INTRODUCTION

1 Volume 1 set out a detailed assessment of how transport can support economic prosperity and people's quality of life. In doing so, it highlighted the types of journeys being made – commutes, business trips, non-work/leisure journeys and freight movements – and what users sought from those journeys, in terms of speed, reliability, connectivity and quality.

2 This volume seeks to assess how well the transport system performs in supporting the unique and changing demands of the UK economy, both now and in the future. It is clear from Figure 1 that there is a strong relationship between GDP growth and transport demand. As the economy grows, the accompanying increases in transport demand need to be understood, managed and planned for, if they are not to impose unacceptable social and environmental costs on society, and stifle the further growth of the economy.
This volume will examine these demands in more detail and consider where and when they are concentrated, how well the existing networks perform, and how the performance is likely to change over the next twenty years. Armed with this assessment of the challenges facing the UK, it concludes by identifying a set of strategic economic priorities for future transport policy. These priorities are the areas and links where the transport network is most likely to become a constraint on continued and sustainable economic success, and a barrier to improved quality of life. Such priorities must sit alongside other policy objectives, most obviously those on climate change.

The volume is divided into four chapters:

- **Chapter 2.1**: a presentation of transport demands over time, measured by place, time of day and mode;
- **Chapter 2.2**: an assessment of the connectivity and performance of the network now;
- **Chapter 2.3**: an assessment of how performance will change over the next twenty years; and
- **Chapter 2.4**: an identification of the economic priorities for future transport policy.
2.1 How we travel: the pressures on the UK transport network

**Introduction**

1.1 In 2005 the population of Great Britain made a staggering 61 billion trips, spending a total of 2.5 million years travelling. An average resident of Great Britain makes over 1,000 trips a year, travelling over 7,000 miles. On top of that, the network supports 250 billion tonne-kilometres of freight per year.

1.2 Whilst the sheer scale of these figures underlines the importance of transport to the UK population and economy, they say nothing of the concentration of demands. Many of these trips are made at the same time, side by side, on the same transport infrastructure, placing parts of the UK’s transport networks under real pressure. Whilst the demand for freight transport is relatively continuous throughout the working day the demand for personal travel is far more peaked. Figure 1.1 illustrates that many trips are concentrated in just a few hours of the day.

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1 National Travel Survey data set DfT, 2005. Great Britain domestic trips only.

2 Transport Statistics for Great Britain, ONS, 2005. One tonne-kilometre is equivalent to one tonne moving a distance of one kilometre.
1.3 The level and nature of these demands can be expected to rise over time as the UK’s population and economy grows and changes. This chapter examines the demands that are placed on the UK’s transport networks in detail, and considers the factors that have influenced changing patterns of demand. A report such as this, however, can only present a strategic overview of the facts, there are local nuances that cannot be captured in a summary, and it is not the intention to understate the importance of detailed analysis to transport decision-making.

1.4 The assembled statistics reveal an interesting picture of how globalisation; changes in the structure of the economy; and migration of households are changing the nature of transport demand. The challenge for the UK is to recognise and address these demands, so that transport issues do not slow continued and sustainable economic growth and cause a reduction in people’s quality of life.

1.5 The chapter is presented in five sections. The first four sections examine in turn:

- business travel – trips made in the course of work;
- commuting – trips made to and from work;
- freight distribution – the movement of goods between business, and between businesses and households; and
- non-work/leisure travel.

The final section draws these demands together to consider where and when they coincide.
Business travel represents a fairly small proportion of total travel in the UK: the 5 million business trips per day represent only 4 per cent of personal travel. However, as the structure of the UK economy has shifted and the services sector has become the major engine of growth, so the importance of business travel has increased: deals are reached and relationships built through face-to-face meetings; some services need to be performed in-situ; and many businesses depend on being able to transport skilled staff and expertise to the point of demand.

Domestic business travel

Markets vary in size and consequently different businesses can have very different transport needs. Some firms serve relatively localised markets or deal in sufficient volumes to justify running many offices close to the points of demand; other, more specialised firms may serve a whole region, or even their whole market, from a single office. The dispersed nature of some markets means that, on average, business trips tend to be longer than other trips, see Figure 1.2, and on account of their length are more likely to use the inter-urban corridors.

Average business trip lengths have increased over time, driven by factors such as:

- falling car running costs;
- falling freight distribution costs;
- the growth in the size of markets facilitated by Information Communication Technologies (ICT); and

Figure 1.2: Trip length distribution by journey purpose, Great Britain, 2002-2005

Source: National Travel Survey, 2005, DfT.

Note: Business trips defined as personal trips in the course of work, including a trip in the course of work back to work. This includes all work trips by people with no usual place of work (e.g. site workers) and those who work at or from home.
2.1 How we travel: the pressures on the UK transport network

- the consolidation of office functions.

The average domestic business trip length increased by over 21 per cent between 1992-94 and 2004. Nevertheless, over 69 per cent of business trips are still less than 15 miles in length and tend to be concentrated within and around urban areas and conurbations. Long distance business travel is still rare. The demand for business trips over 200 miles by all modes is estimated to be approximately 60,000 trips per day.4

1.9 Figure 1.3 shows the favoured modes for business trips. The table classifies business trips on the basis of whether they are the sole business trip made by an individual on that day, or whether the trip is one of a set of business trips conducted on the same day.

**Table 1.3: Favoured modes for business trips, Great Britain, 2002-2004**

<table>
<thead>
<tr>
<th>Sole business trip of day (49% of business trips)</th>
<th>Multiple business trips on day (51% of business trips)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>By number of trips</strong></td>
<td></td>
</tr>
<tr>
<td>Private motorised road transport</td>
<td>Private motorised road transport</td>
</tr>
<tr>
<td>84%</td>
<td>89%</td>
</tr>
<tr>
<td>Public road transport</td>
<td>Public road transport</td>
</tr>
<tr>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Rail</td>
<td>Rail</td>
</tr>
<tr>
<td>7%</td>
<td>3%</td>
</tr>
<tr>
<td>Air</td>
<td>Air</td>
</tr>
<tr>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Non-motorised</td>
<td>Non-motorised</td>
</tr>
<tr>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>By distance travelled</strong></td>
<td></td>
</tr>
<tr>
<td>Private motorised road transport</td>
<td>Private motorised road transport</td>
</tr>
<tr>
<td>79%</td>
<td>86%</td>
</tr>
<tr>
<td>Public road transport</td>
<td>Public road transport</td>
</tr>
<tr>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Rail</td>
<td>Rail</td>
</tr>
<tr>
<td>11%</td>
<td>7%</td>
</tr>
<tr>
<td>Air</td>
<td>Air</td>
</tr>
<tr>
<td>6%</td>
<td>5%</td>
</tr>
<tr>
<td>Non-motorised</td>
<td>Non-motorised</td>
</tr>
<tr>
<td>0%</td>
<td>1%</td>
</tr>
</tbody>
</table>

4 National Travel Survey data set, DfT, 2004 and 2005.

1.10 Although new technologies, such as laptops and mobile-phones, allow workers to make better use of travel time, it is still typically less productive than time spent at the workplace. The associated loss of staff utilisation directly affects the profitability of firms. The requirement to minimise travel time, and sometimes the need to carry small loads, shapes the nature of the demand for business travel. On aggregate, business users have a marked tendency for private road transport, which offers access to markets that cannot be quickly reached by public transport, and the ability to chain trips together in ways that public transport can rarely support. This is evident from the higher proportion of trips that are undertaken by private road transport when travelling to more than one destination in a day.

1.11 Rail and air services carry a relatively small proportion of the total number of domestic business trips but a higher proportion of total distance travelled. Rail and air are not universally available and offer a more limited choice of domestic destination than road transport. However, where they are available, they are more popular for long-distance trips than short, and conventional high-speed rail and air services provide the means of making long-distance return journeys to the biggest urban areas within a working day.

4 National Travel Survey data set, DfT, 2004 and 2005.
1.12 Figure 1.4 shows the distribution of business trips throughout the day. There are peaks at the start and end of the typical working day, with a lower but significant level of demand throughout the inter-peak period.

![Figure 1.4: Time profile of business trips, Great Britain, 2002-2004](chart)

Source: National Travel Survey, 2002-2004, DfT.

### International business travel

1.13 It is not just the demand for domestic business trips that has grown over time. Growing international trade has also led to an increase in international business travel. Reflecting the need to minimise travel time and the fact that the UK is surrounded by water, most international business travel, to and from the UK, is by air (78 per cent), the remaining 22 per cent being carried by sea or via the Channel Tunnel. UK residents make around 39,000 business trips into and out of the UK each day by air and a further 33,000 flow in and out of the UK from abroad by air.

1.14 The impact of globalisation on international travel can be seen below in Figure 1.5. Taking a long view, beyond the impact of the terrorist attacks of September 11 2001, it can be seen that there has been a marked increase in international business travel. The volume of international business trips is now of a similar magnitude to the demand for long-distance domestic business travel. A large proportion of these trips (66 per cent) are to and from Europe.

1.15 Whereas Heathrow dominates the market for long-haul business travel to and from the UK (handling over two thirds of long haul business passengers), flights to EU25 countries are more evenly spread across airports. Heathrow handles 37 per cent of EU25 passengers, London Stansted 12 per cent, London Gatwick 10 per cent, Birmingham International 9 per cent, Manchester 9 per cent, and Scottish airports 4 per cent.

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1. Travel Trends 2004, ONS.
The demand for travel via air and via the Channel Tunnel cannot be viewed in isolation, because international business travellers rely on surface access links to provide access to airports and international rail terminals. Where good public transport links exist, such as at the major London airports, these are used quite frequently, by as many as 40 per cent of business passengers; otherwise private cars and taxis are used for most travel to and from airports (60 to 90 per cent). Naturally, foreign business travellers, who are less likely to have access to private cars in the UK, rely more heavily on trains and taxis for transit to their ultimate destination.

### Commuting

Of the 29 million people in employment an estimated 11 per cent work from home at least some of the time, whilst 89 per cent always travel to work. In 2001, 49 per cent of commuting trips originated in, and 55 per cent were destined for, the largest urban areas. Whilst most of these trips are relatively short and focused on these urban areas, commuting patterns are more complex than simple tidal flows from the periphery to the centre of urban areas.

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12. Eddington Study analysis of Census 2001 journey-to-work data (settlements with population greater than 100,000, England and Wales only).
1.18 Whilst economic activity and households are concentrated in urban areas, people often choose to live away from their workplace. Aside from commuting costs and journey times, there are number of factors that drive such decisions about household location. These include: the affordability of housing; access to public services and amenities; and the need to choose a location that suits the whole family.

1.19 Over time, a lengthening in commuting trips has been enabled by:
- improvements in transport infrastructure;
- the advent of the affordable motoring;
- increased affluence; and
- structural changes in the economy and the workforce.

1.20 For example, in 1951 the average length of a journey to work in the north west of England was less than 2 miles\(^{13}\), whereas by the time of the 2001 census, the national average commuting trip length had risen to over 7 miles.\(^{14}\) The census results from 1981, 1991 and 2001, illustrated in Figure 1.6, provide an indication of how much commuting trip lengths have increased over time.

![Figure 1.6: Change in average commuting trip lengths, England and Wales, 1981-2001](image)

Source: ONS.

So have commuting journey times

1.21 Figure 1.7 shows trend changes in commuting trip length, commuting journey times, and household car availability. The chart demonstrates that both commuting trip lengths and commuting journey times have increased over the last decade. Although there has been a large increase in car availability, and more people are choosing to travel to work by car and rail, the data suggests that there has been a decline in the average rate of travel for commuters – on average they are travelling more slowly than in 1996.

\(^{13}\) Estimates of Journey-to-work distances from census statistics Warnes, Regional Studies 1971.

\(^{14}\) Census journey-to-work trip lengths are measured ‘as the crow flies’.
2.1 How we travel: the pressures on the UK transport network

1.22 Whilst there is strong growth in total employment in urban areas, the employment and population dynamics are complex. Recent years have seen very strong population growth in London, many new towns, and smaller cities in the south east. Some northern cities have also experienced recent population growth. Greater suburban – and counter-urbanisation have occurred alongside this growth. Together these patterns imply more, and in places long, commutes.

1.23 The ODPM State of English Cities report considered the causes of counter-urbanisation and concluded that they include: the search for cheaper housing; better quality of environment and services; less pressurised pace of life; and the 'rural idyll' more generally. Supporting research revealed a strong preference for life away from the pressures of inner-city living. The research found that given a free choice, most respondents would choose to live in smaller towns and villages, see Figure 1.8.

Figure 1.8: Where people choose to live, if have free choice, 1999

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Non-urban</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>south</td>
<td>north</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>east</td>
<td>west</td>
<td></td>
</tr>
<tr>
<td>London</td>
<td>15%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Big city</td>
<td>31%</td>
<td>17%</td>
<td>7%</td>
</tr>
<tr>
<td>Big city/suburbs</td>
<td>18%</td>
<td>2%</td>
<td>33%</td>
</tr>
<tr>
<td>Small city</td>
<td>25%</td>
<td>32%</td>
<td>42%</td>
</tr>
<tr>
<td>Country village</td>
<td>9%</td>
<td>12%</td>
<td>13%</td>
</tr>
</tbody>
</table>

The growth in the length of commuting trips and the geographic spread of labour markets can also be attributed to structural changes in the UK’s economy and workforce. The loss of traditional industrial jobs, which were often staffed locally, and the growth in the number of professional and specialist workers have contributed to commuting trip lengthening. Volume 1 highlighted the role that large, deep labour markets play in the high-value services economy.

The increase in female participation in the workforce has influenced household location and mobility. When choosing where to locate, many households have to consider accessibility to employment opportunities for two working adults that do not necessarily work in the same town. This can lead to households choosing a location that is convenient for one adult at the expense of a long commute for the other, or a location that is equally inconvenient for both and moderately far away from both places of employment.

In a study of the factors that influence location decisions for dual-career households, Green (1997) notes a preference for rural locations with good access to fast road and rail networks. Indeed, the influence of good rail links can be seen on commuting patterns to central London. Figure 1.9 shows labour market catchment areas for central London, set against Reading, and Brighton and Hove for comparison. The existence of fast rail services has led to the formation of pockets of Central London commuters in places a considerable distance from London, including Brighton, Reading, Hitchin and Colchester.

Figure 1.9: Labour market catchment areas in the south-east

1.27 Commuting trip length is strongly associated with the mode of transport chosen and the type of infrastructure used. Whilst walking and cycling are ideal for very short trips, and public transport can offer competitive journey times for longer trips to urban areas, in most instances the car is the mode of choice for commuters. Figure 1.10 shows the distribution of commuting trip lengths and mode choices for Inner London, Outer London, metropolitan areas and the rest of the UK.

Figure 1.10: Commuting mode choice by destination and length of trip, 2002-2005

Figure 1.10(a): Commuting trips into metropolitan built up areas by mode, 2002-2005

Figure 1.10(b): Commuting trips into other urban and rural areas by mode, 2002-2005

Figure 1.10(c): Commuting trips into Inner London by mode, 2002-2005

Figure 1.10(d): Commuting trips into Outer London by mode, 2002-2005

Source: National Travel Survey data set, DfT, 2005

17 National Travel Survey data set, DfT, 2005.

1.28 Outside of London and the metropolitan areas, 64 per cent of commuting trips are undertaken as a car driver. Indeed, even Outer London does not benefit from the same high levels of public transport service as the heart of the city.

1.29 Commuters destined for Inner London tend to favour public transport. In part this is a result of the high levels of service offered by London public transport services and radial heavy rail routes, and in part a result of the long journey times by road through Inner and Outer London, alongside limited opportunities to park in the centre. London’s density is such that public transport is often a more efficient way to supply transport.

1.30 Commuting is synonymous with peak period travel. Figure 1.10 above showed trips by time of day broken down by trip purpose. Commuting demand is heavily concentrated between the hours of 7am and 10am, and in the afternoon between 4pm and 7pm. Additionally, the near synchronisation of the start of the working day with the school day increases the demand on the transport networks at these times, particularly during the morning peak.
The growth in commuting trip lengths has also led to greater concentrations of traffic on the road links that run along inter-urban corridors. Figure 1.11 shows the clear peaks that now form between 7am and 9am, and 4pm and 7pm.

**Figure 1.11: Weekday(a) time profile of traffic on Highways Agency network, 2004**

(a) Graph is specifically illustrating Tuesday, which is representative of other weekdays.
Source: Highways Agency Traffic Information System (HATRIS).

### FREIGHT TRANSPORT

Freight transport facilitates production, trade and competition, and, as such, is the lifeblood of economic activity. Structural changes in the economy may have affected the type of goods that are transported into, out of and around the UK, yet the amount of freight moved in the UK has stayed at or around the all-time high of 250 billion tonne-kilometres per year.\(^1\)\(^8\) Whether the economy grows through expansion of the service sector, or through the manufacturing and primary sectors, the economy needs raw materials, energy, semi-manufactures and equipment to conduct business.

This section considers freight transport from two perspectives: the transport of goods through our international gateways and the domestic distribution of freight (both internationally and domestically produced).

#### International freight

International trade contributes 28 per cent of the UK’s GDP and, despite the shift towards services in UK output, almost two thirds of UK exports and over three quarters of UK imports by value are currently in goods.\(^1\)\(^9\)

In broad terms, the UK’s international freight links support four types of service:

- services carrying bulk goods – either liquid (predominantly fuel) or dry (coal and other raw materials);
2.1 **How we travel: the pressures on the UK transport network**

- container ships – either deep-sea services calling directly at the UK en route from Asia or other destinations, or smaller feeder services carrying goods from Europe;
- roll-on/roll-off services carrying goods vehicles between Europe and the UK; and
- air services importing goods either in the hold of passenger services, typically via Heathrow, or on dedicated freight services, typically via East Midlands, Stansted and other airports.

**A variety of freight services are required to support the economy**

1.36 The different freight services support different aspects of the UK economy. Although a high proportion of freight by weight is transported via seaports, high-value, light-weight or perishable goods are often transported by air. Indeed, 25 per cent by value of UK trade in goods is transported by air.20

1.37 Detailed Customs data for UK cargo moving outside of the European Union, see Figure 1.12, provides an indication of the relative value per tonne of cargo transported by different means. At one extreme there is ‘conventional’ bulk freight such as oil and coal, which has relatively low value by tonne; at the other extreme, there are goods such as semiconductors, time-critical parcels, scientific and medical equipment, and luxury consumer items that are transported by air.

**Figure 1.12: UK extra EU trade: model breakdown by weight, value and value density, 2004**

<table>
<thead>
<tr>
<th></th>
<th>By weight (Tonnes ‘000s)</th>
<th>By value (£m)</th>
<th>£/Tonne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>188,873</td>
<td>41,149</td>
<td>£218</td>
</tr>
<tr>
<td>Lift On/Lift Off</td>
<td>33,168</td>
<td>58,448</td>
<td>£1,762</td>
</tr>
<tr>
<td>Roll On/Roll Off</td>
<td>3,514</td>
<td>13,576</td>
<td>£3,864</td>
</tr>
<tr>
<td>Rail</td>
<td>209</td>
<td>1,487</td>
<td>£7,119</td>
</tr>
<tr>
<td>Air</td>
<td>1,659</td>
<td>85,280</td>
<td>£51,419</td>
</tr>
<tr>
<td>Other</td>
<td>4,563</td>
<td>3,875</td>
<td>£849</td>
</tr>
</tbody>
</table>

Source: UK Port Demand Forecast to 2030, MDST for DfT, 2006.

1.38 Over time there has also been a change in the type of goods that the UK has traded, with consequent impacts on the demands placed on our sea and airports. Increased international trade, and innovation in logistics, have led to large increases in containerised and roll-on/roll-off transportation of goods. The years between 1985 and 2004 saw a 138 per cent increase in container traffic and a 182 per cent increase in roll-on/roll-off freight movements by weight. The last fifteen years have seen a doubling of deep-sea container traffic (compared to a 50 per cent increase in shorter distance container traffic).21

1.39 Different international freight services tend to be concentrated in different areas of the country:

- services carrying ‘conventional’ bulk freight – typically liquid petroleum products, coal and raw materials – are concentrated on Teesport, Scottish ports and, in the case of coal, Immingham;

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20 The Economic Impact of Express Carriers for UK plc, OXERA, 2006.
21 Focus on Ports 2006, DfT.
• deep-sea container traffic (lift-on/lift-off) is focused on a small number of ports in the south-east of England. The demand for container transport is, in many cases, insufficient to justify dedicated services to the UK and ports such as Felixstowe and Southampton (which between them handle over 50 per cent of container flows) provide a convenient stopping point en route to ports serving larger, north European markets;

• the market for roll-on/roll-off ferry services has been dominated by Dover (serving more vehicles than the next five biggest roll-on/roll-off ports combined), which offers the fastest and most frequent crossings to and from the Continent. However, in recent years, the Channel Tunnel has started to carry a significant proportion (16 per cent) of freight vehicles, although it carries a less significant proportion of freight by train wagons (only 3 per cent of cross-Channel market by bulk); and

• Heathrow airport handles 55 per cent of airborne freight (typically in the holds of scheduled passenger flights), although the amount handled by Nottingham East Midlands and Stansted airports has been growing rapidly, as they have developed as centres for dedicated airfreight carriers.

1.40 Figure 1.13 shows the distribution of freight across UK ports. In terms of weight, it is concentrated on a few large ports the ten largest international ports account for two thirds of freight tonnage. The map shows that there are net-outward flows from the big Scottish ports and from Tees and Hartlepool, and net-inward flows elsewhere.

1.41 Most of the tonnage through UK seaports is international and the majority comes from, or is destined for, Europe. However, time-series data on the country of origin of UK imports reveals very strong growth in the value of imports from China. In the period from 1996 to 2005 the value of Chinese imports increased six-fold: an average growth of 22 per cent per year. Whilst the total value of trade with China is still dwarfed by trade with EU countries, the sharp increases in trade are concentrated at those ports that handle deep-sea container vessels, which may in the future have implications for their capacity.

1.42 A large proportion of inward freight, whether it arrives by sea, air or rail, is transported onwards to locations in London and the south east of England. Firms located in these two regions account for 35 per cent of imports by weight, and 39 per cent of imports by value.
Figure 1.13: Tonnage through major UK ports, 2004

<table>
<thead>
<tr>
<th>Port</th>
<th>Inward</th>
<th>Outward</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immingham</td>
<td>41.9</td>
<td>15.7</td>
<td>57.6</td>
</tr>
<tr>
<td>Tees and Hartlepool</td>
<td>19.0</td>
<td>34.8</td>
<td>53.8</td>
</tr>
<tr>
<td>London</td>
<td>43.9</td>
<td>9.4</td>
<td>53.3</td>
</tr>
<tr>
<td>Milford Haven</td>
<td>21.9</td>
<td>16.5</td>
<td>38.5</td>
</tr>
<tr>
<td>Southampton</td>
<td>25.4</td>
<td>13.0</td>
<td>38.4</td>
</tr>
<tr>
<td>Forth</td>
<td>4.0</td>
<td>30.9</td>
<td>34.9</td>
</tr>
<tr>
<td>Liverpool</td>
<td>23.9</td>
<td>8.3</td>
<td>32.2</td>
</tr>
<tr>
<td>Sullom Voe</td>
<td>5.4</td>
<td>18.6</td>
<td>23.9</td>
</tr>
<tr>
<td>Felixstowe</td>
<td>14.4</td>
<td>10.9</td>
<td>23.4</td>
</tr>
<tr>
<td>Dover</td>
<td>13.3</td>
<td>7.5</td>
<td>20.8</td>
</tr>
<tr>
<td>Orkney</td>
<td>6.7</td>
<td>11.3</td>
<td>17.9</td>
</tr>
<tr>
<td>Medway</td>
<td>12.1</td>
<td>2.4</td>
<td>14.5</td>
</tr>
<tr>
<td>Belfast</td>
<td>9.9</td>
<td>3.7</td>
<td>13.6</td>
</tr>
<tr>
<td>Hull</td>
<td>9.0</td>
<td>3.5</td>
<td>12.4</td>
</tr>
<tr>
<td>Clyde</td>
<td>8.2</td>
<td>3.3</td>
<td>11.5</td>
</tr>
<tr>
<td>Bristol</td>
<td>9.7</td>
<td>1.0</td>
<td>10.8</td>
</tr>
<tr>
<td>Rivers Hull and Humber</td>
<td>9.1</td>
<td>0.2</td>
<td>9.2</td>
</tr>
<tr>
<td>Port Talbot</td>
<td>8.3</td>
<td>0.2</td>
<td>8.6</td>
</tr>
<tr>
<td>Manchester</td>
<td>2.7</td>
<td>3.9</td>
<td>6.6</td>
</tr>
<tr>
<td>Glensanda</td>
<td>0.0</td>
<td>5.2</td>
<td>5.2</td>
</tr>
<tr>
<td>Other Major UK Ports</td>
<td>44.5</td>
<td>26.5</td>
<td>71.0</td>
</tr>
<tr>
<td>All major UK ports</td>
<td>333.2</td>
<td>225.0</td>
<td>558.2</td>
</tr>
<tr>
<td>All UK ports</td>
<td>342.4</td>
<td>230.6</td>
<td>573.1</td>
</tr>
</tbody>
</table>

Source: Focus on ports 2006, DT 
©Crown copyright. All rights reserved Department for Transport 100020237 2006 gsu0607052Map9
Freight distribution

1.43 Once the trade in goods has passed through the international gateways it is transported onwards, along with domestic product, via the UK's domestic freight distribution networks. Figure 1.14 shows the amount of freight distributed domestically by mode.

![Figure 1.14: Domestically distributed freight moved by mode, 2004](a)

1/4 Freight moved is measured in tonne-kilometres and takes account of the weight of the load and the distance it is carried.

1.44 Some goods, such as liquid petroleum products, can be transported through dedicated pipelines. However, others rely on infrastructure that is subject to competing demands, such as:

- the transhipment of containers from deep-sea vessels to local ports (which represents the vast majority of domestic waterborne freight);
- the transportation of coal, coke, aggregates and other dry bulk via the rail network; and
- the distribution of containers and other products, primarily via road and rail.27

Road network plays an important role in distributing freight

1.45 To complete the picture, it is helpful to breakdown distribution by mode in terms of the gross value added28 associated with the freight's distribution. Data from the Annual Business Inquiry survey reveals that road haulage accounts for more than 80 per cent by gross value added of the freight sector.29 Road transport offers greater flexibility in terms of timing and destination than other modes of transport and consequently plays a dominant role in the domestic distribution of goods throughout the delivery chain.

27 Rail has a 24 per cent modal share at Felixstowe and 31 per cent modal share at Southampton, Freight Route Utilisation Strategy – Draft for Consultation, Network Rail, 2006.
28 Gross value added measures the contribution to the UK economy of each individual producer.
29 Annual Business Inquiry data set, 2004, ONS.
1.46 Figure 1.15 shows the time-profile of freight traffic on the road network. It is interesting to note that freight demand picks up sooner in the morning than car traffic, is lower in the morning peak than for the rest of the working day, and tails off before the evening peak, suggesting that freight operators seek to avoid the delays often associated with peak time travel.

<table>
<thead>
<tr>
<th>Time of day</th>
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</tr>
</thead>
<tbody>
<tr>
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<tr>
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<td>20-21</td>
<td>175</td>
</tr>
<tr>
<td>22-23</td>
<td>170</td>
</tr>
</tbody>
</table>

Source: Road traffic statistics, 2004, DfT.

1.47 The average length of inter-urban Heavy Goods Vehicle (HGV) movements is 54 miles and considerable parts of many of these journeys therefore take place on the strategic road network. Figure 1.16 shows the average daily flow of HGVs on different sections of the strategic road network.

1.48 It can be seen from the map that overall demand is heaviest, not on the roads that link ports to urban centres, but rather on the roads that link the urban centres themselves. Centralised distribution warehouses are playing an increasingly important role in the supply chains of our economy. Comparison of the maps in Figures 1.16 and 1.17 reveals a clear link between the location of warehouses, which tend to be clustered around intersections of motorways, and high HGV flows on the strategic road network.

30 Transport Statistics for Great Britain, 2005, ONS.
Figure 1.16: HGV flows on Great Britain trans-European network roads

Key

Annual Average Daily Flow (AADF)

- 15,000+
- 10,000 – 14,999
- 5,000 – 9,999
- 0 – 4,999
- Urban areas >100,000 population

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100020237 2006 gisg06070523map1

Annual Average Daily Flow (AADF): The average over a full year of the number of vehicles passing a point in the road network each day.

Source: Highways Agency Traffic Information System database (HATRIS)
Figure 1.17: Location of new warehouses with concentrations at motorway intersections, 1995-2003

Source: The EUNET 2.0 freight and logistics mode - final report, WSP for DfT, 2005

©Crown copyright. All rights reserved. Department for Transport 1990090227 18PP geo:0670592Map13
The final section of the supply chain, particularly for manufactured goods, mail, parcels, and foodstuffs is often provided by Light Goods Vehicles (LGVs) such as small vans, rather than HGVs. Such journeys are predominantly local and centred on urban areas. Economic growth and the growing popularity of home delivery services\(^1\) have contributed to an increase in the use of vans: over the decade between 1994 and 2004, the van population increased by a third and van traffic by 40 per cent.\(^2\) In 2004, 32 per cent of vehicle kilometres by company vans were associated with the collection and delivery of goods.\(^3\)

### NON-WORK AND LEISURE TRAVEL

It can be seen from the time-profile of travel presented in Figure 1.1 that, at some times of day (most noticeably in the inter-peak period), non-business related demands dominate. However, these trips tend to be shorter than business and commuting trips, see Figure 1.2, and tend to make less use of private cars.

The demand for education trips, like the demand for commuting trips, is very peaked with almost three quarters of education trips starting in the periods 8am-9am and 3pm-4pm.\(^5\) Between the early 1990s and the turn of the century there was a marked increase in the number of children being taken to school by car, but these trips still represent a minority of school trips. Trips to school by car represent only 13 per cent of the total number of car trips on the road in urban areas between 8am and 9am.\(^6\)

Similarly, shoppers tend to make less use of cars than commuters and business travellers. 63 per cent of shopping trips are made by car and a high proportion of these (34 per cent in 2005) are made as car passengers.\(^7\) However, the high proportion of shopping trips that take place at the weekend (33 per cent) and the high concentration of these trips in the weekend lunchtime periods leads to considerable congestion around retail centres.\(^8\)

As might be expected, leisure and other trips dominate the demand for travel after standard working hours on weekdays. However, at these times of day, with much lower levels of demand for commuting and business trips, the impact on other travellers is minimal.

### DRAWING THE DEMANDS TOGETHER

Commuters, business travellers, freight distributors, and other users all compete for space on the UK’s transport networks. Considering the combined demands of these users, it is clear that demand is concentrated in the working day, with clear rush hour peaks.

Furthermore, it is also clear that this demand has a geographical focus on: urban areas and their catchments; key international gateways and their surface access routes; and a handful of key inter-urban corridors between these places.

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\(^1\) The value of Internet sales by businesses rose to £103.3 billion in 2005, an increase of 56 per cent on the 2004. ONS News Release, October 2006.

\(^2\) Survey of Van Activity, DfT 2004.

\(^3\) National Travel Survey, data set, DfT, 2005.

\(^4\) National Travel Survey 2005, DfT.

\(^5\) National Travel Survey, data set, DfT, 2005.

\(^6\) Travel to the shops in GB – Personal Travel Factsheet 6, DfT, 2003.
Business travellers, commuters, and freight distributors all rely heavily on roads and public transport in urban areas and their catchments. The demand placed on urban networks is greatest during the rush hour, when a confluence of demands places the infrastructure under most strain. While a handful of urban areas are able to spread the demand for travel across public transport as well as road networks, central London being the standout example, even these areas experience high levels of car travel in the peak hours.

Commuting trip lengths are increasing and placing the surrounding networks under greater strain. Increased trip lengths are accompanied by a greater reliance on motorised modes of transport and have created peaks of demand during rush hours on the strategic road and rail networks close to urban areas.

The growth in international trade has increased the importance of international gateways to our economy. Trade places demands not just on the international gateways that transport physical products into and out of the UK but also on modes that facilitate international business travel. There has been strong growth in business air travel over the last two decades in line with the growth in the value of trade. Structural changes in our economy have led to greater reliance on ports that handle containers and ro-ro services and airports that are used to transport high-value, lightweight goods. This demand is focused on a small handful of very busy ports and airports and this concentration places consequential demands on the supporting surface access infrastructure. These surface access routes are often part of the strategic road and rail networks.

In order for urban economies to thrive, they need strong connections with other centres of activity: inter-urban corridors provide the means for transporting goods and travellers between agglomerations, and provide surface access to the UK’s international gateways. Over time, reductions in the cost of car travel and freight distribution; increases in the size of markets; and outward migration from the largest urban areas have combined to increase the length of transport movements, placing greater demand on the infrastructure that connects urban areas and their supporting labour market catchment areas.
2.2 The Connectivity and Performance of the UK’s Transport Network

**Headlines**

- The UK has a well established transport network that provides urban networks, links urban areas in the UK, and links the UK to international trade corridors;
- The UK benefits from world-class international air and sea connectivity;
- The UK has the networks in the right place to support travel demands;
- For most of the time, the networks function well with little congestion and few reliability problems;
- However, in some places and during some periods, the network suffers from severe congestion and reliability issues across modes.
- Transport contributes around one quarter to the UK’s greenhouse gas emissions.

**INTRODUCTION**

2.1 The previous section looked at the demands placed on the UK’s transport networks. This section considers how well the UK’s transport networks meet those demands.

2.2 The chapter considers, in turn:

- the consequences of the UK’s economic geography for its transport networks;
- whether the networks are in the ‘right place’ to support the journeys that matter to the UK economy;
- how well the transport networks are performing – both economically and environmentally; and
- users’ perceptions of network performance.

2.3 In each section, the chapter strives to assess the UK’s networks with both analyses of absolute performance and, where suitable data is available, international benchmarking. It should be stressed that international benchmarking is difficult, because of the different geographic characteristics of countries, and the lack of detailed, comparable statistics. Nevertheless, such comparisons do offer insights into the performance of the UK’s networks.

**THE CONSEQUENCES OF THE UK’S ECONOMIC GEOGRAPHY**

2.4 Different countries have different natural and economic geographies. In consequence, the demands placed upon their transport networks will also be different. Small, densely populated countries are more likely to face issues of congestion and capacity; larger countries with diffuse populations, and urban areas a good distance apart will face local congestion issues, but are likely also to face the challenges of bringing those populations and urban areas closer together to facilitate trade.

2.5 The data explained in the first chapter of this volume reinforces this message: demand in the UK is focused on a small number of places, driven by the concentration of economic activity.
Figure 2.1 illustrates this point by showing how the relative proximity of urban areas varies across EU member states. It can be seen that the UK, like the Netherlands, has a high number of large settlements in close proximity to each other, whereas countries such as France and Spain may be characterised as having a greater dispersal of urban areas. These differing structures are a result of the physical geography of these countries, and the different ways in which the economies have developed over time. Consequently these countries face different transport challenges: for instance the infrastructure required to serve business travellers in France, with urban areas that are far apart, will be different from the infrastructure required to serve the UK economy. In particular, French inter-urban networks would need to offer very high speeds in order to make urban areas a day trip away from each other for business travellers; whereas, in the UK, journey times provided by existing services will, for the most part, achieve this comfortably.

In light of this, standard cross-border comparisons of overall length of infrastructure or length per capita can only offer a limited insight into how well a transport network supports the economy of a particular country. In an attempt to overcome these difficulties the study has assembled an alternative set of metrics and comparators that focus on connectivity and performance. Whilst every attempt has been made to construct a set that is comprehensive and representative, the study would guard against over-interpretation of these international comparisons. Our view is that, taken as a package, they provide a useful set of indicators which, alongside the evidence set out elsewhere in this volume, assist an informed judgement as to the performance of the UK’s networks.
Figure 2.1: Spacing between European urban areas

Distance between centres of urban areas

- Less than 100 km
- 100 km to 150 km

Source: GEOPOLIS, F.Moriconi-Ebrard, 1993
2.2 THE CONNECTIVITY AND PERFORMANCE OF THE UK’S TRANSPORT NETWORK

CONNECTIVITY

2.8 The first requirement of a transport network is that it is in the ‘right place’. In part due to economic and geographic history, the UK benefits from having comprehensive transport networks: extensive road, rail, maritime and inland shipping, and aviation networks exist. Over time, however, the demands placed on them have changed.

2.9 Migration and shifts in the location of employment, structural changes in the economy, and changes in the geographic pattern of domestic and international trade have altered the way that the networks are used. It is likely, therefore, that sections of transport infrastructure will be more or less heavily used over time. Chapter 1 of this volume discussed how the changing demands of the economy has placed urban networks and international links under greater strain; but in turn the demand for some sections of infrastructure is greatly reduced: the UK’s canals were once busy industrial arteries; the dense network of rural roads were once the congested heart of the rural economy, in times when much greater proportions of the population, and of economic output, were based outside of urban areas; similarly, many rail lines were far busier before the shift in population towards urban areas and the advent of affordable motoring.

2.10 This section considers whether, despite this rich history, there are any missing links in the networks. For instance, are there any gaps in the networks that, if bridged, would link local economies more effectively to the national networks?

Connectivity within urban areas and their catchments

2.11 With the exception of new towns, most of the UK’s urban networks have evolved over hundreds of years and have developed to serve the complex intra-urban movements that occur within our towns and urban centres. As a consequence, the UK’s towns and cities are served by dense and inter-twined road networks corresponding to their pattern of growth through history, and in some places by commuter rail lines that provide access to the surrounding area. Inevitably, progress and population migration has meant that there are some links that carry far more traffic than they were originally designed to accommodate, or serve different purposes than they did when originally designed.

2.12 Given the high density of buildings and the desire to maintain the liveability of urban spaces, responding to the challenge is a real task. The scope for significant revisions to the topology of surface urban networks is limited, and often very expensive. The existence of expensive sub-surface metro networks in many cities, and the increasing use of road tunnels, illustrates that introducing new surface networks to urban areas is a difficult task. The development of traffic control systems, which synchronise traffic signals to make best use of the available capacity, has helped considerably. Over 180 towns in the UK have adopted such systems, and modern systems are capable of adjusting signal timings to respond to variations in traffic flows, whilst providing priority access for public transport vehicles.¹

2.13 Looking at the areas that surround the UK’s urban centres, the structure of the rail network in the South East provides good access to employers in central London from outlying areas, but elsewhere is less well designed to support commuting flows. The tracks into Leeds and Glasgow carry a larger share of commuters than those into other UK urban areas, but these flows still represent a minority of overall commuting demand. In these places, and in Outer London, the extensive road network is the backbone of commuter travel.

Connectivity between urban areas and international gateways: the inter-urban corridors

2.14 The UK’s domestic connectivity is provided by a combination of modes – road, rail, air and sea – and it is this totality that should inform assessments of the UK’s overall connectivity. Figure 2.2 below shows the urban areas of Great Britain with populations over 100,000, overlaid with national and international transport networks: the strategic road network, rail network, major international airports (airports handling 1 million or more passengers per year) and major ports (ports handling over 1 million tonnes of freight per year). The main conclusion is that the UK’s towns are well connected – the links are there – but the remainder of this section considers each part of the network in more detail.
Figure 2.2: Great Britain: Urban areas, the connecting networks and international gateways

Key
- Major airports
- Major ports
- Rail network
- Strategic road network
- Urban areas > 100,000 population

Source: DfT and Ordnance Survey.
2.15 For the inter-urban road network to provide good connectivity, it needs to satisfy two criteria:

- towns and cities, and international gateways should have good access to the network; and
- the routes between these places should be relatively fast and direct.

2.16 Comparing access to the strategic road network between countries is difficult because of inconsistencies in the classification of roads, but it is possible to benchmark access to the motorway network. Of the 73 UK towns and cities with more than 100,000 inhabitants, just over two-thirds are directly connected by a junction to the motorway network.\(^2\) The high population densities of UK urban centres mean that a relatively high proportion of the total population has direct access to motorways, ports and airports, as illustrated in figure 2.3 below.

2.17 Figure 2.2 shows that almost all large urban areas in the UK are connected by the strategic road network and that the distance between these areas via the strategic road network is not much longer than the direct distance. The UK outperforms most other European nations on this measure. The route lengths between the six largest UK urban economies via the motorway network are on average only 21 per cent longer than that the straight-line distance; compared to Italy 21 per cent, Germany 23 per cent, Netherlands 25 per cent, Spain 25 per cent and France 29 per cent.\(^3\)

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\(^2\) Eddington Study analysis based on data from www.viamichelin.com.

\(^3\) Eddington Study analysis based on data from www.viamichelin.com.
2.18 A similar analysis can be conducted for the rail network (see Figure 2.4). The average rail journey times between major UK urban areas are close to that of other European countries, with journeys between London and other UK major cities performing particularly well relative to journeys from other European capitals. France and Spain have a small number of high speed lines but journeys on the rest of the network take considerably longer.

2.19 The UK, like other large European countries, has good domestic air connectivity, with scheduled services available for all of the trips between the six largest urban economies that are further than 200km apart. These air services provide the means for business travellers to travel to and from opposite ends of the country within a working day.

International connectivity

2.20 Ports and airports facilitate trade by providing the means for transporting goods into, out of and around the UK, and by providing access to international business centres for business travellers. However their connectivity should not just be considered in terms of the access they provide to other urban areas and countries, but also in terms of how well they are connected to supporting infrastructure such as the strategic road and rail networks.

2.21 The location of ports, and therefore port-to-port connectivity, is determined by a range of factors that are beyond the scope of transport policy, such as proximity to international shipping lanes, length of sea crossing and the physical geography and tides of the UK’s coastline. Ports are not necessarily located close to centres of economic activity, and the provision of good surface access is important for the distribution of freight.

2.22 The UK’s major mainland ports are generally well connected to the strategic road network, as demonstrated by Figure 2.3. However, at some ports traffic has to use local, urban roads in order to reach the strategic road network, creating congestion, pollution and noise for local residents.

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* Eddington Study analysis based on data from OAG flight schedules.
2.23 All of the top ten container and bulk-handling ports on the British mainland have rail connections to the main intercity rail networks and a significant proportion of freight arriving at them is transported onwards by rail. The volume of freight that can be moved onwards by rail is dependent on engineering issues, such as whether the bridges and tunnels are high enough to accommodate containers; but also, critically, on the availability of suitable train paths on the network, as freight has to compete with passenger services. This can be problematic where passenger demand is high, for instance in the South East where rail freight competes for space with very heavy commuter rail flows.

2.24 Around a third of the UK’s urban population are within an hour of a major port (see figure 2.3 above) – a higher proportion than in other major European countries. In part this is a function of the geography of the UK, and in part it is the result of the connectivity of the strategic road network. The road network provides good access to freight distribution hubs in the Midlands (all major ports are within three hours of travel). Over 75 per cent of the population live within a half-day truck drive of the West Midlands, allowing the existence of lean logistic chains centred on the Midlands’ transport links, since the return journey from hub to destination is possible within the limits of a driver’s legal working day.

2.25 The connectivity of the UK’s airports is particularly important for supporting certain types of business activity, such as the financial services and banking sector. Airports also have a role in the movement of high value freight: 25 per cent of the UK’s trade in goods by value is via air. In terms of connectivity, the important characteristics of an airport are:

- the range of destinations served and frequency of connections; and
- the proximity of the airport to the people it is serving.

2.26 Figure 2.5 illustrates the connectivity of major European cities to other cities of economic significance. This measure of connectivity takes into account all airports near a city, how far these airports are from the city centre, the range of destinations served, the relative commercial importance of the destinations served, and the frequency of services.

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1 Rail has a 24 per cent modal share at Felixstowe, and 31 per cent modal share at Southampton. *Freight Route Utilisation Strategy – Draft for Consultation*, Network Rail, 2006.

2.27 On the basis of this measure, London is the best-connected city in Europe, closely followed by Amsterdam. Heathrow handles more international terminal passengers than any other airport in the world and London also benefits from having several airports in reasonable proximity. However, it should be noted that London’s leadership on this measure has been eroded by expansion at Paris Charles Gaulle, Schipol and Frankfurt in recent years.

2.28 Other UK cities are less well connected. Manchester, the second best connected city in the UK, is 16th overall. France, Spain, Germany, Italy and Switzerland all have second cities which are better connected than Manchester. However, the UK has four cities amongst the top 20 best-connected in Europe – equal to Germany and more than any other country. Glasgow (19th) and Edinburgh (20th) are reasonably well-connected for their size. However, Birmingham (30th) has relatively poor connections to other major cities.

2.29 Nearly two-thirds of the UK’s 73 large towns and cities are within an hour’s free-flow travel of a major international airport (the location of the UK’s major international airports can be seen in figure 2.2). This is broadly in line with Italy and Spain and considerably higher than France, although the Netherlands and Germany both have a higher proportion of their urban areas near an airport. When considering what percentage of the population this represents, again, the UK performs strongly compared with European competitors (see figure 2.3).

2.30 Free-flow journey times between UK urban centres and the airports that serve them are broadly consistent with other major European urban centres. London is the exception, with free-flow journey speeds of over 40 minutes to Heathrow (London’s closest major airport). This is a slower connection time than most other European competitor cities.

CONNECTIVITY – CONCLUSIONS

2.31 The UK’s strategic transport network is broadly in the right place. The UK’s largest economic centres are well connected to each other through the strategic road networks, and most large towns and cities are also well connected. Rail journey times between London and the other major cities are good. More of the UK’s large towns and cities are near ports than in other major Western European countries, although there are some issues with surface access. London has the best international air connections in Western Europe, although other cities fare slightly less well.

PERFORMANCE OF THE NETWORK

2.32 The analysis presented thus far has considered the networks in terms of accessibility and connectivity. Performance has been measured in terms of free-flow speeds and no account has been taken of either the congestion or over-crowding caused by the confluence of demands on the networks, or the consequent impacts on the environment.

2.33 This section addresses economic and environmental performance of the networks in turn. The first part considers where the congestion and over-crowding are having a direct impact on businesses and travellers. The second part considers environmental issues such as climate change, air quality and noise. However, it should be remembered that:

- although the issues are addressed separately in the following text, high economic and environmental external costs can often coincide. For example, road congestion, particularly stop-start conditions, leads not just to wasted travel time but also to high levels of emissions and noise; and

7 In this context congestion is defined as the reduction in journey times experienced as more vehicles join a road.
environmental impacts are not without their cost to the economy. The recently published Stern Review on the Economics of Climate Change highlighted the impact that unabated climate change could have on the economy.

Economic performance of urban area networks

Outside of central London, the majority of commuter, business and leisure travel is by road, and therefore the performance of the local and national road networks is of real importance to the UK economy. Figure 2.6 sets out the percentage of traffic travelling in very congested conditions on different parts of the network. A high percentage of traffic travels in relatively uncongested conditions – over 90 per cent outside major urban areas.

Figure 2.6: Congestion levels on the road network, 2003

<table>
<thead>
<tr>
<th>Area type</th>
<th>Percentage of traffic in very congested conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>London</td>
<td>24%</td>
</tr>
<tr>
<td>Major urban areas/conurbations</td>
<td>15%</td>
</tr>
<tr>
<td>Other urban areas</td>
<td>9%</td>
</tr>
<tr>
<td>Strategic roads – M roads and A roads</td>
<td>7%</td>
</tr>
<tr>
<td>Rural</td>
<td>2%</td>
</tr>
<tr>
<td>Whole network</td>
<td>8%</td>
</tr>
</tbody>
</table>

Source: DfT

However, the data also shows that congestion levels are highest on roads in major urban areas, particularly London. 99 per cent of lost time on the roads is estimated to be on urban roads. Almost 30 per cent of travel time in major urban areas during peak periods in 2004 was spent at speeds below 5 mph, and over 50 per cent at speeds of less than 20 mph. In the inter-peak period, when much business and freight travel occurs, around 20 per cent of time was spent at speeds below 5 mph, and over 40 per cent at speeds of less than 20 mph.

Further detail is offered by figure 2.7, which illustrates where delays occur on the road network in Great Britain. As well as illustrating that congestion is concentrated on major urban areas, congestion is also common around ports, airports and on a small subset of inter-urban links.

\[\text{Defined as traffic conditions where the ratio of the volume of traffic relative to road capacity is above 0.8.}\]

\[\text{However, since the Congestion Charge was introduced in 2003, Central London has seen the first increase in traffic speeds for 30 years output suggesting a reduction in congestion.}\]

\[\text{National Transport Model output, DfT.}\]

\[\text{Urban Speed Survey 2004, DfT.}\]
Figure 2.7: Congestion on the road network, Great Britain, 2003

Key

Base year - Total lost hours per link km
- 139,400 to 1,340,000 (877)
- 27,670 to 139,400 (2,704)
- 6,510 to 27,670 (5,309)
- 0 to 6,510 (8,766)

+ Major airports
• Major ports

Source: DfT.
However the congestion measures presented above capture only part of the picture. Research studies have demonstrated a strong positive relationship between congestion (a measure of average congested vehicle speeds against free-flow speeds) and travel time variability (a measure of the variation in journey times). As congestion rises, travel times become less predictable. Whilst congestion measures capture the time lost to driving in congested conditions, they do not convey the time loss associated with the journey time variability – as travel time variability increases travellers will tend to leave earlier to ensure they can reach their destination on time.

Similar patterns of high demand can be witnessed on the rail network in London and the South East. At most times trains operate below capacity, but this changes in peak periods. Figure 2.8 shows the percentage of train capacity used during the morning peak period. It can be seen that crowding gets worse nearer Central London as more commuters join the services, and that the majority of lines into London are significantly above capacity in this peak period.

The London Underground network also suffers from high levels of crowding during the morning peak. This is concentrated in, but not restricted to, Central London. There are also high levels of crowding on the edges of Central London, where passenger volumes are high but the network is less dense (see Figure 2.9).

Figure 2.8: Rail Crowding in London and the south east during the AM peak, 2002 (inward flows and load factor – all services)

The London Underground network also suffers from high levels of crowding during the morning peak. This is concentrated in, but not restricted to, Central London. There are also high levels of crowding on the edges of Central London, where passenger volumes are high but the network is less dense (see Figure 2.9).


Capacity is defined as all passengers seated for journeys over 20 minutes; no more than 30 per cent standing on shorter journeys.
Figure 2.9: 2005 AM peak hour crowding on the Inner London Underground Network

Source: TfL.
Economic performance of inter-urban corridors

2.40 Strategic road and rail networks play an important role in facilitating long-distance business trips and freight distribution, and are increasingly required to support access to deep, skilled labour markets on the outskirts of urban areas.

2.41 Figure 2.10 shows the average delay on the strategic road network for the worst 10 percent of journeys – a metric that captures delay due both to recurrent congestion and to incidents. Overall, vehicles on the strategic network lose just over a minute per 10 kilometres travelled. The worst 10 per cent of journeys suffer an average delay of $3\frac{1}{2}$ minutes per 10 kilometres travelled, relative to the free-flow speed.

2.42 Congestion and reliability issues on the strategic road network tend to be concentrated on a small subset of the most heavily used links, such as the M25 London Orbital, the M1 London to Sheffield, the M6 between Birmingham and Manchester and the M62 linking Manchester and Leeds (all of which are heavily used by HGVs).
Figure 2.10: Average delay on the Strategic Road Network, worst 10 per cent of journeys

Key
Average delay per 10 vehicle miles
- 9 minutes or greater
- 6 minutes up to 12 minutes
- 3 minutes up to 6 minutes
- 0 minutes up to 3 minutes
- Excluded routes

Source: Highways Agency Traffic Information Systems database (HATRIS)

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Information derived from the Highways Agency Traffic Information System database (HATRIS)
2.43 Journey reliability on the UK’s rail network has improved considerably in recent years, and recent results suggest that performance has now reverted to the levels achieved before the Hatfield rail disaster in 2000. Overall, around one in eight trains now arrive over 5 minutes late in the UK.14

2.44 Domestic aviation is also an important contributor to domestic connectivity. Data on the performance of the UK’s airports is set-out below.

Economic performance of international gateways

2.45 The UK’s ports handle an impressive volume of goods. With 573 million tonnes handled in 2004,15 the UK handled a higher volume of goods than any other EU25 country (16 per cent of total EU25 tonnage16). In addition, each year around 50 million international and domestic passenger journeys are made through UK ports.17

2.46 The continued growth in international trade is starting to affect both the ports and their surface access links. At times of high demand, such as the pre-Christmas period, congestion at some container ports can be an issue, forcing shipping to delay entry to port by several days and creating queues of lorries on local access roads. Congestion on port access routes is worst in the South East and where port links pass through urban areas – of which Dover is the most notable example. Here, congestion can reach such high levels within the town that phased closures of sections of the M20 (“Operation Stack”) have to be used to create additional lorry parking whilst access routes clear. This can cause serious knock-on disruption for business and commuter movements along the M20.

2.47 Analysis from the Department for Transport’s Freight Model shows that freight traffic on some port access routes experience some of the worst average delay for freight traffic, i.e. immediate access to the port can be the most congested section of the HGV leg of the supply chain. This has a knock-on effect for the efficient throughput of freight within a port and for the remaining stages of the supply chain.

2.48 Capacity constraints on rail surface access routes may not be as visible as for road – on rail, often bottlenecks many miles from the port itself have significant impacts on the ability to move freight by rail to and from the port. Usually, how much freight is actually moved onwards by rail (rail freight usage) depends on cost rather than congestion issues.

2.49 While London airports offer world-class connectivity, the high level of demand means that they also suffer from high levels of delay. 24 per cent of flights at Gatwick and 28 per cent at Heathrow are delayed, a problem common to most large airports in the EU: London’s main competitors in terms of air connectivity – Amsterdam, Paris and Frankfurt – suffer from slightly less delay (see figure 2.11).
2.50 Manchester is less prone to delays than Heathrow or Gatwick, with 21 per cent of flights delayed. However, the average length of the delay that occurs at Manchester is amongst the highest in Europe. The UK’s other regional airports also have stronger punctuality records than Heathrow and Gatwick.

2.51 The majority of delays at Heathrow, Gatwick and Manchester are directly or indirectly due to infrastructure constraints. For example, around 40 per cent of delays at these airports were caused by late arriving flights, whereas less than one delay in ten is caused by operational, commercial or technical issues. This would suggest that the airports are working at, or close to, capacity and have little redundant capacity to accommodate disruptions to flight schedules.

2.52 Roads around airports often have relatively high levels of congestion compared with the rest of the network. This is especially true around Heathrow and Manchester. Road journeys to these airports from the central business districts are delayed throughout the day by over 50 per cent compared to the free-flow speed. For Heathrow this represents a journey of more than an hour, compared to just over 40 minutes at free-flow.

Environmental performance of the transport network

2.53 The impact of transport on the environment is felt in many different ways. It is important that individual user as well as national decisions about transport, take proper account of these environmental impacts.

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18 AEA Airlines’ delay rates by airport on Intra-European services, Association of European Airlines.

19 Eddington Study analysis using DfT Transport Direct web-site.
2.54 The impacts of transport on the environment can damage quality of life and in some cases, as shown by the Stern Review, the growth prospects of the economy as well. The main impacts of transport on the environment are emissions of greenhouse gases and the impact that this has on climate change, the emissions of air pollutants, noise, and damage to both the natural and built environments.

Climate Change

2.55 Climate change is the most important long-term challenge facing the global community. The impact of greenhouse gas emissions on the global climate is scientifically well-established and as the Stern Review has shown, climate change could have very significant impacts on the UK and global economy (as well as on other social indicators not captured in GDP). Some climate change is already happening, and a further amount is inevitable due to historical greenhouse gas emissions. Adaptation is therefore important, but abatement effort, to reduce emissions, is critical.

2.56 Domestic transport currently represents around a quarter of total UK carbon dioxide emissions (the main greenhouse gas). This proportion is expected to grow to around 2010 and then start to fall back to 2000 levels by 2050 (see Figure 2.12). The rise in emissions in the short term is a result of the very strong historical relationship between transport demand and economic growth. In the longer term however, this relationship is expected to weaken as a result of demographic changes. In addition continued fuel efficiency improvements are also likely to lead to falling emissions even though transport demand continues to grow.20

2.57 There is currently no international agreement on how to allocate emissions from international aviation and shipping. However, if international aviation and shipping were counted on the basis of departures, transport’s share of UK carbon emissions rises from 23 per cent to 28 per cent of the total. In aviation, another important consideration is the climate change impact of other, non-carbon emissions from aviation. If the aviation sector is defined as all domestic services plus all international departures from the UK it would contribute about 6 per cent of the UK’s CO₂ emissions but approximately 11 per cent of total UK climate change impact, including an assumption for non-carbon emissions from aviation.


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### Figure 2.13: CO₂ emissions from transport by mode, 2004

<table>
<thead>
<tr>
<th></th>
<th>In MtC</th>
<th>As per cent of total domestic transport</th>
<th>As per cent of total UK CO₂ emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Road transport</strong>a</td>
<td>32.6</td>
<td>93.1</td>
<td>21.4</td>
</tr>
<tr>
<td>of which:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger cars</td>
<td>19.4</td>
<td>55.5</td>
<td>12.8</td>
</tr>
<tr>
<td>Light duty vehicles</td>
<td>4.4</td>
<td>12.4</td>
<td>2.9</td>
</tr>
<tr>
<td>Buses</td>
<td>1.0</td>
<td>2.8</td>
<td>0.6</td>
</tr>
<tr>
<td>HGVs</td>
<td>7.6</td>
<td>21.6</td>
<td>5.0</td>
</tr>
<tr>
<td>Mopeds &amp; motorcycles</td>
<td>0.1</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Railways</strong></td>
<td>0.7</td>
<td>1.9</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Civil aircraft</strong></td>
<td>0.6</td>
<td>1.9</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Shipping</strong></td>
<td>1.0</td>
<td>2.9</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>All domestic transport</strong>b</td>
<td>35.0</td>
<td>100</td>
<td>23</td>
</tr>
<tr>
<td><strong>Total UK emissions</strong></td>
<td>152.5</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

**Memo items:**
- International aviation: 9.0 (5.5)
- International shipping: 1.6 (1.0)
- **All transport emission (incl. International)**: 45.7 (28.0)
- **Total UK CO₂ emissions (inc. International)**: 163.1 (100)


a. Total road transport includes a small amount of emissions from LPG vehicles and from engines.
b. Total includes a small amount of emissions from other mobile sources and machinery.

#### 2.58 Targets guiding Government policy on climate change include:
- the Kyoto Protocol target to reduce UK greenhouse gas emissions by 12.5 per cent, from 1990 levels by 2008-12;
- the domestic target to reduce UK CO₂ emissions by 20 per cent by 2010; and
- the long term target to put the UK on a path to reduce total carbon dioxide emissions by some 60 per cent by 2050, with real progress by 2020.

#### 2.59 Transport is also the source of a small amount of other greenhouse gas emissions (around 6 per cent by weight of total transport greenhouse gases). These include methane and nitrous oxide, present in very small amounts in exhaust emissions, and also gas emissions from refrigerants used in car air-conditioning systems. These gases all have high global warming impacts.

### Air Quality

#### 2.60 Transport can also have an impact on air quality. Over the last decade air quality has improved significantly and Government projections suggest that these trends will continue. However, there are parts of the UK where levels of nitrogen dioxide and PM₁₀ remain above the mandatory limits set by the EU and above the objectives set in the Government’s Air Quality Strategy. Just under half of all UK local authorities have declared an Air Quality Management Area in response to an expectation that a Strategy objective will be exceeded. If future traffic flows exceed expectations, or emission control technologies fail to deliver anticipated reductions, the challenge will increase.

#### 2.61 Emissions of key air pollutants from road transport have been reduced by about 50 per cent over the last decade as Figure 2.14 shows, despite increases in traffic. This is largely due to a progressive tightening of European emissions standards, which have helped force improvements to vehicle engineering and design.
Air quality emissions from shipping are regulated by the Merchant Shipping (Pollution) Act 2006. Rail emissions are set to decrease as new, or re-engined rolling stock complies with progressively tougher emissions standards set by the EU’s Non Road Mobile Machinery Directive.

In aviation, the Government is acting at a number of levels to reduce emissions from aircraft and airports. At the international level, the Government plays an active role in negotiation with International Civil Aviation Organisation (ICAO) aimed at setting emission limits for aircraft engines. At the national level, following the White Paper on the Future of Aviation the Government has launched the Project for the Sustainable Development of Heathrow with the aim, amongst others, of exploring all possible options to improve air quality. At the local level, relevant local authorities, mainly in the south east around Heathrow and Gatwick, are working with airport operators, airlines, the Government and local stakeholders to improve air quality around airports.

Noise

Noise pollution from major sources, such as transport, can be a concern for some communities living close to them. As a result, all EU member countries, including the UK, are now required to produce noise maps and action plans in order to manage noise arising from major sources, following the introduction of EU directive 2002/49/EC. However, aside from the EU directive requirements, other means of minimising the noise impacts from a number of transport sources are already in place.

Traffic noise can be a concern for communities living close to the road network. Noise from construction and maintenance work can also cause nuisance. Traffic noise from the trunk road network can be tackled through measures such as using appropriate materials and designs in both construction and maintenance. Quiet surfacing materials have been required to be used as a matter of course since 1999 in all new road construction and also in the maintenance of existing ones. Measures such as noise barriers on motorways also help...
reduce traffic noise to acceptable limits in residential areas and have recently been used to relieve the most severe noise problems experienced by communities living close to the existing trunk road network.

2.66 Technological progress means modern jet aircraft are typically 75 per cent quieter than their 1960s counterparts. The number of people around the UK’s major airports who live within higher noise contour areas has decreased over the past ten years. Nevertheless, aircraft noise remains a key local environmental impact for people living near airports and flight paths. It can cause significant disturbance and annoyance.

2.67 Although aircraft design continues to improve (most recently, the ICAO Chapter 4 noise certification standard came into effect on 1 January 2006), as the growth in air traffic continue. There is an overall international and national framework for noise control measures, but many actions need to be delivered locally.

2.68 The Government set out the policy framework in The Future of Air Transport. This involves a combination of necessary measures that will be needed to meet its overall objective of limiting, and where possible reducing, the number of people in the UK significantly affected by aircraft noise.

2.69 These measures include the promotion of research and development into new low noise engine and airframe technologies, in support of the aviation industry’s Sustainable Aviation environmental targets (which include the aim of reducing perceived noise from aircraft to 50 per cent of its current average by 2020).

2.70 The Government also implements the international regulatory framework, the ‘balanced approach,’ agreed by the International Civil Aviation Organisation, and EU Directive 2002/49/EC which requires periodic noise mapping and action planning at larger EU airports from 2007 onwards.

2.71 Noise related operating restrictions at Heathrow, Gatwick and Stansted airports are set by the Government; at other airports noise control measures are matters for the airport operator in consultation with stakeholders, including the local community and aircraft operators. The Civil Aviation Act 2006 provides these airport operators clear powers to establish and enforce noise controls.

Landscape, heritage and biodiversity impacts

2.72 Transport infrastructure can have a negative impact on landscape, heritage and biodiversity. The severity of such impacts varies considerably according to the specific location of a particular development. The diversity and complexity of environmental concerns can lead to competing challenges for surface infrastructure: for example, bypasses removing heavy traffic from town and village centres improve air quality and are popular with benefiting communities, but create a new or changed impact on the landscape.

2.73 Although modern infrastructure design has been greatly improved, both new and existing roads, rails, ports and airports can have serious implications for wildlife, biodiversity and nature conservation. New infrastructure can cause direct loss of habitats if care is not taken over route planning, construction and maintenance. Set against this, the road and rail estates can also be valuable habitats supporting a wide range of plant and animal species otherwise under threat from urban expansion and land-use changes in the countryside.

22 The Future of Air Transport, DfT, 2003
PERCEPTIONS OF TRANSPORT PERFORMANCE

2.74 Having collected and examined such 'hard' data as is available on performance, this chapter now considers perceptions of performance. These perceptions offer an alternative assessment of the state of the UK's transport networks, in particular helping to highlight the extent to which performance may affect the UK's international competitiveness.

Business views 2.75 Transport is a key consideration in determining business location. London's transport systems are highly rated by inward investors, whilst Birmingham's and Manchester's are also well thought of (see figure 2.15). London is considered by many European senior executives to be the best city in Europe to locate a business. Contributing to this was London's first place ranking in terms of transport, both for travelling around the city and for transport links with other domestic cities and internationally.

Figure 2.15: Best European cities to locate a business, 2006

<table>
<thead>
<tr>
<th>Access to markets customers and clients</th>
<th>External transport links (other cities &amp; internationally)</th>
<th>Internal transport (travel within the city)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 London (1)</td>
<td>London (1)</td>
<td>London (2)</td>
</tr>
<tr>
<td>2 Paris (2)</td>
<td>Paris (2)</td>
<td>Paris (1)</td>
</tr>
<tr>
<td>3 Frankfurt (3)</td>
<td>Frankfurt (3)</td>
<td>Berlin (3)</td>
</tr>
<tr>
<td>4 Joint 4th Brussels (4)</td>
<td>Amsterdam (4)</td>
<td>Barcelona (5)</td>
</tr>
<tr>
<td>5 Joint 4th Amsterdam (6)</td>
<td>Brussels (5)</td>
<td>Munich (4)</td>
</tr>
<tr>
<td>6 Milan (7)</td>
<td>Munich (7)</td>
<td>Zurich (9)</td>
</tr>
<tr>
<td>7 Munich (8)</td>
<td>Joint 7th Madrid (6)</td>
<td>Stockholm (6)</td>
</tr>
<tr>
<td>8 Barcelona (9)</td>
<td>Joint 7th Zurich (8)</td>
<td>Frankfurt (7)</td>
</tr>
<tr>
<td>9 Madrid (5)</td>
<td>Joint 7th Berlin (12)</td>
<td>Madrid (9)</td>
</tr>
<tr>
<td>10 Birmingham (-)</td>
<td>Barcelona (10)</td>
<td>Manchester (14)</td>
</tr>
</tbody>
</table>


2.76 Results from a 2005 survey conducted on behalf of the Confederation of British Industry, presented in Figure 2.16, underline the importance of transport to industry.23

2.2 The Connectivity and Performance of the UK’s Transport Network

2.77 In a British Chamber of Commerce survey, three quarters of businesses said that transport delays had caused them to incur increased operating costs in the form of penalties for late deliveries, overtime costs, missed meetings affecting contract negotiations and lower productivity. An even higher proportion had incurred costs from lost working-hours.

2.78 Business however, also has poor perceptions of the performance of the rail system, with over half of respondents to an Institute of Directors survey saying that the rail network does a poor job of meeting their business travel needs.

Commuter views 2.79 Figure 2.17 below, reports results from a survey of commuters, which suggests that a significant number are late at least once a month because of transport problems. The survey found that delays are less frequent for car users (only 40 per cent are delayed at least once a month), than for bus users (50 per cent), and tubes and train users (over 90 per cent). Delays

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are worst amongst London commuters, with 70 per cent experiencing delay at least once a month. However, over 50 per cent of commuters said that they were never late for work due to transport problems.

![Figure 2.17: How often employees are late for work because of transport problems, 2001](image)

Source: Omnibus Survey, 2001, ONS.

### Rail

**Perceptions of rail**

2.80 Rail users overall report a high level of satisfaction with rail services, with the 2005 National Passenger Survey reporting that 80 per cent are at least satisfied with the rail service.27 Contrary, perhaps, to popular belief, punctuality, reliability and frequency do not stand out as major concerns of rail users, with around three quarters of respondents at least satisfied, including on the heavily-used London and South East lines. There is much more dissatisfaction with the way train companies deal with delays, with just 34 per cent at least satisfied and 30 per cent dissatisfied or worse. Passengers are least happy with these ‘soft’ issues like dealing with delay, the availability of staff, and toilet facilities on the train.

### PERFORMANCE — CONCLUSIONS

2.81 In some places and at certain times of day, the UK’s transport network is stretched beyond its capacity.

2.82 Routes carrying multiple demands, such as many urban roads, inter-urban routes near to urban areas, and South East rail services, can suffer severe congestion, delay and overcrowding.

2.83 London’s world-class international passenger connections are tarnished somewhat by poor punctuality records due to infrastructure constraints and severely congested surface access routes. Reliability problems on access routes to ports have knock-on effects, not only for port throughput but also for the rest of the freight supply chain.

2.84 People’s perceptions of the UK’s transport networks are mixed. But many transport users are satisfied with their own experience of the network, and the UK’s major urban areas are seen as good business locations, in part because of their transport networks and connectivity.

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2.3 **Future Scenarios**

**Headlines**

- The UK starts from a position today where for long periods, the networks function well with little congestion and few reliability problems; but in some places and during some periods, the networks suffer from severe congestion and reliability issues across modes.

- Travel demand is forecast to grow strongly across all modes under a range of plausible scenarios. Existing pressures will widen in their geographical impact and their intensity, concentrated on urban areas, around international gateways and on some sections of the inter-urban networks.

- Rising incomes and population, and falling transport costs are some of the most significant drivers of this growth, and without action, congestion, over-crowding, unreliability and associated rising costs will be the price of economic success.

- Central scenario estimates suggest that, without action:
  - By 2025 one third of London traffic and one fifth of traffic in other urban areas are forecast to be travelling on very congested roads where traffic flow starts to break down. These journeys would be subject to stop-start travel conditions, and high levels of travel-time variability.
  - Some parts of the inter-urban road network would also be put under considerable pressure, suffering an increase in congestion of some 37 per cent.
  - In England alone, each year rising congestion would add more than £10 billion of costs to the economy and a further £12 billion worth of wasted time for households, by 2025.
  - Under the current fares policy, by 2025 inter-urban rail services are likely to see many trains at or beyond seating capacity, concentrated on the approaches to cities, especially London.
  - Commuter lines into London are forecast to become heavily over-crowded. Many more passengers would be required to stand for long periods of time.
  - Aviation demand is forecast to more than double by 2030 (assuming the introduction of carbon pricing) putting increasing pressure on the capacity and performance of international gateways. Expanding airport capacity in the South East would reduce business costs by £6 billion over the period to 2060 (net present value); and
  - Shipping demand is forecast to outstrip existing capacity beyond 2020, and expanding capacity would prevent consequential rises in delivery costs of around £140 million a year.

- Scenarios which include higher transport costs, e.g. because of carbon prices or higher fuel costs, see lower growth; but transport demand continues to be strong, with the high oil price scenario reducing vehicle traffic growth by 6 per cent.

- Action is needed to prevent rising transport demands dampening the UK’s long term productivity and competitiveness.
INTRODUCTION

3.1 So far this volume has considered the demands the economy places on the UK’s transport system, and how the networks and international gateways perform. At many times and places they function well, but it is clear from the evidence that some parts are under considerable strain and suffering from high levels of congestion, over-crowding and unreliability.

3.2 These areas of poor performance are already affecting the productivity of the economy, and as the economy grows, and the UK’s population becomes larger and more affluent, the pressure placed on the transport networks will increase. To develop a set of transport policies to support productivity and competitiveness, it is important to understand how these demands are projected to change under a range of different scenarios.

3.3 This chapter draws together forecasting scenarios and sensitivity tests from a range of models and analyses. The emphasis is placed, not on the expected growth in transport demand, but on the potential adverse impacts of that growth. Transport growth is not the problem per se – the transportation of goods and people facilitates economic activity. It is the resultant congestion, over-crowding and environmental impacts that need to be addressed by transport policy if they are not to place a brake on continued economic growth.

3.4 Ultimately, an individual forecast is only as good as its underlying assumptions, which are themselves subject to uncertainty. Whilst the science of transport forecasting has developed over time with access to larger and higher-quality data-sets, it is not possible to predict the future with certainty – unexpected shocks to the economy and social changes can confound expectations. Because of this, a range of alternative scenarios is explored wherever possible, and sensitivity tests are used to highlight the assumptions that have the most significant effect on outcomes.

3.5 This chapter has been split into six sections:

• The first section identifies the four forecasting models, and sources that have drawn upon by this study.

• The four subsequent sections then summarise, for each model, the forecasting scenarios and sensitivity tests which have been considered, and then go on to explore the potential implications of these anticipated transport demands for economic performance.

• The chapter concludes with a summary of the economic consequences of rising transport demands.
THE FORECASTING MODELS USED

3.6 Strategic transport models typically relate to particular modes, rather than particular journey types. This section presents scenarios for the next 20-25 years which have been developed for the purposes of this study, from a range of sources including:

- strategic modelling of the road network taken from the National Transport Model (NTM) which provides forecasts of demand for all surface transport modes, and road congestion across the network; and

- strategic rail modelling for the Department for Transport which focuses on demand and crowding forecasts for inter-urban rail services and rail services in London and the South East;

3.7 The study has also made use of forecasts produced for recent DfT policy documents for the UK’s international gateways, which are summarised here, but are set out in more detail in the published documents:

- analysis conducted for the Air Transport White Paper; and

- the Ports Policy Review.

3.8 The detailed assumptions adopted for the forecasting are either presented in background papers that have been published to accompany this study, or detailed in the published documents from which the analyses are drawn.

NATIONAL TRANSPORT MODEL SCENARIOS

3.9 A wide range of scenarios have been tested using the National Transport Model. There is a considerable amount of data to report and summarise and this chapter starts with a presentation of a baseline scenario, and then moves on to consider how outcomes might vary under a range of alternative scenarios. The scenarios address uncertainties that affect both demand and supply.

3.10 One uncertainty associated with the forecasts lies around the assumptions on the long-term trajectory of transport policy. The forecasts have been based on the assumption that government spending will continue in the same pattern as over recent years.

3.11 The analyses presented in this chapter assume that national road pricing is not introduced, and that no additional road pricing schemes are in place by 2025. In making these assumptions, this study does not seek to imply that either will necessarily be the case. The central forecast has been constructed to illustrate one potential, but plausible, scenario to act as a baseline for subsequent comparison. Emerging road-pricing options have been deliberately excluded from the baseline to allow their potential to be examined in Volume 3.

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1 Transport demand to 2025 and the economic case for road-pricing and investment, DfT, 2006.
2 Updated air traffic forecasts are expected alongside the forthcoming Air Transport White Paper progress report.
3 UK Port Demand Forecasts to 2030, DfT, 2006.
2.3 Future scenarios

3.12 The National Transport Model central scenario suggests the demand for travel and freight transport will continue to rise and the projected 71 per cent increase in GDP would not be without its costs. The forecasts suggest that there would be increases in car vehicle kilometres of 28 per cent, car passenger kilometres of 17 per cent, bus passenger kilometres of 21 per cent and walking and cycling of 11 per cent.

3.13 On the roads there is a forecast 12 per cent growth in heavy goods vehicles over the period to 2025, primarily on inter-urban routes and in the areas around ports and large urban areas, and a 70 per cent forecast increase in supporting light goods vehicle traffic.

3.14 These increases are driven by:

- rising population;
- household incomes rising in real terms;
- car ownership continuing to rise (especially in areas that currently have lower levels);
- a continuation of current trends in migration; and
- real reductions in the cost of travel (particularly car travel).

3.15 Increases in the demand for car use will be greatest away from London in smaller urban areas, and increases in bus use will be highest within Greater London. The change in demand for inter-urban rail services and rail services in London and the South East is presented in the next section.

3.16 There is nothing inherently bad about an increase in the demand for transport. Transport demand results from trade, employment, consumption and social interaction – the very things that define the UK as an advanced economy and enrich our life experiences. The demands, however, need to be understood, managed and planned for, if they are not to impose unacceptable social and environmental costs on society, and stifle further growth of the economy.

3.17 Despite assuming road-building equivalent to around an additional 3,500 Highways Agency lane kilometres (a continuation of current spending levels), the NTM forecasts road congestion to increase by 30 per cent on 2003 levels by 2025. Figure 3.1 illustrates where the congestion is likely to be concentrated. The increases in congestion are concentrated in urban areas, and also appear on some inter-urban corridors and the areas around the UK’s key international gateways.

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1 See figure 3.2 for a comparison of assumptions under the central, high and low scenarios.

2 Lost time per vehicle kilometre, i.e. the delay relative to travelling at free-flow speeds.
Figure 3.1: 2025 congestion patterns on Great Britain road network

Key
2025 baseline – total lost hours per year

- 139,350 or more (1,750)
- 28,000 to 139,350 (3,881)
- 6,520 to 28,000 (5,557)
- 0 to 6,520 (6,465)

Source: DfT.
The model forecasts that by 2025, 13 per cent of traffic on England’s roads will be travelling on very congested roads (an increase on 8 per cent in 2003). In these conditions, traffic flow starts to break down, with journeys subject to stop-start travel conditions, and high levels of travel-time variability. One third of London traffic, and one fifth of traffic in urban areas would suffer these very congested conditions. With forecast increases in commuting and business trip lengths, congestion is also forecast to spread more widely across the strategic road network.

Business and commuting road users can expect to face higher than average delays – the modelling suggests that 15 per cent of business traffic, and 16 per cent of commuting traffic, will be subject to very congested conditions.

The following figures are offered as estimates under the central scenario. Without action, the cost to the economy of lost travel time on the roads in England would increase by over £10-12 billion per annum on 2003 levels (£6 billion of business travel time, £4-£6 billion of freight distribution time). Adding in the value of the lost time experienced by other travellers raises this figure to £23-24 billion per annum. Expected improvements in vehicle fuel efficiency, however, mean that road transport CO₂ emissions would fall by 4 per cent over the period to 2025. These cost figures can be considered to be conservative because:

- they exclude reliability impacts, which would be significant;
- they exclude wider economic impacts such as the implications for trade, globally mobile investment or the more dynamic effects of changing land use patterns and impacts on labour markets; and
- they do not account for higher values of time in London and the South East (where incomes are higher).

The figures presented above are significant and, if wider economic impacts and travel-time reliability effects were taken into account, would be larger still. However, given the uncertainties associated with forecasts, there is a need to consider alternative scenarios.

**Alternative demand scenarios using the National Transport Model**

The first set of alternative scenarios focuses on the impact on the forecasts of income growth, changes in the cost of motoring and rail fares. In total eleven different sensitivity tests and scenarios were modelled, nine of which represent the effect of different assumptions on:

- the growth in GDP;
- the rate of growth of the value of time;
- vehicle fuel efficiency; and
- oil prices.

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6 Defined as traffic conditions where the ratio of the volume of traffic relative to road capacity is above 0.8
7 2005 price base.
8 The ‘value of time’ – or value of travel time savings – may be defined as the amount of money that travellers are willing to pay to save travel time. When modelling it is used to represent the trade-off that travellers make between journey times and money costs when choosing between different travel options. It is standard practice to increase the ‘value of time’ as incomes grow to capture the effect of people placing a higher value on their time.
These sensitivities have been combined to produce high and low forecasts to complement the baseline presented above. Figure 3.2 sets out the assumptions in more detail.

**Figure 3.2. Assumptions used to produce 2025 high and low forecasts of demand**

- GDP growth was varied by plus or minus 0.25 percentage points per year (the baseline assumes GDP growth of 71 per cent on 2003 levels);
- The degree to which the value of time rises in line with income was varied between zero (i.e. it does not rise as incomes rise), and 1.0 (i.e. it rises one-for-one with incomes) for business travellers and 0.8 (i.e. only 80 per cent of the rise in incomes) for other travellers, to produce a range of 63.8 per cent around the baseline values of time;
- The annual rate of improvement in vehicle fuel efficiency was varied by plus or minus 50 per cent: around the baseline assumption of a 23 per cent improvement in fuel consumption for cars, and a 16 per cent improvement for HGVs;
- Three oil price scenarios were modelled – US$20 per barrel, $50 per barrel, and $100 per barrel;
- The high demand forecast was produced by combining high GDP growth, high value of time growth, and high fuel efficiency improvements with low forecast year oil prices;
- The low demand forecast was produced by combining the low GDP growth, low value of time growth, and low fuel efficiency with high ($50 per barrel) forecast year oil prices.

**3.23** The modelled results for traffic, congestion and emissions of CO₂ by road vehicles are summarised in Figure 3.3. Most of the alternative scenarios result in small changes around the baseline forecasts of traffic and congestion – less than 2 per cent change in total traffic and less than 3.5 per cent change in the average level of congestion. The ‘extreme’ oil-price assumption of $100 per barrel resulted in larger reductions in traffic and congestion on the forecast year baseline – 5.9 per cent and 8.5 per cent respectively – however this scenario would still represent a large increase in traffic and congestion on 2003 levels.
### Figure 3.3: Alternative forecast scenarios

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Percentage change from 2025 central forecast</th>
<th>Traffic (Vehicle km)</th>
<th>Congestion</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline Forecast</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central annual growth rates</td>
<td>low</td>
<td>−4.8%</td>
<td>−1.9%</td>
<td>−3.5%</td>
</tr>
<tr>
<td>high</td>
<td></td>
<td>5.0%</td>
<td>1.9%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Value of Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower (0/0.8)</td>
<td></td>
<td>−27.1%</td>
<td>−1.7%</td>
<td>−1.7%</td>
</tr>
<tr>
<td>Higher (1/0.4)</td>
<td></td>
<td>36.7%</td>
<td>1.0%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Fuel Efficiency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td>−9.0%</td>
<td>−1.6%</td>
<td>−2.4%</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td>9.5%</td>
<td>1.4%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Oil Price</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td></td>
<td>−9.5%</td>
<td>1.5%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Higher</td>
<td></td>
<td>9.4%</td>
<td>−1.4%</td>
<td>−2.2%</td>
</tr>
<tr>
<td>Lower</td>
<td></td>
<td>41.3%</td>
<td>−5.9%</td>
<td>−8.5%</td>
</tr>
</tbody>
</table>

Low (high) deviations show percentage difference in traffic levels, or other metrics, in 2025 compared to the baseline scenario. For example, under the low GDP growth scenario the change in congestion on base year levels would be ((100% + 30%) x (100% - 3.5%)) - 100% = 25.5%, because the baseline rise in congestion would be 30% and the low demand scenario is 3.5% below that level.

Source: DfT.

#### 3.24 The impacts of different assumptions on CO₂ emissions from road transport are more complex. In most cases, the changes in CO₂ emissions directly reflect the changes in traffic and congestion – for example, lower GDP growth would result in less traffic, less congestion and fewer emissions. However, in the case of vehicle fuel efficiency, it can be seen that whilst a lower rate of improvement would result in lower traffic and congestion (because motoring would be more expensive), it would also result in more emissions. It is worth noting in passing that the CO₂ forecasts are particularly sensitive to assumptions about improvements in vehicle fuel efficiency – the model results suggest that if improvements are made at only half of the expected rate, then CO₂ emissions from road transport would be 11.3 per cent higher than in the baseline forecast, and 7 per cent higher than in 2003. These higher levels of emissions could, in themselves, have ramifications for the cost of motoring if carbon-pricing were to be introduced.
Two additional scenarios were constructed from combinations of assumptions to produce a plausible ‘high-low’ range around the baseline forecast. The assumptions were grouped according to whether they individually increased or decreased the demand for road transport. Those that decreased demand were grouped to provide a low forecast; those that increased demand were grouped to produce a high forecast. The high demand set of assumptions resulted in a 5.2 per cent increase in traffic levels on the 2025 baseline, and a 7.8 per cent increase in congestion and an increase in the cost of congestion to the economy of £2 billion (above the baseline scenario). The low demand set of assumptions resulted in a 7.4 per cent reduction in traffic levels against the 2025 baseline, and a 10.6 per cent reduction in congestion. While this latter scenario may, at first glance, seem a significantly more attractive outcome it should be noted that it still represents a 16 per cent increase in congestion on 2003 levels, a £7-9 billion increase in the cost of congestion to the economy on 2003 levels, and is the product of some intrinsically unattractive assumptions.

The alternative scenarios presented so far have only considered the impacts of changes in income growth and motoring costs. Although these could be considered the key drivers of demand for transport, it is clear that even some extreme assumptions about their future trajectory lead to congestion forecasts that are significantly higher than current day levels. However, income and motoring costs are not the only drivers of the demand for travel, and the NTM provides a facility to test the impact of a number of other assumptions. In order to understand what conditions would have to be met for congestion in 2025 to remain at around current levels, the study set out to construct a further scenario.

This alternative, ‘benign’ future in 2025 would:

- see lower population growth (6.8 per cent rather than 8.5 per cent);
- see less economic growth (resulting in 5 per cent less GDP in 2025);
- have lower car driver licence holding (no increase on 2003 levels);
- have everybody making fewer trips (a fall in trips per person per week of 7.75 per cent);
- see shorter commuting trip lengths (constrained to produce a 5 per cent reduction); and
- have double oil prices ($70 per barrel).

The impacts of these assumptions on traffic and congestion are illustrated in Figure 3.4. First, the lower population growth is modelled, then the impact of lower GDP is added on top, and so on, until the full ‘benign’ scenario is reached after all assumptions have been added in.
Figure 3.4 demonstrates that only if the majority of these assumptions are implemented collectively can congestion be held at around 2003 levels. While some individual assumptions could be considered plausible, as a package, they create an unlikely scenario. Therefore, it would take some significant breaks of trend in several variables for congestion not to substantially increase.

3.29 Figure 3.4 demonstrates that only if the majority of these assumptions are implemented collectively can congestion be held at around 2003 levels. While some individual assumptions could be considered plausible, as a package, they create an unlikely scenario. Therefore, it would take some significant breaks of trend in several variables for congestion not to substantially increase.

TECHNOLOGY SCENARIO

3.30 Technological innovation is another source of uncertainty and, by its very nature, one that is particularly hard to predict – see Figures 3.5 and 3.6. Following discussions with the Foresight Team of the Office for Science and Technology, an alternative package of sensitivities was derived to represent an optimistic, but plausible, view of the impact of technology.

\[\text{Figure 3.4: Impacts of successive benign assumptions on 2025 outcomes}\]

Source: DfT.

3.30 Despite the falls in congestion on 2003 levels in the ‘full’ Benign scenario, the cost of congestion to the economy would actually rise by £4bn. This is largely an impact of increases in the values of time but also reflect slightly higher levels of congestion for business travellers.
Over recent decades, technology has developed at pace bringing with it changes in lifestyles and a change in the fundamental mechanisms of the economy. Technological advances, notably information communication technologies, have the potential to significantly impact both on domestic behaviour and business activity:

- **Home-working**: where this is a viable alternative, it negates the need to travel during the commuter peaks. This does not necessarily mean trips will not take place, but where they do, they are likely to be at an alternative time of day, when congestion is lower.

- **Working on the move**: the need to forge business relationships and trust through face-to-face meetings, or to deliver a service, may mean travel is unavoidable. Consequently, mobile work, enabled by technology, may therefore be an important growth category. The need to travel will therefore remain, but technology has the potential to add flexibility in the choice of journeys for example, by facilitating work on the train, at the airport or in other buildings.

- **E-commerce**: a greater reliance on the internet for retail activity has seen this market grow to a value of an estimated £103.3 billion in 2005. This may negate the need to travel to the shop in person, but will increase the need for journeys to distribute such goods.

- **Logistics**: greater reliance in e-commerce is likely to change the nature of delivery activity, particularly in urban areas where population densities are high. Consumer demands for efficient and timely deliveries, coupled with the pressures on the transport network, are likely to bring greater pressures for improvements to logistics and delivery systems.

- **International travel**: the impact of globalisation on the UK economy, coupled with the further shift of economic activity towards services, is likely to increase the demand for international travel. Information and communication technologies are likely to show complementarities, which together increase demands for international connections. There may be an increased need for improved services such as facilities to work at the airport or on the plane.

**Continued in Figure 3.6**

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14 2005 e-commerce Survey of Business, ONS.
Four scenarios based on technological improvements were considered:

- **Effective road capacity**: There are a number of technologies currently being explored, which if they are proved effective, safe and practicable for widespread application, have the potential in the long term to reduce the need for additional infrastructure. Developments in high-precision positioning systems, new sensor technologies and vehicle-to-vehicle communication systems could increase the effective capacity of the transport networks by allowing vehicles to travel closer together. Many of these technologies are many years away and it is too early to judge whether any of the systems could be delivered in a safe and cost-effective manner, but it is worth considering what the impact of their implementation might be. This scenario was represented by increases in the effective capacity of the road network – 20 per cent on strategic roads, and 10 per cent on all other roads.

- **Fuel efficiency**: A package of measures including voluntary agreements with European, Japanese and Korean automobile manufacturers have already resulted in significant improvements in vehicle engine efficiencies, and the baseline forecasts are based on further improvements beyond the expiry of the current set of agreements in 2008/9. The baseline modelling is based on there being a successor to the current set of voluntary agreements that will lead to similar improvements in new-car fuel economy. This scenario assumed a further increase in engine efficiencies – 50 per cent higher than assumed in the baseline scenario.

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• **Home-working:** In 2005, approximately 3.1 million people were regular home workers. Of these 2.4 million are also tele-workers, employing computers or telecommunications to work at, or, from home. Improvements in Information Communication Technologies have the potential to reduce the level of travel by commuters. This scenario assumed a 10 per cent reduction in commuting trips i.e. equivalent to half of commuters working at home one day a week. In reality, an increase in home working may also lead to an increase in other types of trip outside of the peak period, but these are not represented in this scenario.

• **Public transport attractiveness:** Information Communication Technologies also have the potential to improve the attractiveness of public transport. Improvements in smartcard payment systems and systems that reduce the uncertainty associated with bus and train departure and arrival times could result in a shift away from car use. This scenario was represented with a reallocation of 5 per cent of car trips to other modes.

3.32 In addition to the sensitivities based around technological improvements, one more sensitivity is considered as part of the package. To reflect a measure that could be adopted to tackle climate change, a carbon tax implemented to internalise the external costs of carbon emissions has been assumed.

• **Carbon Tax:** fuel costs were increased to reflect the external cost of carbon emissions, in line with guidance provided by Defra.¹⁷

3.33 The five alternative sensitivities outlined above were modelled individually and collectively. Figure 3.7 compares the results from the scenarios with those from the baseline.

<table>
<thead>
<tr>
<th>Percentage change compared to baseline scenario</th>
<th>Traffic</th>
<th>Lost time</th>
<th>Congestion</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective capacity</td>
<td>0.9%</td>
<td>–14.2%</td>
<td>–15.0%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Fuel efficiency</td>
<td>1.4%</td>
<td>3.7%</td>
<td>2.2%</td>
<td>–10.2%</td>
</tr>
<tr>
<td>Homeworking</td>
<td>–2.2%</td>
<td>–6.6%</td>
<td>–4.4%</td>
<td>–1.7%</td>
</tr>
<tr>
<td>Public transport attractiveness</td>
<td>–1.9%</td>
<td>–6.2%</td>
<td>–4.4%</td>
<td>–1.5%</td>
</tr>
<tr>
<td>Carbon tax</td>
<td>–1.9%</td>
<td>–6.9%</td>
<td>–5.1%</td>
<td>–2.9%</td>
</tr>
<tr>
<td>All the above sensitivities combined</td>
<td>–3.0%</td>
<td>–23.6%</td>
<td>–2.13%</td>
<td>–13.1%</td>
</tr>
</tbody>
</table>

The technology sensitivities vary in the scale and direction of their impacts. Increases in effective road capacity would reduce the level of congestion but increase the demand for car travel; improvements in vehicle engine efficiency would reduce the cost of motoring and therefore increase the demand for car travel – without reducing congestion; and increases in home-working, improvements in public transport information systems and the introduction of a carbon tax would reduce car use and congestion to differing degrees. However, all of them – including the complete scenario, which represents the achievement of all of these improvements and the introduction of a carbon tax – result in an increase in congestion on

¹⁷ The values originate from GES working paper 140 Estimating the Social Cost of Carbon Emissions, (Clarkson & Deyes, January 2002). The paper suggested an illustrative per tonne of carbon estimate of £70/tC as a central estimate within the range of £35 to £140/tC in 2000 prices for the global damage cost of carbon emissions. These values rise by £1/tC per year in real terms to reflect the increasing marginal cost of emissions over time.
2003 levels. The increase in congestion in the combined scenario would represent an increase in the costs of congestion to the economy of over £6 billion on 2003 levels, plus a cost of lost time of £7 billion to other users.

3.35 The alternative scenarios presented above have been selected to illustrate the type and scale of social and technological changes that would be required to significantly improve expected outcomes. Figure 3.8 summarises the additional costs of congestion above 2003 levels, under each scenario.

Figure 3.8: The cost of rising road congestion under the main scenarios

<table>
<thead>
<tr>
<th>Additional cost of congestion in England in 2025 relative to 2003 (£ billion, 2002 prices)</th>
<th>Central</th>
<th>High demand</th>
<th>Low demand</th>
<th>Benign</th>
<th>Optimistic technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional cost to business and freight</td>
<td>10-12</td>
<td>12-14</td>
<td>7-9</td>
<td>3-4</td>
<td>6-7</td>
</tr>
<tr>
<td>Additional cost to other users</td>
<td>12-13</td>
<td>15-16</td>
<td>9</td>
<td>3-4</td>
<td>7-8</td>
</tr>
<tr>
<td>Total additional cost to all road users</td>
<td>23-24</td>
<td>28-29</td>
<td>17</td>
<td>7-8</td>
<td>14-15</td>
</tr>
</tbody>
</table>

Note: These are purely estimates of ‘time lost’ and are therefore conservative estimates. They do not include: reliability; labour market, agglomeration, trade and globally mobile invest opportunities; area specific values of time; and the impacts on other modes.

3.36 Continued economic success is therefore expected to lead to increases in the economic and social costs of congestion above current levels under each scenario, and it would take a fairly implausible combination of events for congestion to stabilise at current levels.

STRATEGIC RAIL SCENARIOS

3.37 Rail travellers can also expect worsening travel conditions. Increases in the demand for inter-urban rail services in excess of 35 per cent over the period to 2026 would cause significant increases in levels of overcrowding. Figure 3.9 illustrates how demand compares with seating capacity, particularly on those on the approaches to large urban areas. The maps show ‘all-day average’ levels of crowding – passengers on services in peak periods would face higher levels of crowding than indicated on the maps.
Figure 3.9: Crowding levels on inter-urban rail services

Source: Atkins report for DfT Inter-urban forecasts, 2006
FUTURE SCENARIOS

3.38 The impact of different income growth and rail fare assumptions on rail demand have also been explored.\textsuperscript{18} The sensitivity tests suggest that higher fares\textsuperscript{19} might result in crowding levels in some places as much as 30 per cent lower than in the central forecast. Nonetheless, the resultant crowding levels would still be significantly higher than 2006 levels. GDP sensitivity tests\textsuperscript{20} resulted in crowding within 15 per cent above or below the central forecast.

3.39 Figure 3.10 illustrates modelled levels of crowding on London-bound services in a typical morning peak in 2026.\textsuperscript{21} Some radial rail links, which provide Central London with access to deep, skilled labour markets, would become significantly over crowded. More passengers would be required to stand for long periods of time in uncomfortable conditions, and some would be left standing on platforms waiting for trains with standing room before being able to board.

Figure 3.10: Forecast all rail crowding in London and the South East during the morning peak 2026 (inward flows and load-factor – all services)

\textsuperscript{18} See inter-urban rail forecasts, Atkins, commissioned for the DfT and Eddington Study, 2006.
\textsuperscript{19} In the sensitivity test, fares were assumed to rise at a rate of RPI plus 2.5 per cent per annum.
\textsuperscript{20} Sensitivity tests based on GDP growth that varied by plus or minus 0.25 per cent per annum around the central forecast of +2.5 per cent per annum.
\textsuperscript{21} The modelled time period (3 hours) and colour scale for the map is different to that adopted for the inter-urban maps above.
3.40 It is not easy to translate these impacts into economic costs because, as well as the discomfort and reduced attractiveness of rail travel which goes with rising overcrowding, punctuality and reliability may also be affected as the network carries more passengers. A paper produced by OXERA suggests that the cost to business of current punctuality and reliability problems in the UK has recently been around £400m-£1bn per annum.22 Although future estimates do not exist, the cost could rise through time as demand and overcrowding grow, and incomes rise leading to increases in the value of lost time due to unreliability.

AVIATION FORECASTS AND SCENARIOS

3.41 The influence of higher incomes and globalisation are forecast to have a large impact on the level of demand for air travel. Air passenger travel forecasts for the Air Transport White Paper (ATWP)23 show that, even assuming the introduction of a carbon charge of £70/tC in 2000 rising by £1/tC per annum in real terms, demand is expected to more than double between 2004 and 2030. The dominance of South East airports is projected to continue, accounting for 57 per cent of demand. Such increases in the demand for air transport could result in a doubling of year 2000 levels of aviation carbon emissions by 2030.24

3.42 The 2000 air traffic forecasts provide a range of sensitivity tests, as well as establishing high, central and low demand scenarios. The forecast range is 349-461 million passengers per annum (mppa) in 2020 around a central forecast of 401 mppa, and Figure 3.11 shows the results of the sensitivity tests.

Figure 3.11: Results of the sensitivity tests in the Air Traffic Forecasts

<table>
<thead>
<tr>
<th>Sensitivity Test</th>
<th>Mid-point traffic forecast in 2020 (million)</th>
<th>Percentage change (%) relative to central scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central scenario</td>
<td>401</td>
<td></td>
</tr>
<tr>
<td>Lower medium term GDP growth (0.5% points lower)</td>
<td>333</td>
<td>-17%</td>
</tr>
<tr>
<td>Greater market maturity – 1.0 income elasticity</td>
<td>351</td>
<td>-12%</td>
</tr>
<tr>
<td>Lesser market maturity – 2.0 income elasticity</td>
<td>451</td>
<td>+12%</td>
</tr>
<tr>
<td>Environmental fuel tax</td>
<td>361</td>
<td>-10%</td>
</tr>
<tr>
<td>A 1 percentage point increase in fares growth per annum</td>
<td>301</td>
<td>-25%</td>
</tr>
<tr>
<td>A 1 percentage point decrease in fares growth per annum</td>
<td>481</td>
<td>+20%</td>
</tr>
<tr>
<td>Increase in airport charges</td>
<td>371</td>
<td>-7.5%</td>
</tr>
</tbody>
</table>

3.43 Analysis for the The Future Development of Air Transport in the UK: South-East forecasts growth in air-freight from 2.2 million tonnes a year in 2003 to 14 million tonnes by 2030, with the express sector accounting for more than half of the market.25

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23 The Future of Air Transport, DfT, 2003
25 The Future Development of Air Transport in the UK South East, DfT, 2003
3.44 The economic cost of this increase in demand for air transport is clear when the impacts of increasing capacity are considered. Above a baseline of maximum use of existing runways, direct economic benefits of additional capacity at Stansted (2012) and Heathrow (2020) are estimated at £24 billion. It is estimated that of this figure, some £6 billion accrue direct business travellers, and these benefits would be higher still if reliability impacts were accounted for.26

**Forecasting Scenarios from the Ports Policy Review**

3.45 Increasing trade with Europe, China and other Asian countries is also projected to lead to a strong growth in containerised ports traffic. Forecasts for DfT27 project a growth in the total weight of UK port traffic (including the Channel Tunnel) of 37 per cent between 2004 and 2030. Breaking this down into its constituent parts:

- Container traffic (measured in TEU28) is expected to grow by 178 per cent (with a high scenario of 299 per cent and a low of 74 per cent);
- The volume of roll-on/roll-off units (ro-ro) is expected to grow by 112 per cent (with a high scenario of 203 per cent and a low of 32 per cent); and
- All other port traffic (dry and liquid bulks, and general cargo) is expected to grow by 8 per cent.

3.46 Unitised cargo’s (containers plus ro-ro) share of total port traffic, measured in tonnes, is expected to grow from 27 per cent in 2004 to about 42 per cent in 2030.

3.47 If the two new ports on the Haven and the submitted plans for London Gateway29 are built, so removing the need for a good deal of transhipment, delivery costs could be reduced by around £260 million per annum or up to 10 per cent by 2025 relative to a scenario without any new infrastructure. However, even this new capacity would not be enough to deal with the rising demands out to 2030 because capacity constraints would begin to bite again after 2020, in the absence of any further supply response. While in practice the ports sector can be expected to respond to such signals, it is interesting to consider the economic consequences were that response to be halted in some way. Capacity constraints would imply delivery costs per TEU would rise again by some 5 per cent between 2020 and 2030 amounting to some £140 million more per annum by 2030.

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26 *The Future of Air Transport*, DfT, 2003. Figures are present value benefits over the period to 2060.

27 *UK Port Demand Forecasts to 2030*, DfT, 2006.

28 TEU is twenty-foot equivalent unit, a volume measure.

29 As of November 2006, final approval had been given for Felixstowe South and Bathside Bay but London Gateway was awaiting final approval subsequent to the ‘further minded to’ letter of August 2006.
CONCLUSIONS

3.48 This section has collated forecasts of the future performance of our transport networks. The picture that emerges is that continued economic success will lead to increases in congestion, travel-time unreliability and over-crowding, which have the potential to stifle the growth of the UK economy, without appropriate action:

- a conservative estimate of the increase in the cost of congestion to businesses amounts to £10 billion per annum in 2025 on England’s roads alone, with an increase in the value of lost time to other travellers of £12 billion;

- forecast increases in the demand for rail travel could amplify and exacerbate the estimated £400 million–£1 billion business costs of poor punctuality and unreliability on the rail networks, as well creating substantial overcrowding pressures;

- the benefits of ports capacity responding to meet future demands could reduce business costs by an estimated £140 million per annum;

- additional runway capacity at Heathrow and Stansted could deliver benefits of £24 billion (£6 billion accruing directly to business travellers) over the period to 2060; and

- the costs to the economy of forecast transport demand growth are significant under a wide range of scenarios.

3.49 Application of valuation techniques that account for reliability impacts, and wider economic and productivity effects could increase these figures significantly.

3.50 All forecasts are subject to a measure of uncertainty – unexpected changes in the rate and pattern of economic growth, social and demographic changes and technological changes could all affect the rate of growth in transport demand – but sensitivity tests demonstrate that the overall direction of travel is clear.
2.4 Identifying the Economic Priorities for Future Transport Strategy

The transport sector faces significant challenges

4.1 The focus of this study is on the relationship between the transport network and economic success, and this volume therefore seeks to identify the economic challenges facing the transport sector. However, there are also very significant environmental and social challenges facing the sector. In particular, Sir Nick Stern’s recently published Review on the economics of climate change set out his analysis of the challenge to the transport sector in terms of reducing emissions of greenhouse gases.

4.2 In light of this, the next volume of this report, which makes recommendations on the best policies to meet the economic challenges, considers the environmental impacts of different policies alongside their economic impacts, so as to make a fully-balanced judgement.1 The Government, in considering the analysis presented here, will of course want to adopt a transport policy targeted at meeting all the challenges facing the transport sector.

The Strategic Economic Priorities

4.3 This chapter brings together the central conclusions in this volume in order to identify a set of economic priorities for future transport policy. The central conclusions are:

- the changing structure of the UK economy and internal migration patterns continue to shape the nature of transport demand in the UK;
- as a result, there are likely to be changing demands on the UK’s network;
- those networks which support the UK’s urban areas, as centres of services growth, and the UK’s international trade gateways, are likely to see the fastest growing demands;
- due to its economic geography, overall UK demand tends to be focused on the same pieces of infrastructure and at certain times of day;
- the UK has comprehensive networks in place to meet these demands, including to meet the demands for domestic inter-urban journeys through a combination of road, rail, sea and air links;
- much of the network is uncongested for the majority of the time: however at those key points where economic success has concentrated demand, notably within and around urban areas, at international gateways and on busy inter-urban corridors, congestion, delay and reliability are already real issues;
- without action, continued economic success is likely to exacerbate these problems under a range of plausible scenarios: congestion and reliability are likely to worsen in these areas.

1 See Volume 3: Meeting the challenge: Prioritising the most effective policies.
The key economic challenge facing the UK’s transport system is, therefore, not the extent of the network but its capacity and performance. On the basis of the evidence above, it seems clear that this challenge will be greatest in the following three places – the Eddington Study’s three strategic economic priorities:

- **The UK’s congested and growing urban areas and their catchments:** those urban areas where rapid economic growth, often evidenced by high land values, labour shortages and congestion, is coupled with a lack of capacity in the transport system. The result is that increasing congestion and capacity constraints threaten to impede growth and dampen the boost to national productivity offered by urban agglomerations.

- **The UK’s international gateways and supporting surface infrastructure:** in particular, the major international passenger routes and principal international freight routes, where delays, including on surface access routes, and current and future capacity constraints, look likely to damage the competitiveness of the UK’s imports and exports, and its leading role in the global airfreight logistics sector;

- **A limited number of inter-urban corridors connecting urban areas and international gateways:** where the unreliability of the transport network is adding costs to business, threatening productivity and innovation in the freight and logistics industries and both inter-regional and international trade. From a passenger perspective these corridors connect urban areas with each other and with international airports, and from a freight perspective they connect ports with distribution hubs and distribution hubs with their eventual markets.

This study believes that these three strategic priorities should form the focus of transport strategy going forward. The next step is to consider the evidence for how best to respond to these challenges in a context where transport users must face the full costs of the journeys, recognising the environmental impacts. This issue is the subject of the next volume of this report.

The identification of these priorities should not interpreted as giving support to any projects brought forward in these areas, nor that projects outside the areas should not be pursued. Instead, the priorities are intended to guide transport strategy and option generation, so that a range of policies can be brought forward to meet these economic challenges. Furthermore, these are strategic priorities based on transport’s contribution to economic growth: policies designed to meet different policy goals, notably environmental protection, may also suggest the prioritisation of action on different sections of the transport system.
Recommendations 1 and 2

1. To meet the changing needs of the UK economy, Government should focus on improving the performance of existing transport networks:
   (i) Government action needs to focus on tackling congestion, capacity constraints and unreliability on existing networks.
   (ii) In some limited circumstances, there may be opportunities to extend the network which offer good value for money, for example Government may wish to explore the case for extending the reach of existing urban networks in order to deepen labour markets.

2. Over the next 20 years, the three strategic economic priorities for transport policy should be: congested and growing urban areas and their catchments; together with key inter-urban corridors and international gateways that are showing signs of increasing congestion and unreliability.
   (i) Look for signals of congestion, overcrowding and high productivity as high-level indicators that transport improvements may make a significant impact on economic growth.
   (ii) Bring forward and assess a wide range of alternatives to address transport performance in these areas.
   (iii) To achieve the greatest benefits from available funds, prioritise the options in these areas that offer the highest value for money, based on a full appraisal of the economic, environmental and social impacts.