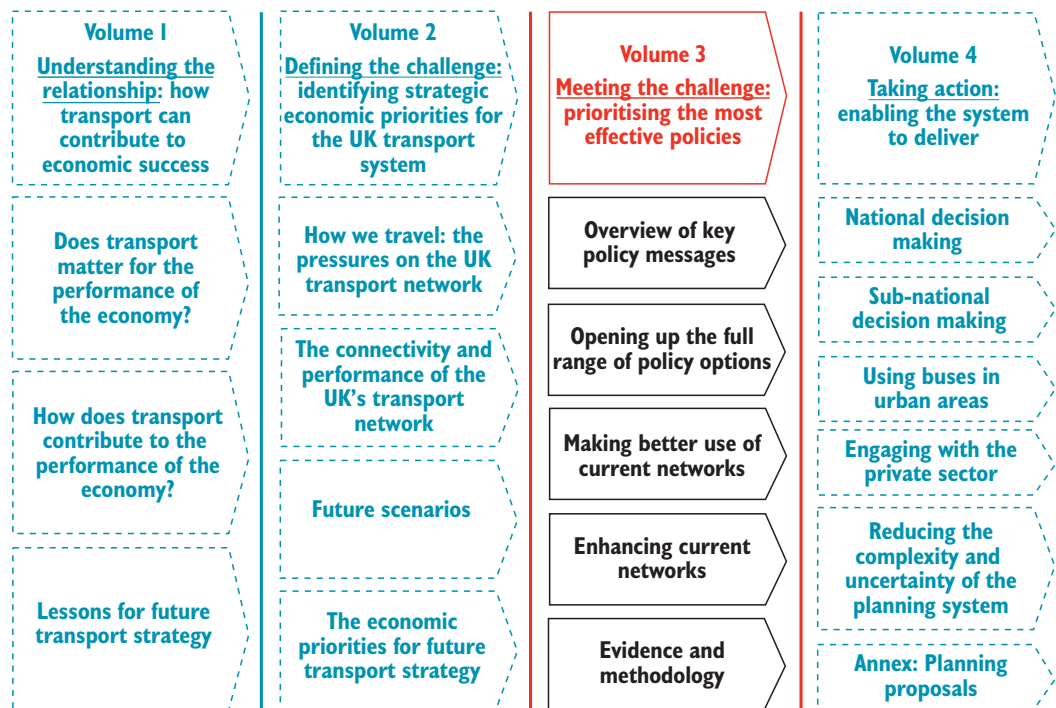


3

MEETING THE CHALLENGE: PRIORITISING THE MOST EFFECTIVE POLICIES



INTRODUCTION

1 Volume 2 set out the extent and performance of the UK transport system now and in 2025, under a range of scenarios. Particular focus was given to those journeys that support and drive economic growth. The volume made clear that there are several areas of the network where poor performance threatens to damage the long-term growth of the UK economy. The strategic priorities for transport policy identified were:

- growing and congested urban areas and their catchments;
- key international gateways; and
- key inter-urban corridors.

Identifying the best policy options

2 Volume 3 takes these strategic priorities and adopts an evidence-based approach to identifying the transport policies that are most likely to offer a cost-effective response to the challenges facing the UK and to contribute to GDP.¹ It considers a wide range of transport policies including mechanisms to make better use of infrastructure, such as pricing; investment in ‘variable capacity’ – those short- and medium-life assets such as buses or longer trains that provide additional transport capacity without the need for more fixed infrastructure on the ground; and investment in fixed infrastructure – long-life transport capital assets such as roads or rail track.

3 Returns on investments are explored and compared by considering both the broadest possible range of impacts on which Ministerial decisions are made, including social, environmental and economic impacts; and a narrower GDP-only perspective. There is no attempt to make any conclusions or recommendations about specific schemes, but rather to inform a strategic view of the policy options most likely to deliver strong benefits for the UK

¹ Gross Domestic Product, as described in Volume 1, is currently the best measure of the size of the economy as it measures the total value of goods and services produced.

economy cost-effectively, and under what circumstances they would do so. The starting point has been that any transport intervention should offer benefits that exceed its costs, and that in a world of limited public resources, government will need to prioritise spending on those policies or investment options that offer the best value for money in meeting its social, environmental and economic objectives.

Structure of Volume 3 4 The volume is split into six chapters:

- **Chapter 3.1:** provides an overview of the key policy messages, conclusions and recommendations of this volume;
- **Chapter 3.2:** introduces the full range of policy options;
- **Chapter 3.3:** focuses on options that allow better use of the current networks;
- **Chapter 3.4:** discusses infrastructure options, both variable capacity and fixed infrastructure for enhancing those networks; and
- **Chapter 3.5:** discusses the evidence used for demonstrating and comparing the returns from each of the policy options; and describes how those returns have been assessed.

3.1 OVERVIEW OF KEY POLICY MESSAGES

Headlines

The case for targeted transport intervention is compelling, even after taking account of environmental effects. Some transport interventions offer very high overall returns on government spending.

- Transport schemes can deliver overall benefits averaging £4 per £1 of government expenditure.
- These figures have added in estimates of the missing GDP impacts identified in Volume 1 that are not captured in recent appraisals. Such impacts can be very significant, adding up to 50 per cent to the benefits in some cases.
- Environmental effects often reduce the returns available, but overall returns remain remarkably high in most cases once they have been factored in; and such effects increase the benefits of some urban public transport proposals.

A sophisticated policy mix of better use, carbon and congestion pricing and targeted infrastructure offers strong benefits.

- There is a strong economic and environmental case for ensuring users across all modes face the true costs associated with their journeys, be they environmental or congestion-related, in line with the Stern Review of the economics of climate change.
- Better use options – especially better pricing on the roads – have very considerable potential; infrastructure options are not always the most cost effective solution.
- But some infrastructure schemes do offer very high returns:
 - Interventions targeted on the worst problems and bottlenecks caused by competing demands on the transport system, such as surface access links and corridors close to major urban areas, are likely to offer some of the highest returns;
 - Small can be beautiful: small-scale interventions such as walking and cycling schemes, and junction improvements, are often the most cost-effective solutions. Although on their own they may not always be able to tackle the true scale of the problem faced; and
 - GDP returns from the interventions in urban areas on which evidence is available are surprisingly low, leading to concerns that high-return options may not be being generated.
- Even in a world with carbon pricing and widespread congestion-targeted road pricing there seems to be a good case for more transport infrastructure. Beyond 2015, without road pricing there would be an economic case for a rate of strategic road capacity enhancement over 50 per cent higher than the baseline rate; with road pricing, there would still be a case for additional investment but significantly below current rates of build.
- Step-change measures intended to provide a transformation to the transport system are unlikely, in a world of constrained resources, to be a priority especially when they use new and untested technologies.

But it is not only through government funding that transport delivers strong welfare and GDP benefits: private sector investment has a key role to play.

INTRODUCTION

1.1 As a whole, Volume 3 seeks to identify the transport policies that are most likely to offer a cost-effective response to the challenges facing the UK transport system. In doing so, the volume sets out the available evidence in real detail. This overview sets out the key overarching messages from that evidence. In part, this chapter therefore acts as a summary for the detailed chapters that follow. However, it also combines the evidence in this volume with the discussion in earlier volumes, because only by taking a considered view of all the evidence can conclusions be drawn with real confidence.

1.2 The chapter:

- provides a brief introduction to the evidence, and what it can and cannot show;
- reports the headline analysis of the returns available from transport schemes;
- provides a series of headline conclusions that can be drawn from the data and evidence summarised here (and which is set out more fully in subsequent chapters);
- takes a look beneath the headlines to explain some of the cross-cutting findings in more detail; and
- summarises the conclusions and recommendations of this volume.

INTRODUCTION TO THE EVIDENCE

The evidence paints a broad picture

1.3 This volume presents available evidence on the costs and benefits of a wide range of transport interventions, incorporating the best available estimates of the economic, environmental and social impacts. The range of interventions considered can be broadly defined as:

- *better use*: interventions that lead to more efficient use of the existing transport system;
- *variable capacity*: investment in relatively short- and medium-life assets that increases the effective capacity of the available fixed infrastructure, for example additional bus services or longer trains and platforms; and
- *fixed infrastructure*: investment in additional, very long-life capital assets such as roads, rail lines, and ports etc.

A database of schemes has been developed

1.4 The evidence presented is based on information on over 170 business cases and appraisals of real schemes across the UK,¹ with a combined cost to government of well over £100 billion. To complement this information, modelling has been undertaken to explore the returns of some illustrative interventions both at the national level and in some local case-study areas; and the study has also drawn on modelling which estimates the overall benefits provided by private sector developments in the port and airport sectors.

¹ There is a mixture of schemes which have been implemented, or which have been recently proposed.

The purpose is to identify the types of interventions that offer good returns

1.5 In doing so, the aim is not to create a wish list of specific schemes that should be funded; that is not the purpose of a strategic study of this kind. Instead the available evidence has been used to help identify the types of interventions that are most likely to offer a high value for money contribution to GDP and wider welfare.² Existing interventions have been categorised to the strategic economic priority (as identified in Volume 2) they most closely match, though it is likely that some urban interventions in the database are not, in reality, in areas that are growing and congested.

1.6 There is a long history of using cost-benefit analysis to guide decision making towards the highest value for money projects. Indeed, the UK is seen as a world-leader in the development and use of these techniques. This history shows that as valuation techniques become more sophisticated, so the range of impacts measured and valued by cost-benefit analysis can expand, leading to better-informed and more transparent decision making.

For the first time estimates of ‘missing’ GDP impacts and environmental effects have both been incorporated

1.7 This study has made an important first attempt to estimate some of the ‘missing’ GDP impacts identified in Volume 1, using recent new evidence.³ Similarly, emerging evidence on the values that can be ascribed to important environmental impacts (carbon emissions, noise, air quality and landscape impacts) have also been used to enrich the analysis in many areas. It is likely that some environmental effects would be highly scheme specific, as would their true valuations. Available evidence does however allow an aggregate approach to be taken to provide an indicative estimate of their order of magnitude. For example, by relying on generic values for different landscape types, an estimate can be made of the potential scale of this effect to be incorporated into the assessment of welfare in a consistent way across schemes.

1.8 The different measures which are used to capture these valuations, and to report the evidence on costs and benefits are summarised in Figure 1.1, while Chapter 3.5 provides a fuller explanation of cost-benefit analysis, including the new GDP and environmental estimates that have been added into the value for money assessments.

1.9 It is important to interpret the results carefully as the assessment of the wider economic benefits and reliability effects has for the most part been undertaken at an aggregate and indicative level. While the effect is likely to be representative of different types of policies, it may lead to over- or under-estimation on particular schemes. Impacts on trade, globally mobile investment and several dynamic effects have not been possible to estimate given the current state of knowledge on these impacts.

1.10 As always, developing ‘state of the art’ estimates is challenging and innovative. These new estimates are presented to provide high-level insights into transport’s effect on our economy and quality of life, not to inform decision making and appraisal on individual schemes. They are presented as ‘order of magnitude’ estimates for different types of scheme, in order to guide policy makers towards those policies that are likely to offer good returns. They are no substitute for the full-blown, location-specific appraisals of the most promising options, which are needed when making funding decisions.

² The notion of welfare is used throughout this volume to encompass the overall net benefits to society including economic, environmental and social impacts.

³ *Transport, wider economic benefits and impacts on GDP*, DfT, July 2005. This is used to provide an estimate of the GDP effects, which is a new and emerging field. This methodology is currently being applied in the context of schemes coming forward for the Transport Innovation Fund.

1.11 When interpreting the analysis in this volume it is also important to recognise that, in some areas, only a small sample size is available so care must be taken not to over-extend the conclusions that can be reached. Similarly, existing schemes were developed without a full understanding of some of transport's impacts on the economy (e.g. agglomeration impacts); if that knowledge had been available different schemes may have emerged. Nonetheless, even where the sample size of evidence is relatively small, the potential offered by some interventions is evident, so areas for further investigation are identified.

1.12 In short, the results presented from the database and strategic modelling are representative of the 'average' impacts of different types of schemes for which evidence is available, and cannot be interpreted as providing precise answers on the impacts of individual schemes. There may also be 'better' schemes on which the study does not have information, either because they have not been developed or because the information was not known to be available. Nonetheless, the evidence provides important new insights into transport's contribution to the UK's economy and quality of life, and has some important implications for future policy.

Figure 1.1: Measuring costs and benefits of government expenditure – the metrics used

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.

The main difference between the metrics set out below is the extent to which benefits are counted and given monetary valuations (monetised). The view taken in this study is that the conventional Benefit:Cost ratio (BCR) as generated from the NATA process (*New Approach to Appraisal*^a) 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, social 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. Metrics used are as follows:

- **Conventional benefit:cost ratio (NATA BCR):** the benefit:cost ratio set out in DfT’s appraisal guidance. Captured and monetised within this BCR are: changes to the overall costs of travel, the value of changes to travel times, safety benefits, and the financial costs of doing the project including impacts on taxation revenues. This does not yet include a number of GDP impacts, and here 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 effects, competition impacts and reliability. Such effects have been indicatively estimated for this study based on developing ‘state of the art’ guidance on how to assess these impacts from DfT.
- **Wider benefit:cost ratio (BCR):** this adds the ‘missing’ GDP effects into the conventional NATA 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 goes broader than the three previous metrics by incorporating most significant environmental effects into the monetised assessment by relying on recent valuation evidence. Environmental effects estimated in this way are carbon (using current Defra guidance), air quality, noise and landscape (all from published academic and government research).

^a The DfT guidance, *New Approach to Appraisal*, can be seen at www.webtag.org.uk.

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

I.13 The metrics as described in Figure 1.1 are demonstrated in a range of charts in this and subsequent chapters. Figure 1.2 provides a guide to interpreting one particular form of chart used.

Figure 1.2: Understanding the distribution data

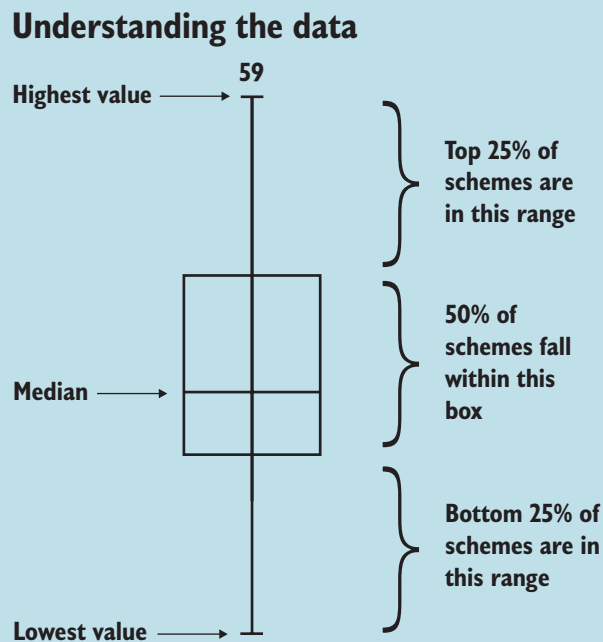
The box and whisker charts in this and later chapters demonstrate the range and distribution of returns to allow a comparison across different interventions in different areas.

In the type of chart shown below (known as a ‘box and whisker’ chart), the full range of returns from the available evidence is reflected by the length of the vertical line. The top point of the vertical line marks the return offered by the best scheme; the bottom point marks the return of the lowest-performing. In some cases, the extreme values at the top and bottom will be outliers so must be interpreted with caution.

The ‘box’ in the centre of the line is in many ways more informative as its vertical length marks out the range of returns from the middle-performing 50 per cent of schemes. So, for example, if the top line of the box is at wider BCR 4 and the bottom line of the box is at wider BCR of 2, the middle 50 per cent of the schemes offers wider BCRs in the range 2 to 4. The line across the middle of that box shows the ‘median’ average return.

Schemes whose returns lie on the vertical line above the ‘box’ are the top-performing 25 per cent schemes in terms of their returns; likewise, those below the ‘box’ are the lower-performing 25 per cent of schemes.

The figure at the top of the line is the sample size (in this case 59)

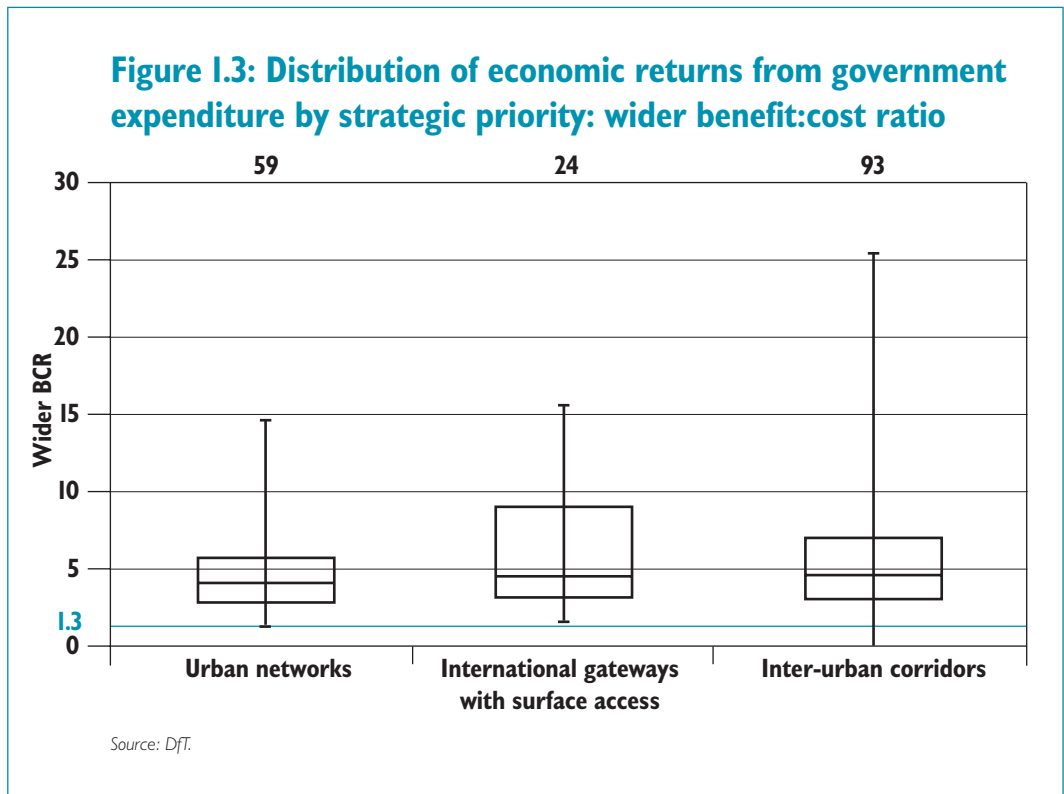


Source: Eddington Study.

HEADLINE ANALYSIS

Good returns across the strategic priorities

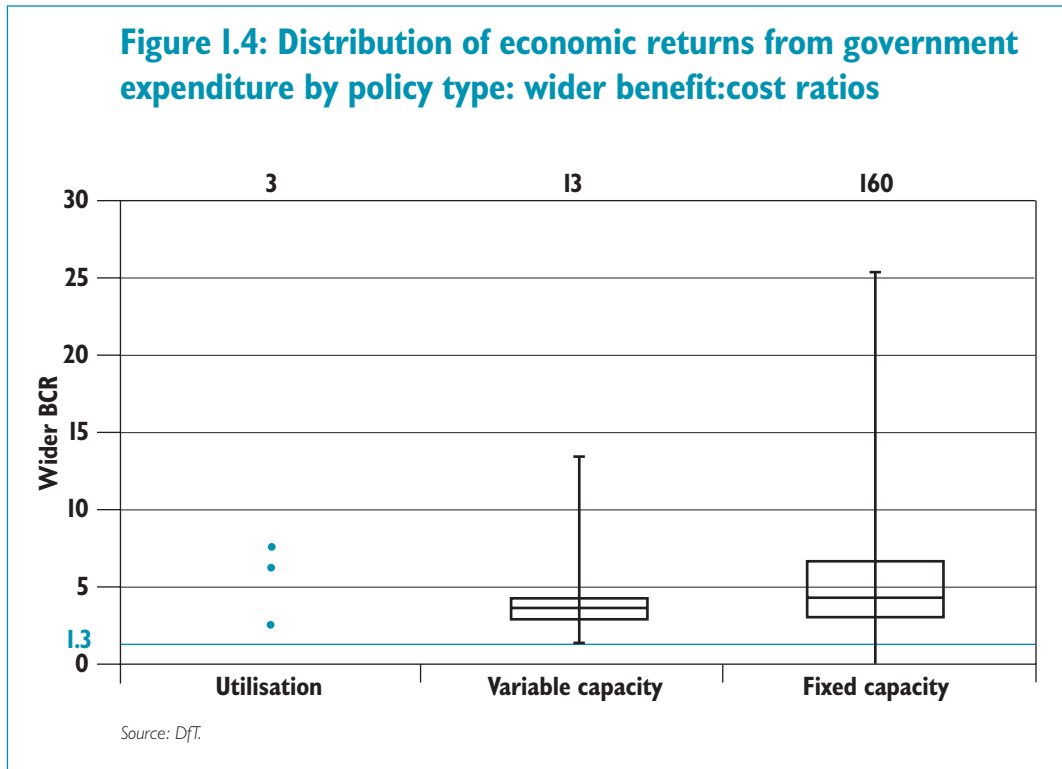
I.14 On the basis of these metrics, there are some overall messages that can be drawn from the evidence.



I.15 Figure 1.3 shows that there are very good returns across the strategic priorities with some very high returns offered in each. More detailed analysis suggests that the very highest returns are from those interventions that are well targeted on particular pinch points on the network and that serve all of the strategic priorities. In addition, although not shown in this chart, walking and cycling schemes can offer some very strong welfare returns with wider BCRs well in excess of 10.

And across different types of policy option

I.16 When considering the possible returns by policy type, as in Figure 1.4, it is evident that the returns from fixed-infrastructure options are much more varied than for other policy types. In part, this will reflect the number of schemes on which evidence is available to this study, but it does highlight the need to ensure interventions are well targeted because some very low returns are possible.



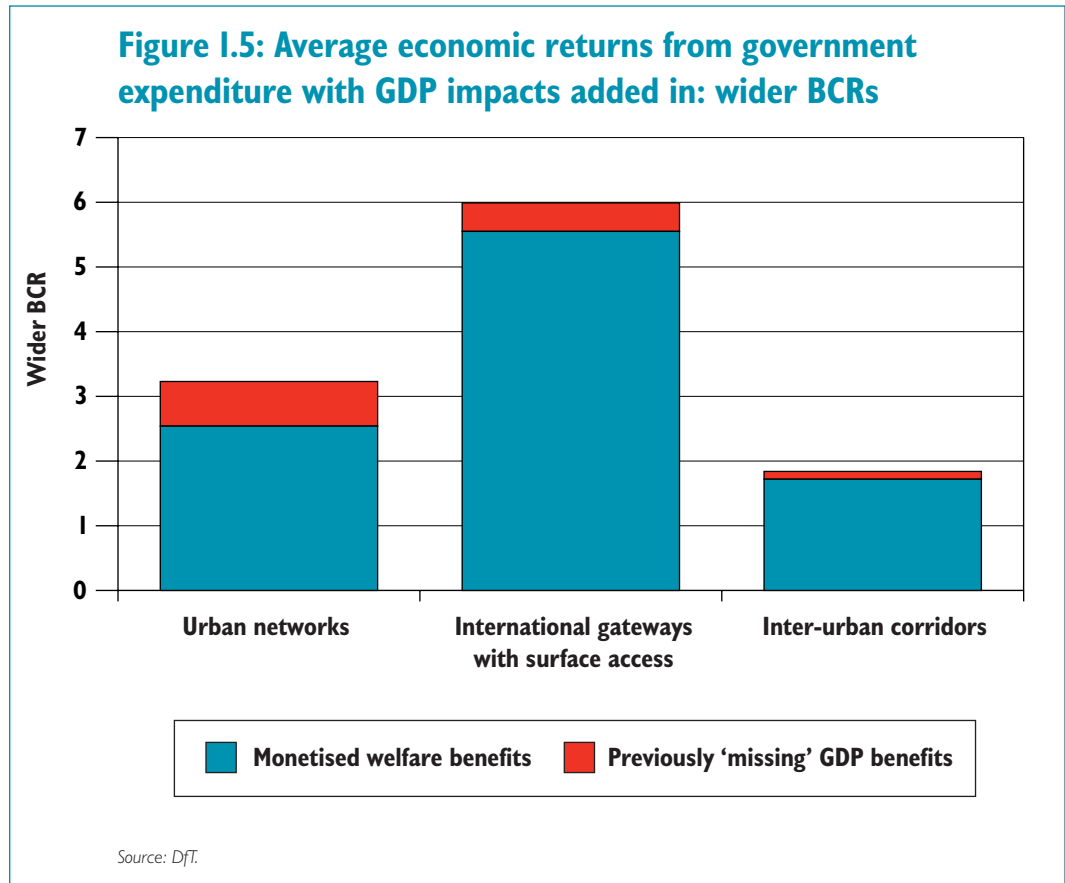
I.17 Figure 1.4 shows the returns of the interventions grouped according to policy type. Utilisation refers to those better use measures that allow more effective use of the transport system. This captures urban traffic control and active traffic management schemes. Variable capacity refers to interventions such as improved bus services, and fixed capacity incorporates road or rail infrastructure along with, for example, junction improvements.

I.18 These returns are based on a combination of current schemes and a strategic assessment of future schemes. Over time some benefits would be expected to rise, as continued economic success increases demand for travel and increases people's value of time. Set against that, increased values put on social protection, higher values for local and international environmental protection, and increasing costs of land and technologies may force the cost of interventions up. Given the scale of returns today, it seems likely that good returns will continue to be found from transport for very many years to come.

Utilisation measures demonstrate strong potential

I.19 Owing to a small sample size, the distribution of utilisation schemes cannot be represented by a 'box and whisker' chart. The 'dots' represent the three schemes in the database and demonstrate that, of the evidence available, some strong returns are possible, so there is a clear case for exploring these types of schemes further.

I.20 Figures 1.3 and 1.4 demonstrate the wider BCRs of the interventions which include an estimate of the benefits to the wider economy that are not captured within conventional appraisals. Figure 1.5 demonstrates the magnitude of these 'missing' GDP effects relative to the benefits that would otherwise be estimated.

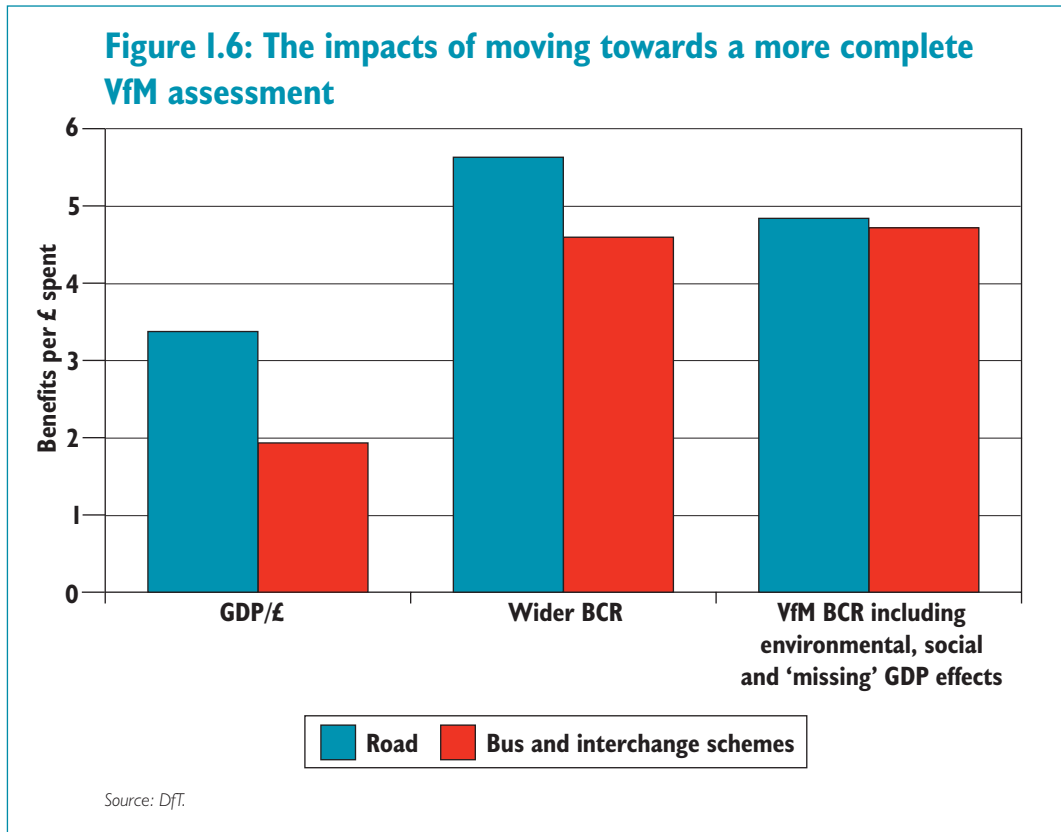


'Missing' GDP effects are more significant in urban areas

I.21 The average of the wider BCRs is strong for each strategic priority, and the 'new' GDP benefits add considerably to the estimated returns, particularly for urban networks. This is largely driven by the agglomeration and labour market benefits to which interventions in these areas give rise.

I.22 The wider BCRs shown in Figure 1.5 are averages of the schemes on which evidence was available. These averages are therefore distorted by the returns from some of the very large schemes. For example, removing all large rail schemes for illustration would increase the average return from inter-urban corridor schemes from a wider BCR of 1.8 to just under 5.

I.23 However, the true returns are lower for most interventions after environmental costs are factored in, i.e. in moving from a wider BCR to a VfM BCR. The analysis in Figure 1.6 is based on those schemes for which monetised environmental impacts can be estimated – around a third of the schemes in the database. For the types of schemes represented, predominantly road and bus, these results are likely to be representative of the impact across all such schemes in the database, i.e. there is no reason to expect systematic biases in the types of schemes on which we have full environmental monetisation.

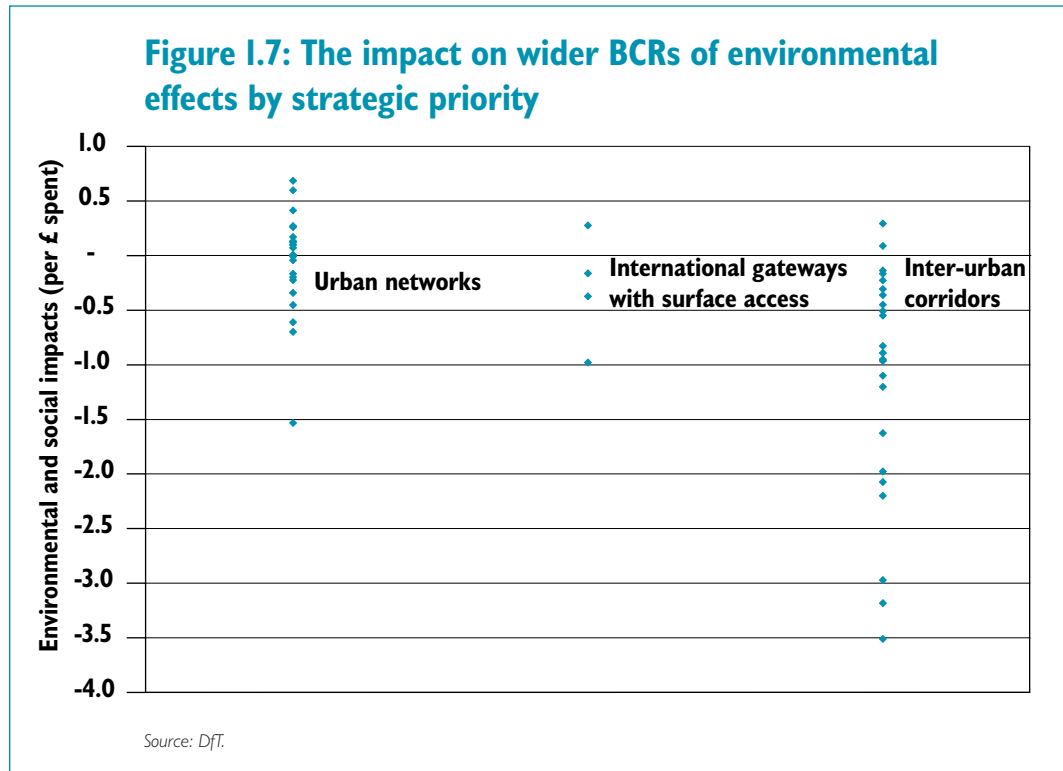


1.24 In addition, although not demonstrated in the charts, well-targeted small-scale walking and cycling schemes can have a beneficial impact on the environment owing to the mode shift from car to these non-polluting modes, but overall impacts would depend on the infrastructure requirements.

1.25 Figure 1.6 shows that starting from a narrow perspective of GDP only, as additional welfare effects are incorporated – i.e. looking at the wider BCR – there is a significant shift up in the average returns of public transport interventions, more so than the relative shift for road schemes. This is because the wider BCR incorporates impacts on non-work/leisure trips.

1.26 Taking the analysis further to include environmental impacts – i.e. looking at the VfM BCR – the average returns of the interventions are again affected. For roads there is a shift down, driven by landscape impacts, carbon emissions and local air pollutants. For public transport interventions, the impact is minimal but slightly positive. These positive effects are a result of the beneficial impacts on journey ambience from improved interchange facilities; and mode shift to public transport services allowing lower levels of congestion and hence emissions.

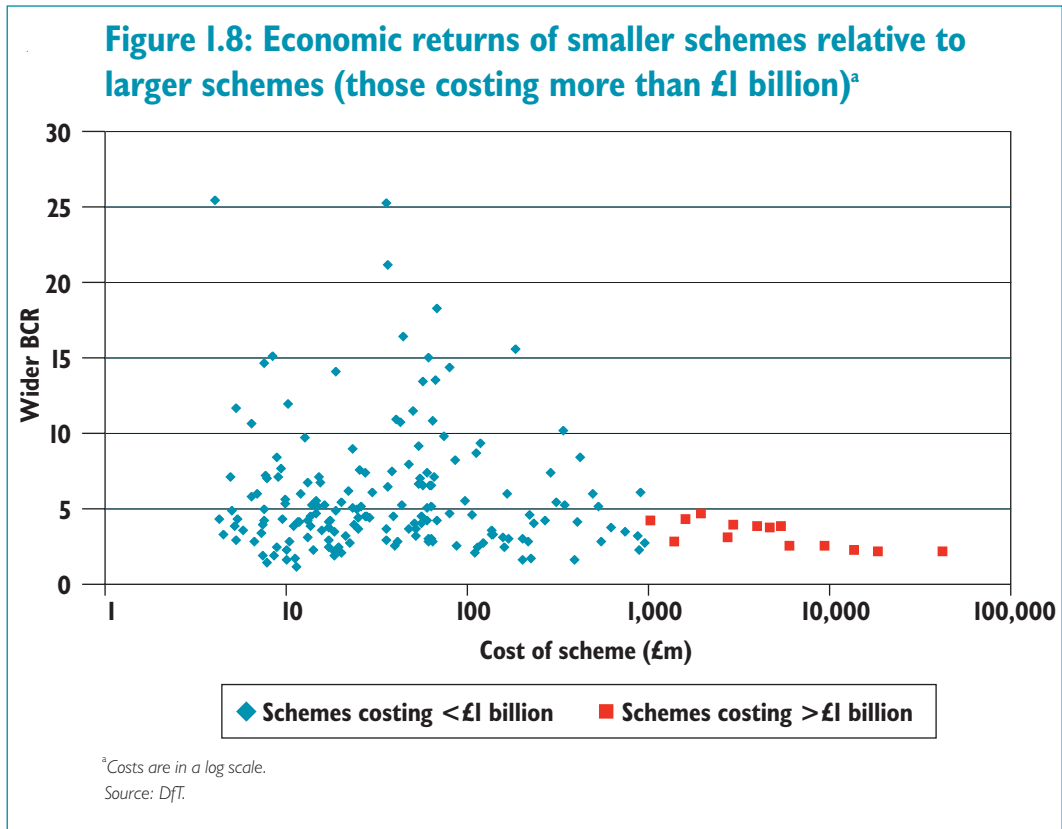
1.27 Looking in further detail at the environmental effects by strategic priority demonstrates the broad range of impacts. Figure 1.7 plots the estimated impact on the returns of interventions of such environmental effects for a sample of schemes for which this is possible.



I.28 Each point plotted in Figure 1.7 demonstrates the indicative impact on the wider BCR for an individual intervention. Where there are positive effects, many of these will represent public transport schemes. Road schemes are more uniformly negative, though there is a very considerable variation in the scale of the impact. This is shown in Figure 1.7 as the inter-urban corridor link is composed mainly of roads. Up to around 3.5 can be knocked off the wider BCR as a result of the adverse environmental effects, but of course others have very small environmental impacts. On average the inclusion of environmental costs knocks around 1 off these returns for road schemes, and adds slightly to the returns of bus and interchange schemes. Policy makers must be very careful not to generalise about the impacts of such policies.

Small can be beautiful

I.29 And small is beautiful: many of the very high return schemes are small projects, including walking and cycling schemes (for which the environmental returns may be positive owing to the mode shift from car to these non-polluting modes) and junction improvements. Some recent and proposed junction improvements on the strategic road network, for example, suggest possible wider BCRs in the range of 2-25 costing from £5 million to over £100 million. Returns drop off sharply beyond the £1 billion point. This is shown in Figure 1.8.



I.30 The reasons for the high returns are likely to vary according to the particular intervention. It may be that because lower-cost schemes tend to be smaller scale, they are more likely to be targeted on particular problems and pinch points that provide significant benefits for many travellers. In absolute terms, where a small and a large intervention offer the same wider BCR, the contribution of larger schemes is of a much higher magnitude for a much higher cost. However, small schemes may not be of sufficient scale to tackle the magnitude of future challenges. In some cases, the highest return option in the longer term for a given problem may be a large-scale and high-cost intervention.

Projects that overlap priorities offer high returns

I.31 Where there is a case for additional infrastructure, interventions that improve journeys where the ‘strategic priorities’ overlap, and there are many different users travelling at the same time, offer very high returns since they address multiple demands on the most heavily used section of the networks. For example, inter-urban corridors that are close to major urban areas are used by business passengers, freight, airport or port users and commuters, often at similar times of day. Projects in these areas can offer wider BCRs of around 10, sometimes with very low costs, although where additional infrastructure is required, the environmental implications can be significant.

I.32 Surface access routes to ports and airports are also often used by large volumes of travellers on different sorts of journeys, and the evidence demonstrates strong wider BCRs, many in excess of 3 with a few over 15 (before environmental effects have been accounted for).

Step-change measures **I.33** Step-change measures intended to transform the economy are not, in a world of constrained resources, likely to be a priority. The available evidence for step-change projects in the UK, such as a new high-speed North-South rail line, shows wider BCRs at the lower end of the distribution before accounting for landscape and carbon effects. Furthermore, BCRs of alternative options to solve these problems are not available. However, it is often argued that such measures miss transformational economic impacts, such as a radical shift in the economic geography of the UK brought about by new levels of connectivity. The evidence for transformational benefits is at best unproven, and Volume 2 has demonstrated that the UK's urban areas and regions are already well connected. Another potential benefit (which should be included in the wider BCR) is that of freeing up capacity on existing rail lines. Whilst this is true, it is not at all clear that creating new networks is the most appropriate or cost-effective method to achieve increased capacity: high speed options should be assessed coldly alongside other policies for achieving the same objective. Other transport investments are very likely to offer superior returns compared to where projects rely on new and largely untested technologies.

I.34 Where new and untested technologies are relied on, or where demand for the new link is only speculative, expensive step-change transport measures are unlikely to offer the best value for money in delivering economic or environmental objectives.

Benefits of road pricing

Strong economic and environmental case for prices to reflect external costs **I.35** The Stern Review argued that prices should be used to reflect the externalities associated with climate change. The same is true for congestion: users should pay the full costs of their journey, including a carbon price and a congestion price. The study has examined a number of pricing schemes and modelled a national distance-based scheme that prices both congestion and environmental externalities. Road pricing is certainly the most effective way of pricing for congestion. It is also one possible instrument for carbon pricing road users. However, this modelling should not be taken to suggest this study has taken a view of the best instrument for carbon pricing, only that the impact of carbon pricing on the demand for surface transport has been taken into account.

I.36 In the Road Pricing Feasibility Study (RPFS)⁴, the DfT explored the potential benefits of a national road pricing scheme implemented in 2010 using the DfT's National Transport Model (NTM). This study has explored the impacts of that scheme in the longer term, namely 2025, again relying on the NTM.

I.37 The illustrative national scheme modelled for both the RPFS and therefore this study is a relatively sophisticated, distance-based scheme where prices are based on the marginal social costs of the journeys that take into account costs of congestion and environmental damage, including a carbon cost of £95 per tonne in 2025⁵. Charges are capped at 80p/km⁶ with 75 different levels of charges, varying by time of day, by area and road type.

I.38 Clearly, this is only one of many options, and has been chosen only to make comparisons with the present day more straightforward. The evidence suggests that before considering the costs of setting up and running such a scheme, total benefits estimated at around £28 billion⁷ a year in 2025, including GDP benefits of £15 billion a year. The costs of such a scheme are not known at this stage, and pilots should be used to provide a better assessment. Clearly, costs would have to be extremely high to outweigh the benefits of £28

⁴ *Feasibility study of road pricing in the UK*, DfT, 2004 and *Transport demand to 2025 and the economic case for road pricing and investment*, DfT, 2006.

⁵ Defra guidance.

⁶ 1998 prices, in line with the *Feasibility study of road pricing in the UK*, DfT, 2004.

⁷ 2002 prices.

billion a year, and in that scenario it would not be cost effective to implement a scheme. The analysis of this particular scheme and other road pricing schemes are described in more detail in Chapter 3.3.

I.39 If widespread pricing were introduced, the nature and location of challenges on the roads would be altered. This has implications for the economic case for additional infrastructure across modes. A national scheme is estimated to reduce the case for inter-urban road build beyond 2015 by some 80 per cent. The reduced case for additional infrastructure and the accompanying environmental damage means proper pricing can therefore have significant environmental benefits when compared with other options. Without road pricing, beyond 2015 there would be an economic case for a rate of strategic road capacity enhancement over 50 per cent higher than the baseline rate.

I.40 Applying the principles of pricing to all modes, including roads, rail and aviation, offers significant potential to deliver welfare and GDP benefits, although the evidence is not available to quantify those benefits.

Private sector investment

I.41 This study has not sought to repeat the analysis of the Air Transport White Paper⁸ (ATWP) which suggests there are significant economic benefits from increasing runway capacity at Heathrow and other airports in the South East. Above a baseline of maximum use of existing runways, direct economic benefits of additional capacity at Stansted (2012) and Heathrow (2020) are estimated at some £24 billion. It is estimated that of this figure, some £6 billion⁹ accrue direct to business travellers, and these benefits would be higher still if reliability were accounted for. Other benefits not captured within this figure include the trade benefits of international connectivity and the benefits from increasing the attractiveness of the UK for foreign investors. Plus, there can be economies of scale from hub airports, through enabling a greater variety and frequency of onward connections, and from greater efficiencies in the provision of support services and fixed costs.

I.42 However, the gross benefits must be adjusted to reflect the impacts on the environment from additional runway capacity. The main environmental impacts of aviation that can be quantified are noise from aircraft and the effects of aircraft emissions. Air Transport White Paper analysis estimated that the cost of increased carbon emissions over and above a baseline of making maximum use of existing runways could be in the region of some £3-5 billion.¹⁰ In addition, there are likely to be impacts of increased noise and health impacts from reduced air quality but these are likely to be an order of magnitude lower than these carbon impacts, leaving very substantial net benefits.

I.43 The ATWP also assessed the benefits of additional fixed runway infrastructure at other airports and suggested that an additional runway at two other UK airports could each provide overall benefits that are much lower than for expanding major airport in the South East, with the highest benefits at some £1.6 billion over the period to 2060. The benefits of capacity enhancement at other regional airports are therefore likely to be of a much smaller magnitude than for other major airports, given the lesser magnitude of pressures faced.

⁸ *The Future of Air Transport*, DfT, 2003.

⁹ Present value benefit over the period to 2060.

¹⁰ Present value over the period to 2060.

I.44 This study identifies international gateways as a key strategic priority for the future, and the vital role of aviation in supporting the international competitiveness of the UK's high-tech manufacturing and financial services sectors. This is in line with the analysis from the ATWP set out above, which demonstrated that the potential economic benefits from further expansion of aviation capacity are significant, running to tens of billions of pounds. However, any growth in aviation needs to be sustainable, and must take full account of its environmental costs. One of the most effective mechanisms for achieving this is by ensuring that air travellers pay the full environmental costs of their journey, including their climate change costs. The principle of ensuring users pay their full external costs was supported by the Government in the Air Transport White Paper and was strongly supported by the Stern Review of the economics of climate change.

I.45 The ATWP passenger demand forecasts assumed the introduction of some form of pricing mechanism to ensure air travellers faced the full external costs of their climate change impacts. This was based on the Defra central cost of carbon estimate of £70 per tonne of carbon (in 2000 prices). With this pricing mechanism in place, the analysis demonstrated that demand would continue to grow, and that there would be significant economic benefits from some additional runway expansion. It is important to understand the impact of a range of carbon pricing scenarios on the case for aviation expansion, and the forthcoming ATWP Progress Report will test a wider range of carbon price scenarios.

I.46 Provided economic analysis shows that there is a net benefit from increased airport capacity, even after users pay the full environmental costs of their journeys, there will remain a strong economic case for additional runway capacity.

I.47 The evidence also suggests that the expansion of ports capacity in response to capacity constraints, subject to environmental considerations, can deliver benefits. Full assessments of costs and benefits were not available to this study. However, the available evidence suggests that under a scenario of full construction of Felixstowe South, Bathside Bay and London Gateway deep-sea container ports, shipping costs could be reduced by around £200 million per annum or up to 10 per cent by 2025. These gains arise because the extra UK capacity reduces the need for a good deal of transshipment which adds to delivery costs. Without further expansion in capacity, it is also likely that capacity constraints will start to bite sometime between 2020 and 2030. In this scenario, additional capacity expansion could reduce costs by a further £140 million per year. These estimates do not account for wider benefits such as impacts on trade, globally mobile investment and reliability.

I.48 If additional ports infrastructure is added, there are likely to be adverse environmental impacts. Ports are mainly located in estuaries where they compete with birds for sheltered locations and coastal habitat such as mudflat and saltmarsh; there are knock-on effects on surface modes (road and rail); and air quality and carbon emissions.

I.49 While this study does not have detailed evidence on these impacts, recent port capacity planning approvals demonstrate that in some circumstances there remains a case for additional capacity, once environmental impacts have been factored in.

I.50 The implication for government of the gains to the economy from such private sector investment is that providing a clear policy framework, which prices environmental externalities, will incentivise the private sector to bring forward appropriate infrastructure proposals which deliver economic and welfare benefits while meeting environmental objectives.

GETTING BENEATH THE HEADLINE NUMBERS

I.51 This section looks beneath these headlines, to explore where the highest returns can be found, including by location and by mode. Using current standard appraisal methods to assess welfare, high returns are evident across all priority links and all demonstrate average returns in excess of the minimum rate of return for government investment of 1.3,¹¹ as illustrated in figure 1.3.

Where are the highest returns to be found?

Location of highest returns

I.52 The evidence in Figure 1.5 suggested that targeted improvements to surface access links are able to offer the highest average welfare return on investment. This includes access to ports and airports, both of which support the UK's international competitiveness by improving travel conditions for freight and international business travellers. Although this area of investment has not been specifically targeted in the recent past, if chosen well, such interventions are able to make a significant contribution to GDP and welfare.

I.53 Taking all interventions on which evidence is available suggests the average BCR of interventions in growing and congested urban areas exceeds that for inter-urban corridors. This finding should be interpreted with caution, however, because the inter-urban average includes some very expensive and relatively low performing interventions, such as some rail schemes. These act to constrain the average return on inter-urban routes. Looking at Figures 1.3 and 1.4, it is clear that there are both very high-performing and very low-performing inter-urban schemes.

I.54 For illustration, if the expensive low-performing interventions are removed, the average BCR in Figure 1.5 for inter-urban corridors increases from 1.8 to 4.9; for growing and congested urban areas it changes from 3.2 to 4.2; and with international gateways it increases from 6.7 to 7.2. Hence inter-urban corridors are actually likely to offer some schemes with higher returns than in growing urban areas. Further issues around the returns from interventions in urban areas are explored in Figure 1.9.

¹¹ For more detail see *Transport demand to 2025 and the economic case for road pricing and investment*, DfT, 2006.

Figure 1.9: The conundrum of transport projects in urban areas

Given that agglomerations in a service-based economy tend to be found in major urban areas; that urban networks are particularly heavily used and shared by a wide range of users; and that economic growth and congestion are disproportionately represented in urban areas, projects in urban areas might have been expected to offer very high returns. It is not unreasonable, at the strategic level, to consider that the costs of congestion and unreliability are likely to have a far greater direct impact on the economic success of the UK than might be the case for some other parts of the transport system.

However, the evidence from the database does not suggest very high returns in urban areas relative to other areas. Perhaps the most obvious explanation is that the costs of investment in urban areas tend to be much higher given the higher land prices and density of urban centres. For example, some infrastructure interventions, such as new rail lines, are only possible with extremely expensive tunnelling. This is likely to have implications for the relative returns of interventions to alleviate particular pressures with, for example, demand management rather than investment having a more significant role to play in some cases.

But this cannot be the full explanation and there seem to be barriers to option generation in urban areas (see Volume 4). As a result, the projects in the database may not be well targeted, leading to lower returns. What is clear, though, is that the ongoing success of our major urban areas is often dependent on good transport networks, and **therefore government should consider what steps it might take to improve option generation in urban areas, so that the right policies can be brought forward.**

Modes

1.55 Underlying Figure 1.6, the evidence suggested that, using current appraisal values, public transport performs relatively less well on average than roads. However, there are some good value schemes offering over £3 of welfare for every £1 of government spend, such as some bus service enhancements in large urban areas. Careful targeting and scheme design is critical to the success of public transport interventions.

1.56 In addition, as will be further highlighted in Chapter 3.4, even after accounting for environmental effects, road investment is able to offer among the highest returns if it is well targeted on the key inter-urban corridors (especially near major urban areas) or surface access links to ports and airports where traffic volumes are very high and congestion is a persistent problem. Chapter 3.4 discusses the case for additional strategic road capacity in more detail, including the impacts that road pricing can have on the returns from investing in infrastructure.

Not all schemes improve economic performance

1.57 Some interventions offer relatively poor returns in terms of GDP per pound. For variable capacity this mainly reflects those public transport schemes that have low business use and no freight use, although decongestion benefits will indirectly affect all road users. This may also reflect that many public transport schemes for which the evidence is available are designed to focus on leisure travellers or social and accessibility outcomes, rather than economic outcomes. Clearly, it is right and proper that government makes transport investments aimed at social and environmental goals – the data simply highlight that the economic gain in some projects can be very low.

What difference do the missing GDP impacts make?

A significant proportion of the benefits has previously been missing

I.58 Although current appraisal methodologies capture a significant proportion of a project's economic impact, some effects are not captured at all. These missing elements have been estimated for the purposes of this study, using the developing DfT guidance on the assessment of wider economic benefits, and appear in the figures above.¹² These may be a small proportion of the total benefits but the magnitude varies significantly by scheme and location and in some cases can be substantial in absolute terms. They can be particularly important for some schemes and areas with this analysis suggesting some 30-40 per cent, and potentially up to 50 per cent could be added to the benefits. In effect, this means that traditional appraisal has been significantly understating the benefits of some interventions. As noted above, the benefits to trade and globally mobile investment are still unmeasured but would provide additional uplift, where they are demonstrated.

I.59 Figure 1.5 demonstrated the relative contribution of the GDP impacts that are currently 'missing' from standard appraisals and business cases. Given the potential significance of these missing impacts, it is important that formal appraisal methodologies should evolve to incorporate these impacts as the evidence around them firms up.

I.60 The inclusion of these impacts will have implications for relative priorities. For example, for growing and congested urban areas, the average addition to the BCR is the highest, at 0.7. The addition is lower for other priority links at around 0.4 for international gateways and 0.1 for inter-urban corridors. Again, these are averages for all evidence available so must be interpreted in that context; there are likely to be significant variations at the individual scheme level.

I.61 However, this is only one new addition to conventional cost-benefit analysis. The other important development is on environmental and social valuations.

Accounting for environmental impacts and accessibility when assessing value for money

Environmental and other impacts must be accounted for

I.62 As outlined in Figure 1, some of the impacts of transport improvements are inherently difficult to monetise. Such impacts – notably environmental impacts – play a fundamental role in broader welfare and sustainable development priorities. Such impacts affect government's broader objectives and issues that the public value and, as the Stern Review has convincingly demonstrated, they can also affect economic growth.

I.63 In order to assess how emerging evidence on the monetary valuation of these impacts would alter priorities, roughly a third of the schemes discussed in this chapter were reviewed and best judgements made of the value of many of the currently non-monetised impacts that are not included in the wider BCRs using available valuation evidence, for example using Defra values for carbon¹³ and air quality impacts. This analysis can only be carried out in an aggregate way so the figures need to be interpreted with care and are to be regarded as indicative (the value for money assessment is not normally intended to be so precise). The estimated impacts were illustrated in Figure 1.6.

Returns remain high

I.64 Despite some transport interventions having adverse implications for the environment, such as road widening and airport expansion, many still offer very good returns. This is particularly likely to be the case where the most severe of transport problems are being addressed.

¹² See www.dft.gov.uk: *Transport, wider economic benefits and impacts on GDP*, DfT, 2005.

¹³ In October 2006, DfT issued new guidance on how the value of greenhouse gas emissions should be monetised and incorporated in the appraisal. See www.webtag.org.uk.

Public transport measures show increased relative returns **I.65** Accounting for social and environmental effects tends to increase the relative returns of public transport interventions, as might be expected. Indeed, in value for money terms the average public transport scheme is broadly equivalent to roads, though there is a much greater spread of returns on roads (with some very high and some very low returns).

I.66 Environmental impacts are highly location specific so it is difficult to generalise on their magnitude for any given type of intervention. For example, the same scale of road in one area could be broadly neutral in terms of environmental effects, but in a different location could be severely adverse to the extent that the overall value for money is poor.

I.67 In the majority of cases, the impacts of public transport interventions are less adverse and in some cases will be beneficial. Often, this stems from the higher incentive for mode shift from cars and the fact that they tend to have lower impacts on the ‘footprint’ of fixed infrastructure. However, large new public transport fixed infrastructure, such as new rail lines, would be expected to have an adverse impact on landscape and possibly on emissions (depending on mode shift).

Multiple goals **I.68** Some types of schemes that show good welfare returns, such as public transport, utilisation, walking and cycling, will also have environmental benefits due to their low requirements for land and infrastructure, and their impacts on congestion reduction. Pricing also has the potential to have positive air quality benefits by providing for freer-flowing traffic and it reduces the need for new infrastructure build, as will be discussed in Chapters 3.3 and 3.4.

SUMMARY OF CONCLUSIONS

I.69 The key conclusions from this overview, and from the following chapters, are as follows.

1. **The case for targeted transport interventions is compelling: very high returns are achievable even after environmental costs are factored in.**
 - Some very high returns on government spending are possible from well targeted transport policies with welfare returns often offering more than £5 of welfare for every £1 invested and sometimes over £10.
 - Returns are likely to be particularly high when targeted at relieving pinch points and bottlenecks arising where there are competing demands from large volumes of different users.
 - Whilst well-targeted, small-scale interventions can often deliver the highest returns, they may not be sufficient to tackle the full scale of the problems facing the UK.
2. **Policies that raise the performance of the current transport networks stand out above other interventions in offering the potential to deliver for GDP and minimise environmental and social impacts; but the challenges and risks must be well managed.**
 - There are strong economic and environmental arguments for ensuring users across all modes face the full external costs of their journeys, be they environmental or congestion related. This could be done through appropriate fiscal, regulatory, pricing or trading instruments.

- Introducing well-targeted pricing on the UK transport system, and in particular road pricing, offers enormous potential for improving network performance by spreading demand, lowering congestion and overcrowding, improving reliability and delivering GDP benefits.
 - Making road pricing happen has risks that are real and there is significant uncertainty over costs, behavioural responses and long term impacts that will all need to be carefully managed.
 - Better use measures could significantly reduce the economic case for additional road capacity – and hence avoiding associated environmental damage – and strengthen the case for improved public transport; complementary policies are likely to be worth considering.
- 3. The economic case for targeted new transport infrastructure and variable capacity is strong and offers high returns.**
- Small-scale interventions such as walking and cycling schemes can deliver some very good returns and, in some cases, variable capacity such as bus services can potentially offer a higher return than high-cost new fixed infrastructure solutions.
 - Private sector investment in container, feeder and ro-ro ports capacity, and in airports, is very important for the UK economy and, subject to full consideration of all environmental costs, prevents capacity constraints dampening trade and growth; very high returns from targeted surface access schemes are possible.
 - Targeted investment in strategic roads is able to offer among the highest overall welfare returns, even after accounting for the environmental effects. Additional urban road capacity could, in some circumstances, be the highest-return solution to urban transport problems.
 - Even with widespread road pricing, there is likely to be a case for additional strategic road capacity, given the magnitude of pressures facing the UK.
 - Step-change measures intended to transform the economy are not, in a world of constrained resources, likely to be a priority. The UK is already well connected and the demands for new links are uncertain.
 - Where new and untested technologies are relied on, or where demand for the new link is only speculative, expensive step-change transport policies are unlikely to offer the best value for money in meeting economic or environmental objectives.

Recommendation 3

To meet these challenges, Government needs to: get the prices right across all modes – especially congestion pricing on the roads and environmental pricing across all modes; make best use of existing networks:

- (i) In line with the Stern Review, prices across all modes should reflect the true cost to society, including congestion, overcrowding and environmental impacts – through appropriate fiscal, regulatory, pricing or trading instruments.
- (ii) Use road pricing as the most appropriate way to tackle congestion: introduce wide-spread, congestion-targeted road pricing to deliver the potential benefits cost-effectively.
- (iii) In order to sustain a successful economy, the UK needs to decide between: a very significant road build programme, or widespread road pricing with much more moderate road build. Congestion-targeted road pricing is the most cost-effective and flexible way to deliver the benefits of reducing unreliability and to tackle congestion. Stop the debate on whether to do this, and move on to debating how to do it.
- (iv) Government should take steps now to make sure wide spread road pricing becomes a reality within the next ten years, provided it can be implemented in a way that preserves the very high potential net gains to society.
- (v) Government needs to provide the pathway to wide spread road pricing on this timescale, setting out the key decisions needed to unlock the vast potential of road pricing.
- (vi) The early part of that pathway must involve the use of local pilots to test issues of scheme design and technology, in a way that can inform the transition to wide spread road pricing.
- (vii) Government should explore ways of extending the principles of congestion pricing to other modes.
- (viii) Given the growth in emissions from the sector, Government needs to find a way to ensure aviation pays its full environmental costs.
- (ix) Explore the potential for high value for money better use measures that encourage changes in travel choices or which exploit the opportunities provided by new technologies.

... and together with the private sector deliver sustained and targeted investment, reflecting the high returns available from some transport investment:

- (x) After considering the potential for pricing and better use, deliver sustained infrastructure investment where it delivers strong returns in the three strategic economic priority areas. This is likely to include targeted investment in walking and cycling schemes, commuter links, urban buses, roads, and surface access improvements. Even with road pricing the UK needs to continue investing in transport infrastructure. although the need for investment will be considerably reduced.
- (xi) Do not be seduced by *grands projets* with speculative returns, for example:
 - Pursue high speed rail options only where they have been demonstrated to be the highest value for money option to relieve congested corridors;
 - Do not pursue untested technologies, nor links for which demand is highly speculative.

(xii) Government should provide the policy framework to ensure that the private sector can bring forward proposals to expand capacity at key ports and airports, where it is sustainable to do so:

- Implement proposals for additional runway capacity where the case is robust, having accounted for the environmental costs of emissions.
- Provide clear statements of strategic objectives to enable the private sector to continue to bring forward appropriate additional capacity at ports that are important for the UK economy.