National Audit Office

Transport and the environment: Options for scrutiny

A Review by the National Audit Office | May 2008

This review was conducted by Tom Liptrot and Nicola Thomas under the direction of Joe Cavanagh.

This review can be found on the NAO website at www.nao.org.uk/publications/select_committees.htm

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Contents

Executive Summary

1 This review has been prepared in response to a request from the Environmental Audit Committee. It examines the topic of transport and the environment. Part 1 summarises some of the most significant trends in transport and travel. Part 2 provides information on what is known about the impact of transport on the environment in the UK. And Part 3 describes the main public bodies responsible for transport, together with some of their most important programmes and policy instruments.

2 This summary does not seek to précis Parts 1 to 3, since these Parts are already at an overview level. Instead it seeks to identify the main ways that the Committee could break up this huge topic into smaller subjects suited to a Committee inquiry. The final choice of topic for Committee consideration is of course a matter for the Committee, and so we do not seek in this document to recommend specific subjects.

3 The first and most obvious way to dissect the topic is by **mode of travel**. Road, rail, air and sea are the modes with greatest environmental impacts. But the alternatives of walking and cycling present greener (and healthier) alternatives. Finally, the Committee could look at modal shift – encouraging greener options – as well as modal integration.

4 Another way to look at travel and transport would be by **purpose**. Here the primary distinction is between moving people and moving goods. For the latter, there is the Sustainable Distribution Fund but there has been less systematic attention to the purposes of private passenger travel and whether these can be influenced.

5 Another very obvious way to break up the topic would be by the **type of impact** – on air, land and water. Air splits into greenhouse gases (and climate change) and air quality. There has been much attention to greenhouse gases and air quality in recent times, but less focus on land and water.

6 The Committee could look at the main **public bodies involved**. The Department for Transport has an interest in most aspects of transport policy, supported by agencies such as the Highways Agency, and the Treasury is responsible for a number of fiscal measures. But there is also a significant role for local and, less so, regional government.

7 Some of the main **policy tools and techniques** used in transport policy could be looked at. The New Approach to Transport Appraisal (NATA) is under review; there are increasing expectations of regional spatial strategies and local transport plans as they cope with growing population and new developments such as the Thames Gateway.

8 2008 is likely to present opportunities for the Committee to influence or comment on **important developments**. There is the review of NATA; a consultation on a sustainable transport strategy; and publication of the final King review of low carbon cars.

9 Finally, the Committee could choose to focus on the **most important policy instruments** in this field: vehicle emissions regulation, the Renewable Transport Fuel Obligation, road pricing, behaviour change campaigns, inclusion of aviation in the EU Emissions Trading Scheme and fiscal measures such as Vehicle Excise Duty.

Transport trends

Introduction

1.1 The last 50 years have seen significant growth in the use of private cars, road haulage, and international aviation and shipping. At the same time there has been a decrease in public transport (although rail has recently begun to increase) and active forms of transport like cycling and walking. Many of these trends are forecast to continue in the next 20 to 30 years and some, such as the growth in aviation, are expected to accelerate. This Part examines these trends in more detail.

Passenger travel

1.2 For passenger travel, there has been a big switch from public transport and cycling towards use of cars, vans and taxis, shown in **Figure 1**. Domestic air travel, whilst growing, still accounts for a small percentage of distance travelled. Some of these trends are in part explained by changes in the cost of different modes of travel (shown in **Figure 2**), but there are many other factors at play too, such as increasing affluence and social mobility, changes in urban planning and the growth in out-of-town retail centres[1], and so on.

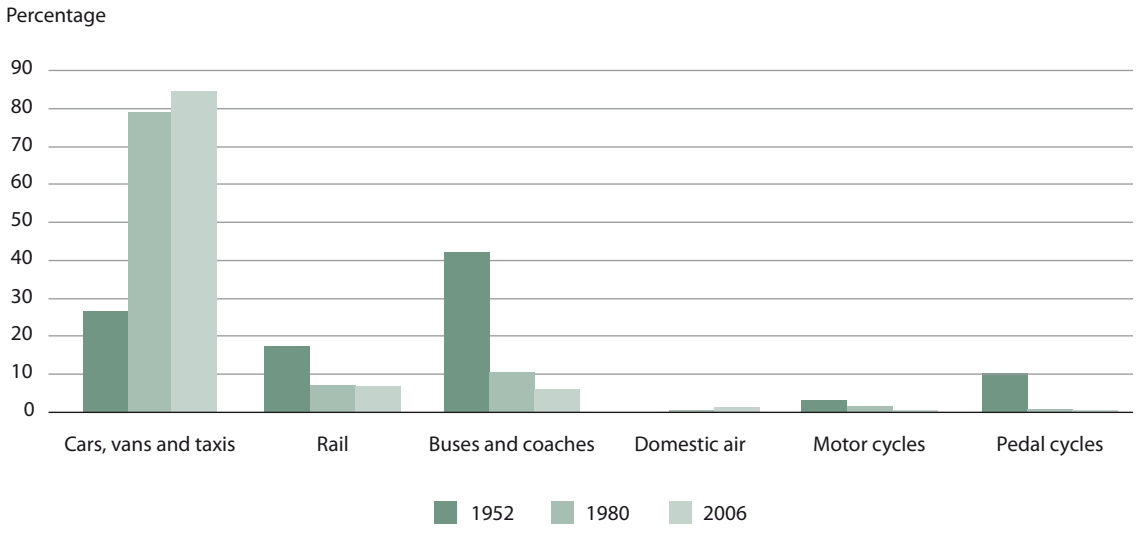
1.3 In the following analysis we will focus on trends and projections for different modes of travel. This reflects two reasons: first, the environmental impacts of transport are often very different between modes; and second, most government policy has a modal focus, although there have been more recent movements towards a more mode-neutral perspective – focusing policies on types of journey rather than mode of travel (for example the school run).

1.4 Before we look at the different modes, however, it is also useful to understand the reasons for personal travel. **Figure 3 on page 8** shows an analysis of the purposes for trips made each year. It shows that shopping and commuting, visits to friends, and other leisure activities as well as business travel are the main reasons for journeys.

Freight

1.5 On inland freight movements, the last 30 years have seen a large increase in the use of road. Among the reasons for the increased dependence on road freight are the changes in the mix of commodities carried, the flexibility of the road haulage industry, and major investment in road infrastructure. The movement of goods by water increased significantly at the end of the 1970s as North Sea oil fields began production but since around 1984 this has remained relatively constant. Rails share of freight has fallen from a leading position in the 1950s to a minor nine per cent in 2005 as the use of road and water increased and of rail declined **(Figure 4 on page 8)**. [1]

1 Passenger transport share by mode, UK, 1952, 1980 and 2005 – passenger kilometres

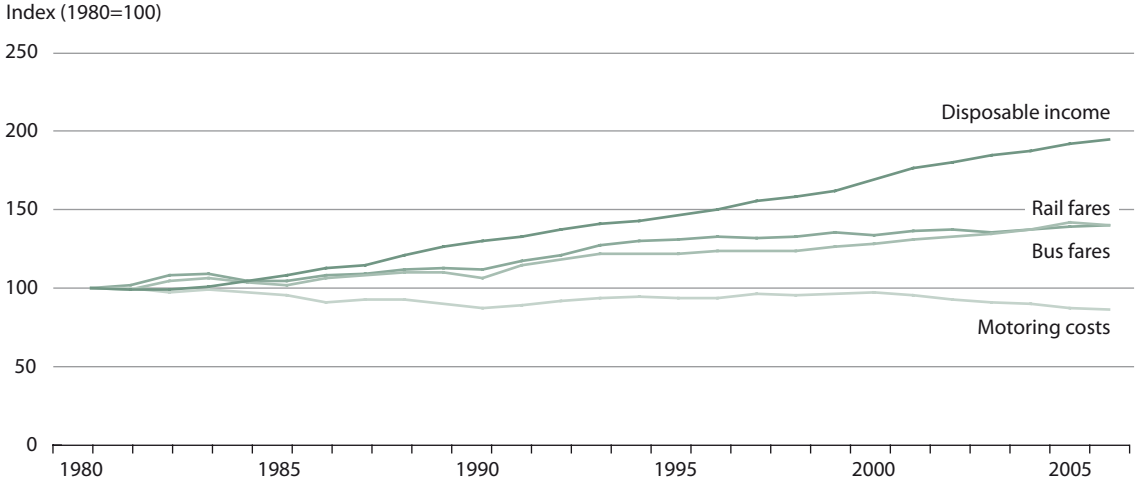


Source: DfT Transport Statistics

NOTE

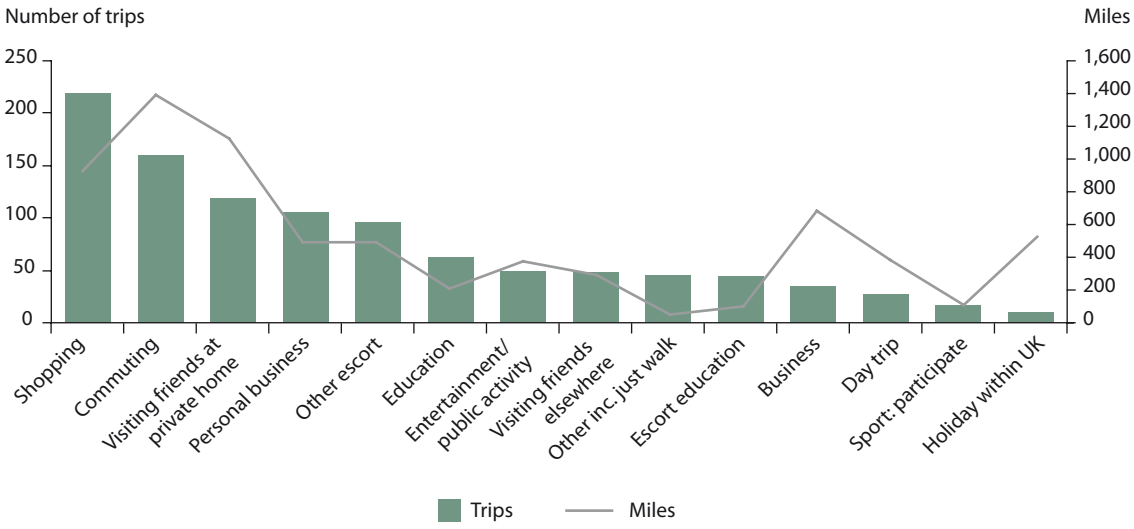
One person in a vehicle going one kilometre travels one passenger kilometre. A bus with 20 passengers going one kilometre counts as 20 passenger kilometres.

2 Changes in the real cost of transport



Source: ONS

3 Trips and distance per person per year, by trip purpose, 2006

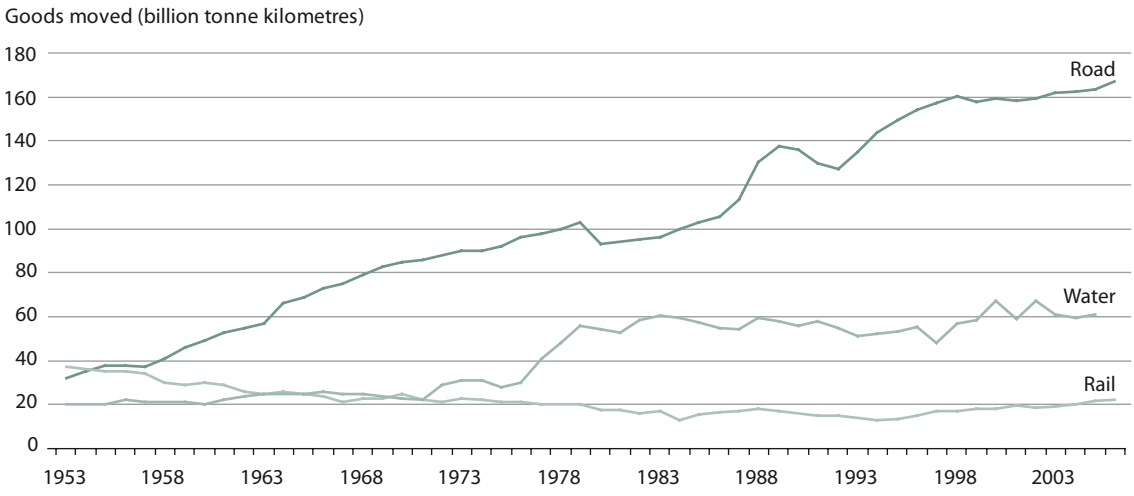


Source: DfT National Travel Survey

NOTE

Escort trips are where the purpose of the trip is solely to take another person somewhere. Escort education is where somebody is being taken to education – such as taking somebody to school.

4 UK domestic freight moved, 1973-2006



Source: DfT Transport Statistics

NOTE

A tonne kilometre measures how much freight is moved and how far it has been moved. To obtain the figure, for each loaded journey the weight of the load is multiplied by the distance it is carried. For example 10 tonnes moved 300 km from London to Manchester is 3000 tonne kilometres. Annual figures are presented here.

Water includes all UK coastwise and one-port freight movements by sea, and inland waterway traffic.

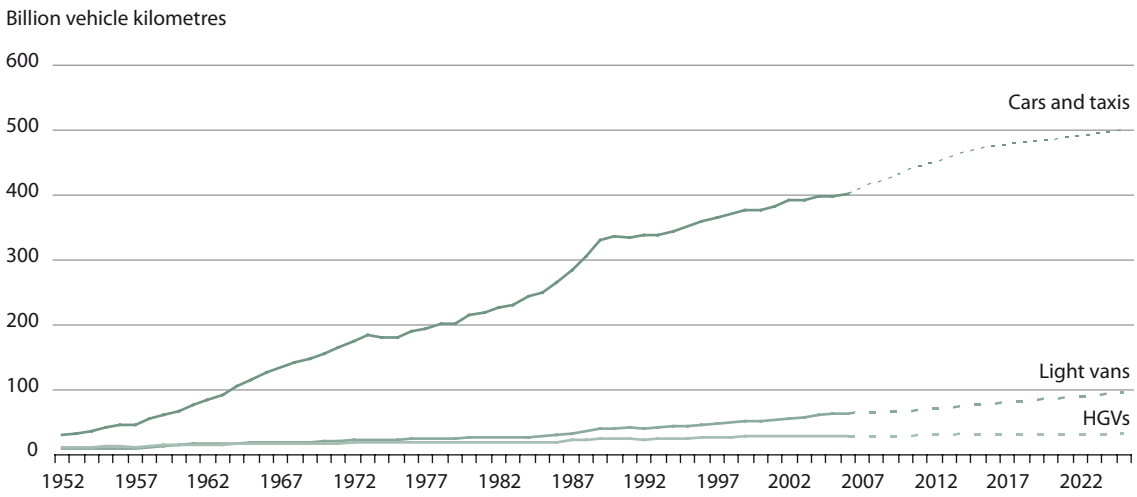
Road traffic

1.6 There has been a ten-fold increase in road traffic from around 50 billion vehicle kilometres[2] per year in the early 1950s to over 500 billion in 2006. Road traffic now makes up 84 per cent of all passenger travel[3] and 82 per cent of freight in the UK. The majority of road traffic is made up of private cars which account for 80 per cent of road traffic[4] (alongside vans – 12 per cent and HGVs – 6 per cent) and 85 per cent of all passenger transport.[5] Some of the reasons for the growth in car use include cheaper cars and motoring costs[6], the building of 3,500 kilometres of motorway since 1959 and increased disposable income.[7] Growth in road traffic is forecast to continue, with car, vans and HGVs projected to grow by a further 30 per cent by 2025 **(Figure 5).**

Bus and rail

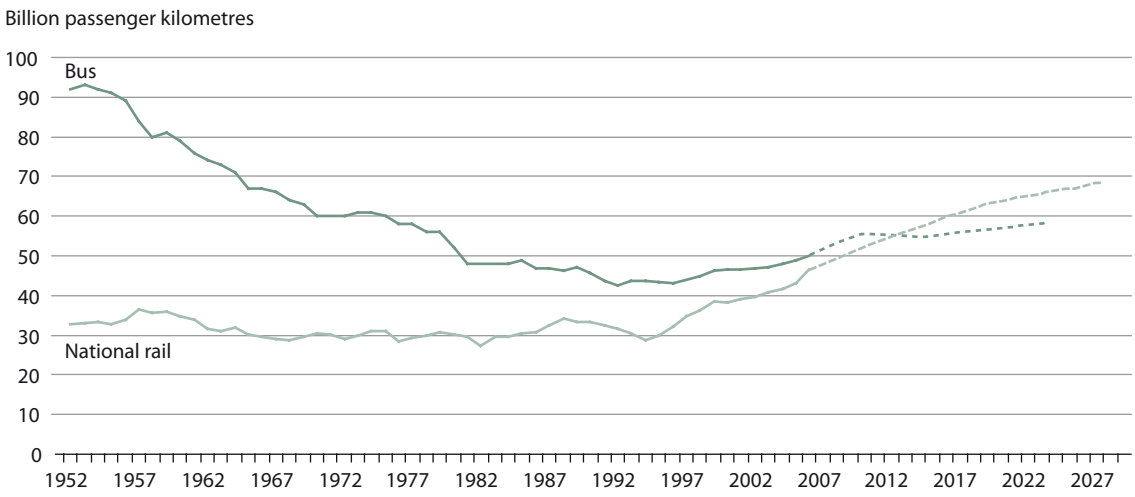
1.7 This rapid growth in private road transport has been mirrored by a decline in the total distance travelled using bus as shown in **Figure 6 overleaf.** Since 1950, bus use decreased from 40 per cent of all journeys to 6 per cent by 2006, with the total distance travelled on buses nearly halving across the UK. As rising economic prosperity has led to increased car ownership, the personal convenience of car travel and a decline in the cost of motoring have made travelling by bus less attractive.[8] In London, where a different regulatory structure exists and the population is more densely packed and increasing, bus use has increased in recent years; other factors at play include increases to the level of subsidy provided for bus services, overcrowding on the tube network, the convenience of Oyster cards and the congestion charge targeting road traffic. There are also other areas – usually areas where there are strong relationships between authorities and bus operators – where patronage has grown. The reasons for growth in these areas varies, with the free concessionary fares scheme introduced in April 2006 being one major component. [9]

5 Road traffic, billion vehicle kilometres, trends and projections



Source: DfT transport statistics, National Transport Model

6 Bus and rail use in the UK, billion passenger kilometres, 1952-2006, and projections thereafter



Source: DfT transport statistics, DfT

NOTE

One person in a vehicle going one kilometre travels one passenger kilometre. A bus with 20 passengers going one kilometre counts as 20 passenger kilometres.

1.8 Passenger rail use stayed about level from 1950 to 1990, with some fluctuations. Since 1994 passenger rail use has begun to increase, as shown in Figure 6, and is forecast to grow by around 50 per cent over 2006 levels by 2029. The recent growth in rail use is attributed to sustained economic growth and the more successful aspects of privatisation, which gave rail operators the means and incentives to attract new business, and greater financial certainty.[10]

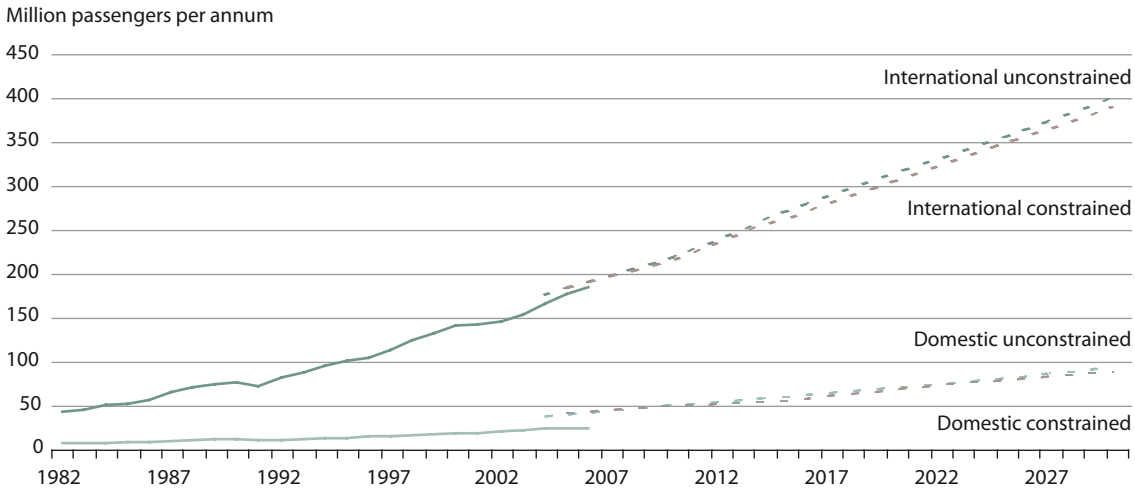
1.9 After a long period of decline, the amount of freight carried by the railway started to grow in the mid-1990s at the same time as passenger numbers began to rise. There are several reasons for this recent revival. Strong growth has occurred in some sectors, such as coal, which rail is particularly well placed to carry. And there has been £1.5 billion of private-sector investment since 1995. Nonetheless, rail freight still remains a minority freight mode, accounting for around five per cent of surface tonnes lifted and 12 per cent of surface tonne kilometres moved.[11]

1.10 In the Rail White Paper published in 2007 the Government confirmed it wanted the rail industry to accommodate a 22.5 per cent increase in passenger demand by 2014. The White Paper also indicated the Government's longer term ambition for a railway that can handle double today's level of freight and passenger traffic.

Air travel

1.11 The most rapid growth seen in any form of transport in the UK is in air travel; three times more passengers use air travel now than in 1980, as shown in **Figure 7**. Recently this growth has been fuelled by higher disposable incomes and lower air fares. However, in domestic terms aviation makes up less than two per cent of passenger kilometres. If unconstrained by airport capacity, the demand for air travel has been forecast by the Department for Transport (DfT) to continue growing at a similar rate until 2030, rising from 228 million passengers per annum in 2005 to 495 million in 2030 (Figure 7). With DfT's predicted constrained demand due to airport capacity[12] this figure is expected to grow to 480 million passengers per annum in 2030.

7 UK air travel, domestic and international, million passengers per annum, constrained and unconstrained projections



Source: DfT Transport Statistics, DfT (2007), UK Air Passenger Demand and CO_2 Forecasts

NOTE

The solid lines represent historic data and the dashed lines represent projections. Projections are made on a different basis to historic data which is adjusted to remove double counting of passengers who arrive and depart in the UK, projections are not adjusted in this way. This is because projections are made on an individual airport basis and are used to calculate how much total capacity airports will require, whereas historic data is used to show how many individuals passengers make flights in the UK. The difference does not affect the trend.

It is projected that demand for air travel will outstrip supply if no further airport capacity in the form of new or lengthened runways or additional terminals is added. The airport expansions supported in the government's Air Transport White Paper will supply some additional airport capacity but not enough to supply all of the projected air travel demand – thus constraining demand.

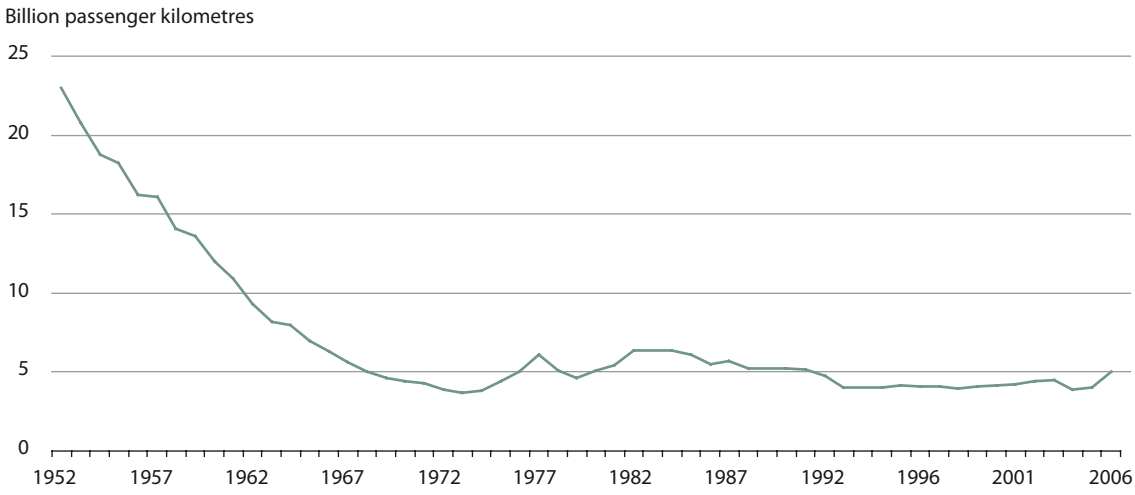
Walking and cycling

1.12 Walking and cycling have small environmental impacts and considerable health benefits, and yet their use in the UK has declined since the 1950s and does not compare favourably to European nations. There has been a huge decline in cycle use since the 1950s **(Figure 8 overleaf)**, and a recent study[13] found that the UK ranked 12th out of 15 European nations in terms of the average distance people cycle each year and 14th on distance walked. In the UK, 55 per cent of all journeys of less than five miles are made by car even though many of these shorter journeys could be done by walking or cycling[14] **(Figure 9 overleaf)**.

Ports and shipping

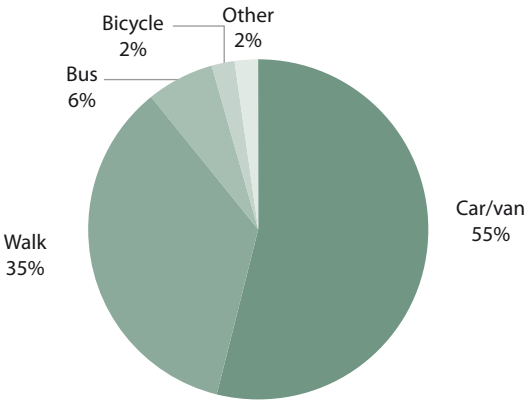
1.13 Throughout the last century there has been a global increase in the volume of trade, and in shipping. Increasing industrialisation and economic liberalisation have fuelled free trade and a growing demand for consumer products. Advances in technology have also made shipping an increasingly efficient and swift method of transport. Over the last four decades, total seaborne trade is estimated to have more than quadrupled, from less than six thousand billion tonne-miles in 1965 to the latest full-year figure of 25 thousand billion tonne-miles in 2003.[15] Total tonnage entering and leaving UK ports has increased by more than two thirds since 1965, from 319 million to 583 million tonnes.[16] In recent times, total imported tonnes have been increasing, while export tonnages have been decreasing, as shown in **Figure 10 on page 13**.

8 Cycle use in the UK, 1952–2006



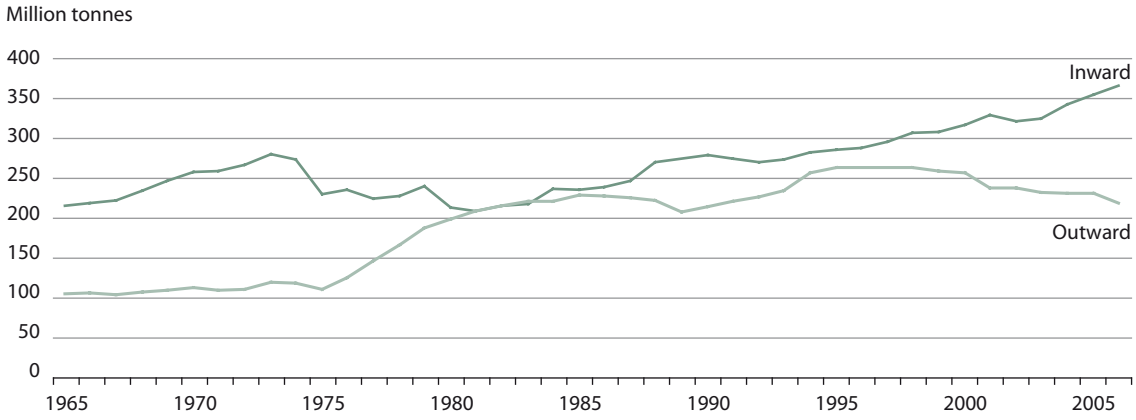
Source: DfT Transport Statistics

9 Trips under five miles distance, by mode, 2006



Source: DfT National Travel Survey

10 UK ports traffic, 1965-2006



Source: DfT Transport Statistics

Transport impacts

Introduction

2.1 Travel and the transport system itself are responsible for a wide variety of social, economic and environmental impacts, both positive and negative. For example, transport growth is both a cause of, and product of, economic growth and is an important component of increasing world trade. The increasing availability of all modes of transport, particularly the growth in private car ownership and cheaper flights, as well as public transport provision, can contribute to increased accessibility, personal freedom and community connectivity. Well designed roads and rail can provide corridors for wildlife and increase biodiversity in urban areas. However, pollution, noise and accidents can have a negative impact on health and ecosystems. A selection of these impacts is shown at **Figure 11**.

2.2 The environmental impacts of transport result from either the normal operation of modes of transport (such as pollution and noise from cars and aircraft); from extreme events (such as major pollution incidents or accidents); or as a result of the infrastructure required to carry the transport system (for example an increase in artificial surfaces can directly affect ecosystems and the pattern and content of run-off to surface and underground water courses). The purpose of this Part is to outline the main environmental impacts of the transport system on the three main environmental media – air, land and water. While discussed separately, the transport system can have simultaneous impacts on all three media, either directly or indirectly. Effects in one part of the system can affect other parts[17] and small changes to any of the components which may not seem to damage individually may have greater, combined cumulative impacts. Finally, we discuss transport and its impact on noise – which can be seen as both an environmental and a social impact, affecting the tranquility of the environment as well as causing stress, anxiety and depression.

11 Examples of the social, economic and environmental impacts of transport

Economic

- Transport is a cause and product of economic growth.
- Transport can increase employment either by allowing greater access to labour.
- International trade has increased at 5.5 per cent per annum since 2000.
- Mobility – 44 per cent of UK households own one car, 26 per cent own two.

Environmental

- Air, water and land impacts
- Greenhouse gases from transport contribute towards climate change.
- Air pollution impacts directly on vegetation and indirectly through effects on the acid and nutrients in soil and water.
- Oils spills – in 1996 the Sea Empress ran aground off Pembrokeshire spilling 72,000 tonnes of oil and polluting 100 kilometres of outstanding coastline.
- Loss of biodiversity and changes in water runoff due to transport infrastructure. Road length has increased by 100,000 kilometres since 1952.

Social

- Health impacts – e.g. from noise and particulates – can trigger increased admissions to hospital, premature deaths and reduce life expectancy. In 2005, the level of man–made particulate air pollution in the UK reduced average life expectancy by around 8 months – with yearly health costs of £20 billion; health benefits from walking and cycling increase fitness and help tackle obesity.
- Noise – of individual car and lorries has reduced; but exposure to overall noise has increased with the growth in transport over the last 15 years. Noise can cause anxiety and depression. Noise is also an environmental impact – affecting peace and tranquility in natural places.
- Local air pollution can damage historical buildings and monuments.

Source: National Survey of Attitudes to Environmental Noise, http://www.swan.ac.uk/empress, World Bank, DfT Transport Statistics, the Eddington Transport Study, National Air Quality Strategy

Air

Greenhouse gases

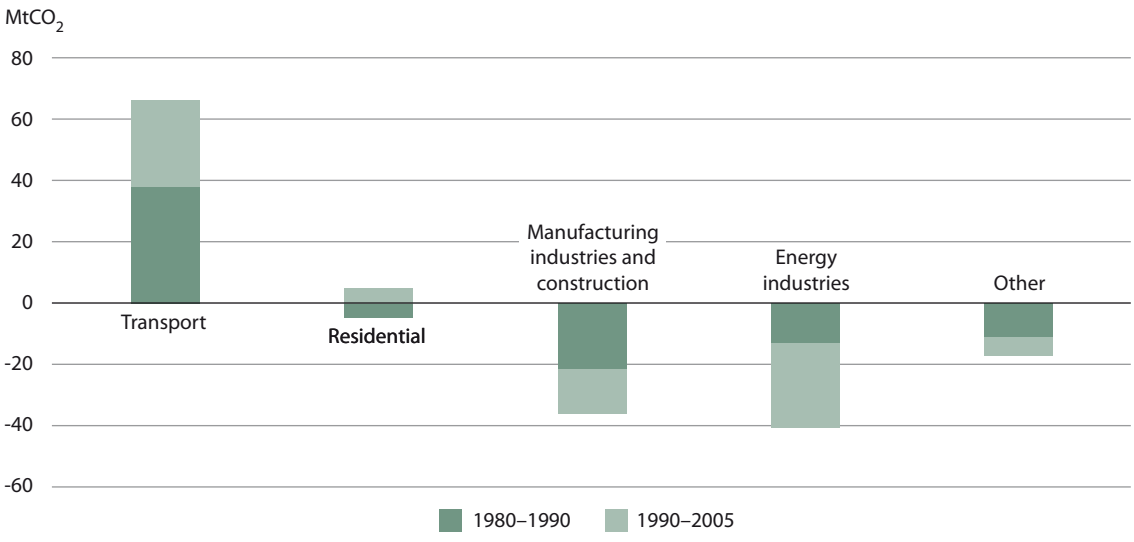
2.3 Carbon dioxide (CO_2) is the main man-made contributor to climate change. Transport, particularly road transport, is a major source of CO_2 emissions, and is the only sector where CO_2 emissions have increased since 1980 – as shown in **Figure 12**. This increase is due to the increase in use of cars and vans, HGVs and air travel; since 1990 however, emissions from cars have reduced slightly due to improvements in vehicle efficiency.[18]

2.4 **Figure 13** shows the CO_2 emissions from different modes of transport. Private road transport (passenger cars, light duty vehicles and HGVs) accounts for around 70 per cent of CO_2 emissions, aviation for around 20 per cent, and shipping and public transport for minor amounts.

2.5 Although the quantity of emissions varies between transport modes, the "carbon efficiency" (CO_2 per passenger kilometre) of these modes shows a different picture. Some modes emit more carbon while moving the same number of people the same distance. **Figure 14** shows that the least efficient form of passenger travel, in terms of CO_2, is domestic air travel, which emits 158gCO_2 per passenger kilometre; the most efficient is rail – at approximately 60gCO_2 per passenger kilometre.

2.6 Total CO_2 emissions from international and domestic air travel are expected to continue growing, particularly after 2010 – by around 200 per cent from 1990 levels by 2020. However, road transport emissions are projected to remain significantly higher, and are expected to level out, at around 2005 levels, and eventually decrease after 2020 as increasing

12 Change in carbon dioxide emissions by source[1], 1980–1990 and 1990–2005



Source: Defra e-digest of statistics

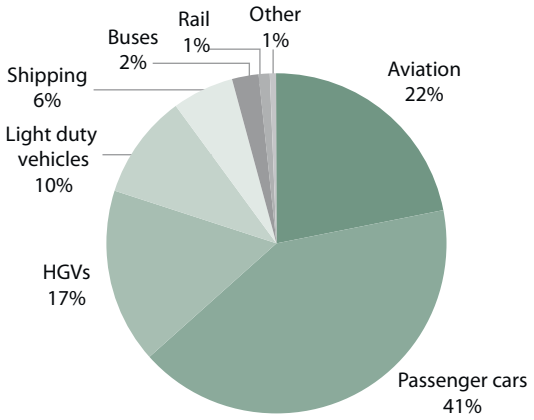
NOTES

1 'by source' is the method used to calculate carbon dioxide emission in the UK. Emissions are estimated using data on fuel use by each form of transport. Using this method, emissions from electricity used to power electric trains is not included in transport emissions. However, the impact is not large as rail plays a relatively small part in UK transport emissions.

2 Transport emissions include international aviation and shipping, although these are not included in the formal estimates of UK greenhouse gas emissions for the purposes of reporting against the UK's domestic and Kyoto Protocol targets. (Data on these sources are presented as memo items in UK reports for the purposes of the Kyoto Protocol). If international aviation emissions are excluded, transport remains the worst performing sector, but the size of the emissions increase is reduced to about 45 $MtCO_2$ rather than 66 $MtCO_2$ since 1980; the rest of the economy decreased emissions by 94 $MtC0_2$.

3 Emissions from residential sources decreased between 1980–1990 and increased by a similar amount from 1990–2005.

13 Carbon dioxide emissions from transport by source, 2005

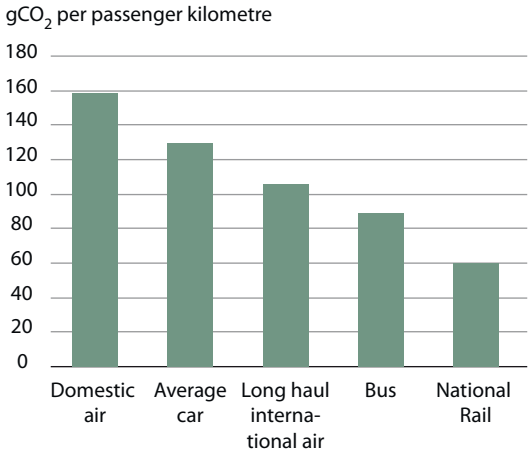


Source: Defra edigest of environmental statistics

NOTE

This figure includes emissions from international aviation and shipping, although these are not included in the formal estimates of UK greenhouse gas emissions for the purposes of reporting against the UK's domestic and international targets. (Data on these sources are presented as memo items in UK reports for the purposes of the Kyoto Protocol).

14 Carbon dioxide emissions per passenger kilometre, 2007



Source: Guidelines to Defra's GHG conversion factors for company reporting, 2007, Annex 6, calculations based on average vehicle occupancy data from DfT NTS, 2006

NOTE

Aviation emissions factors are intended to be an aggregate representation of typical emissions per passenger km from illustrative types of aircraft for the two types of air services. Actual emissions will vary significantly according to the type of aircraft in use, the load, cabin class, etc. These emissions factors do not include the additional impacts of radiative forcing (i.e. non-CO_2 climate change impacts see para 2.7)

CO_2 emission per passenger kilometre for the average car were calculated based on the average gCO_2/km per car and an average vehicle occupancy of 1.6 from the DfT National Travel survey.

Bus emissions factors are calculated based on fleet average gCO_2/km for all bus class and journey data from the UK Greenhouse Gas Inventory and an average load factor of 9.2 passengers calculated using total bus vehicle km and passenger km from DfT Transport Statistics.

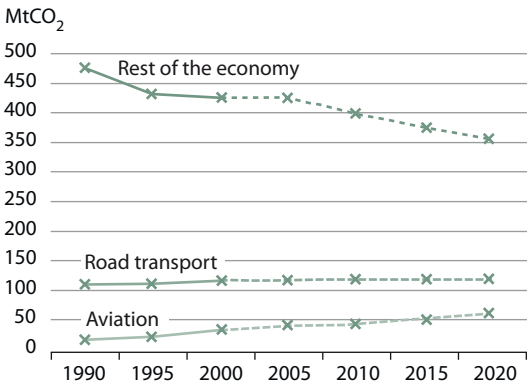
The national rail emissions factor refers to an average emission per passenger kilometre for diesel and electric trains in 2005. The calculation factor is based on total electricity and diesel consumed by the railways in 2005/06 from the DfT National Modelling Framework Environment Module, and DfT transport statistics on the total number of passenger kilometres for 2005-2006.

Similar figures are not available for water transport.

vehicle efficiency starts to counter rising traffic levels.[19] **Figure 15 on page 18** shows CO_2 emissions projections to 2020.

2.7 Aside from CO_2, road transport also releases nitrous oxide (N_2O), another greenhouse gas. Since 1990, transport-related emissions of N_2O have increased significantly, largely as a result of measures such as catalytic converters – these reduce emissions of local pollutants but produce more N_2O as a side-effect. Other forms of transport have also been associated with climate change. For example, between 1990 and 1998, greenhouse gas emissions from UK shipping bunkers increased by around a third.[20] Emissions from planes at high altitude also have non-CO_2 climate warming impacts for example through water vapour emissions, soot and particulates and the little understood effects of cirrus clouds. The scale of these impacts is still uncertain – however they were estimated by the Inter Governmental Panel on Climate Change in 1999 to be 2-4 times that from CO_2 alone (excluding the effects of cirrus clouds); more recently these effects (again excluding cirrus clouds) were estimated to be approximately twice those of CO_2 by a European Commission investigation.[21]

15 Carbon dioxide emissions projections to 2020



Source: Updated Energy and Carbon Emissions Projections (BERR 2008) (road transport and rest of the economy); UK Air Passenger Demand and CO2 Forecasts (DfT 2007) (aviation)

NOTE

Projections for shipping not available.

2.8 Taking all greenhouse gas emissions together, and by end-user[22] instead of by source, transport is the only sector in which emissions have risen since 1990 – by almost 40 per cent.[23] These trends are due to:[24]

- Marked growth in air transport. Between 1990 and 2006, emissions from aviation fuel use more than doubled.[25] International and domestic aviation accounted for 6.4 per cent of UK CO_2 emissions in 2006.[26]
- A rise in road traffic.
- General growth in the economy – people tend to choose more carbon-intensive travel as they become more prosperous and travel more.
- People travelling further and more often, increasing the demand for transport fuel, so offsetting improvements in new car fuel efficiency.
- Introduction of catalytic converters has produced higher emissions of nitrous oxide but reduced emissions of carbon monoxide, hydrocarbons and nitrogen oxides (NO_x).[27]

Air quality trans-boundary pollutants

2.9 The quality of the air we breathe is affected by a number of pollutants including some which are generated by transport. Some pollutants affect national or cross-continental air quality because they are absorbed and dispersed in the atmosphere. Other pollutants (see next section) have a more local effect because they are not dispersed or cause local atmospheric reactions.

2.10 Aside from greenhouse gases, transport is also responsible for emitting other pollutants which can cause regional or cross-continental air pollution. The distance travelled by these pollutants depends on atmospheric conditions, their residence time in the atmosphere, and the formation of secondary pollutants. For example, nitrogen from NO_x in the atmosphere can be deposited in precipitation which can affect the nutrient balance of ecosystems.

2.11 International air quality agreements, such as the Gothenburg Protocol, have been set to reduce pollutants for which transport is partly responsible – including NO_x, non-methane volatile organic compounds – a reactive class of hydrocarbons (NMVOCs) – and sulphur dioxide (SO_2) levels. The impacts of the full implementation of the Gothenburg Protocol have been estimated to include a fall in excessive levels of eutrophication[28] across Europe from 165 million hectares in 1990 to 108 million hectares; and a 44 per cent reduction in the exposure of vegetation to excessive ozone levels.[29]

Air quality – local air pollution

2.12 Road transport is one of the main sources of air pollutants which cause impacts at a local level.[30] The pollutants which persist locally thought to have the most impact on public health are particulate matter, ozone, carbon monoxide and NO_x.[31] These can be responsible for smogs occurring in both summer and winter. Summer episodes occur in the presence of sunny and calm weather conditions and NO_x and NMVOCs, partly from transport, giving rise to high levels of ground-level ozone. As well as health impacts, the resulting increases in ground-

level ozone also have a greenhouse effect. Winter episodes tend to occur when foggy, still weather conditions combine with particulates, NO_x and, to a lesser extent, SO_2.

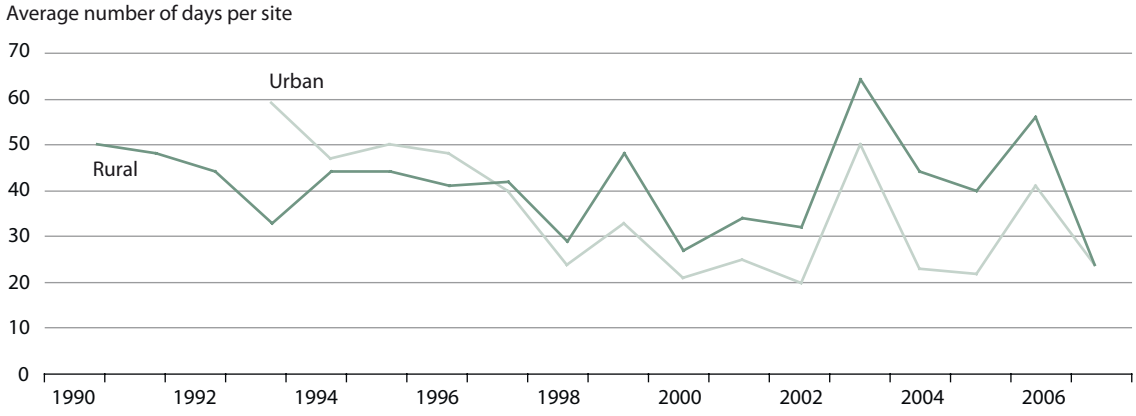
2.13 Since 1997, the UK Government has set Air Quality Standards and Objectives for a range of pollutants,[32] at a local level. The objectives are defined in the latest Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007)[33] and to a large extent reflect EU requirements. The levels are based on what is considered safe for human health, although the pollutants could also affect materials, buildings and ecosystems. Further objectives have been set to protect vegetation and ecosystems.

2.14 Local authorities have a responsibility to assess where air quality objectives are likely to be missed, and designate Air Quality Management Areas to ensure the objectives are met. The assessment process involves evaluation of emissions, monitoring, modelling and mapping current and future air quality. The level of pollutants is measured at a sample of locations in urban and rural areas; the UK has over 1,500 sites which monitor air quality.[34]

2.15 The air quality indicator is one of the 68 indicators of the Government's Sustainable Development Strategy. It measures average levels of pollution from particulates and ozone, as well as the average number of days per monitoring site on which levels of any one of a basket of five pollutants[35] were 'moderate or higher'. Annual average particulate levels have been decreasing since monitoring began in 1997, although the trend has been reversed in each of the last two years. There is an upward trend in background ozone levels and a more marked increase in urban areas, due to a reduction in emissions of nitrogen oxides, which destroy ozone close to their emissions source.[36]

2.16 Around 15 per cent of days at measurement stations across the UK have seen 'moderate or higher' risk from air pollution from any one of the five major pollutants **(Figure 16)**. Performance has seen significant variation between years, partly because weather can have a large impact; the hot summers in 2003 and 2006 led to an unusually high number of pollution days.

16 Days when air pollution is moderate or higher, 1990 to 2007



Source: Defra, Air quality indicator for sustainable development 2007 results

NOTE

Shows number of days when levels of any one of CO, NO_x, Ozone, particulates and Sulphur Diofide are moderate or higher.

The difference between urban and rural areas can be explained by high levels of ozone in rural areas. Ozone is a secondary pollutant, formed from chemical reactions between other pollutants in the atmosphere, and so peak levels tend to occur down wind of the pollutant source. The peak ozone levels therefore occur in rural areas, down wind of urban areas.

2.17 In addition to the air quality indicator, Defra and DfT have a PSA target to improve air quality across a basket of pollutants. The objectives of the PSA target are similar to, but in some cases tighter than, corresponding EU air quality regulations. Modelling has shown that although the majority of the country will meet these objectives there are some areas (mostly by busy roads and urban locations) where these objectives are not being met.

Land

2.18 The impacts of transport on the land are harder to quantify than other impacts, and there is no comprehensive national picture of their extent. Unlike climate change and air pollution, land impacts are not subject to any specific transport-focused targets or regulations; impacts, such as biodiversity loss or potential pollution, are assessed on a case by case basis. New roads, rail networks and runways are responsible for increased land-take across Greenfield sites; and pollutants from the transport itself can infiltrate the soil via run-off. The impact of transport on land also includes the fragmentation effect on habitats and communities. Habitat fragmentation can lead to serious biodiversity decline and loss of species.[37]

2.19 Although there is no aggregate measure of impact, it is possible to measure the growing size of transport infrastructure. Since the 1950s, 100,000 kilometres of road have been built, including 3,500 kilometres of motorway since 1959[38] **(Figure 17)**. The railway network has decreased by 15,000 kilometres since the 1950s; the Government proposes the expansion of at least 25 airports over the next 30 years;[39] and around 1,200 hectares of non-developed land is converted to transport or utilities uses per year **(Figure 18)**.[40]

2.20 The following case studies, presented opposite, illustrate the types of impacts that transport can cause to the land.

Case studies

The Mottram Tintwistle Bypass

This proposed bypass would have, according to the DfT appraisal, a 'large adverse' impact on the 'landscape character, quality and tranquility' of the Peak District Natural Park as well as a 'moderate adverse' impact on the biodiversity of the Swallows Wood Nature Reserve.

Source: Appraisal Summary Table: A57/A628 Mottram – Tintwistle Bypass, DfT, http://www.dft.gov.uk/foi/responses/2007/august/mottramtintwistle/appraisalsummary.pdf

Weymouth Relief Road

This proposed road would go through a Dorset Area of Outstanding Natural Beauty, two Sites of Special Scientific Interest and ancient woodland. English Nature has found that one of the proposals for this route 'would result in substantial impacts to high quality habitats including wetlands, grasslands, and woodlands, due to severance. These impacts include the loss and disruption of the existing pattern of habitats within the valley, loss of wildlife corridors and the fragmentation and disruption of foraging areas, particularly for birds and bats. English Nature is sceptical that severance can be mitigated or compensated.'

Source: English Nature http://www.english-nature.org.uk/About/teams/NewsDetails.asp?Id=17&NewsId=297

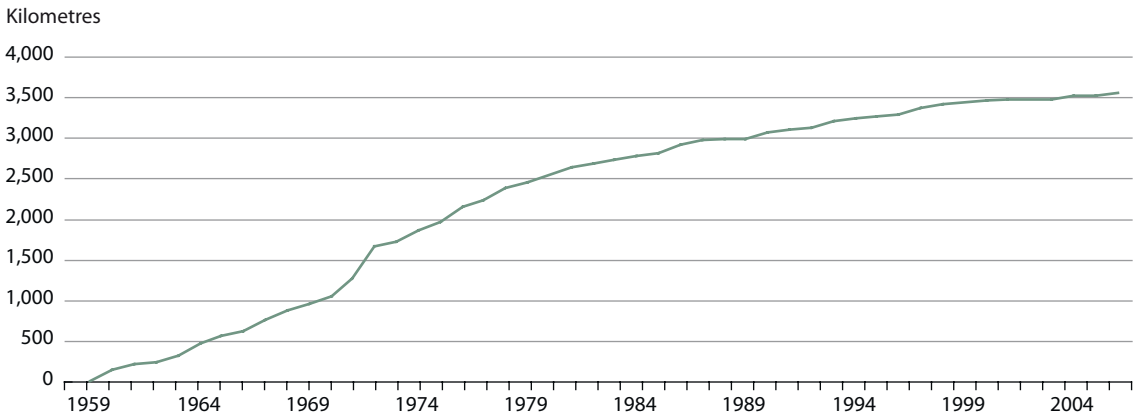
Water

2.21 The impacts of transport on water result not only from modes of water transport, such as river and sea freight or pleasure craft, but also from other modes such as road transport and associated infrastructure. The main impacts on water from transport are pollution (both on-going and specific incidents) and disturbance of aquatic ecosystems. For example:

- Disruption of natural water flows can occur as a result of new transport infrastructure and the increase in the area of artificial surfaces, such as the road network. Run-off to river systems tends to be quicker over artificial surfaces; in storms this can exacerbate problems on flood plains, with associated ecosystem impacts. This should be seen in light of the EU Water Framework Directive which includes targets for all water courses to achieve 'good status' by 2015.

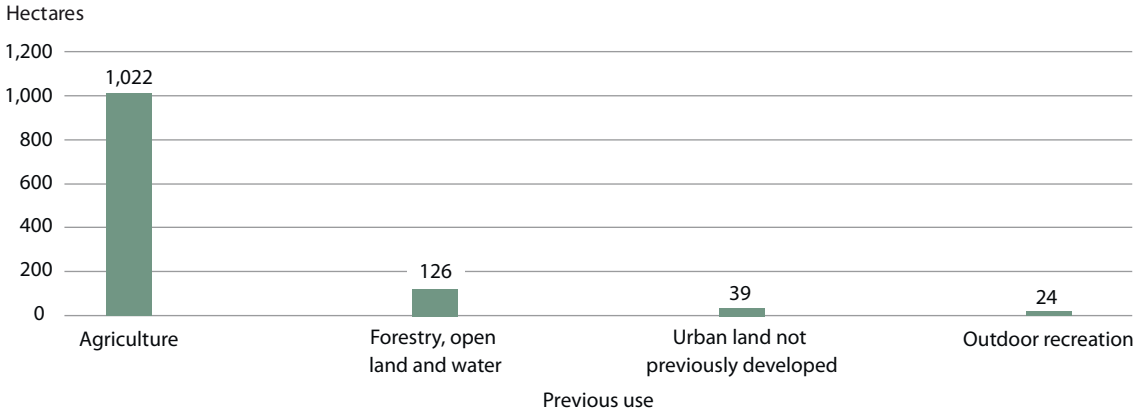
- Freshwater pollution can occur when run-off from roads pollutes nearby watercourses. Two indicators of water pollution in England have shown improvement since 1990. The percentage of good biological quality rivers in England rose from 60 to 71 per cent and good chemical quality rivers rose from 43 to 66 per cent between 1990 and 2006. Defra has recently begun a review of this type of diffuse water pollution, looking at sources including transport.
- Marine pollution – can occur mainly as a result of international and coastal shipping – for example, as a result of tanker spills or routine maintenance. However, the largest proportion of fossil fuel pollution in the marine environment is a result of automobile oil (via drains, sewers and run-off).[41] If ingested, fossil fuels such as oil can be potentially fatal for marine organisms, and can cause loss of insulation if fur or feathers are covered.

17 Motorway length, UK, 1959–2006



Source: Transport Statistics, 2007

18 Average gross annual transfer of undeveloped land to transport and utilities uses, 1995–2004



Source: DCLG, Land Use Change in England to 2006: Additional Tables LUCS-22A, ODPM (2004) Land use change statistics guidance

NOTES

'Transport' uses includes Highways and Roads, including distributor roads in housing estates, bus stations and public car parks, non-highway transport routes and places, e.g. railways, airports and dockland. 'Utilities' includes facilities for post and telecommunications, the production and distribution of gas and electricity, the treatment and disposal of sewage, and cemeteries and crematoria.

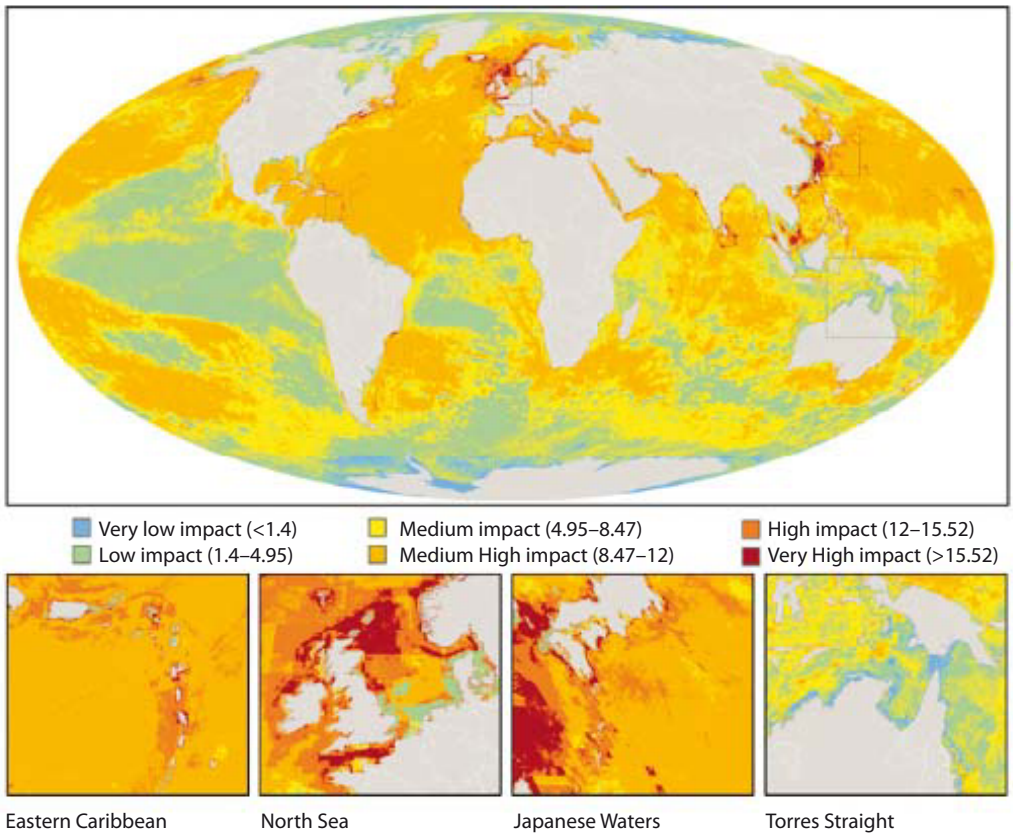
'Outdoor recreation' includes areas such as playing fields and sports grounds, including those in schools and industrial sites, football pitches, golf courses, country parks and allotment gardens.

2.22 A recent study[42] has shown marine areas around the UK to be some of the most heavily used in the world. **Figure 19** shows the results of this research, which is based on the impacts of 17 human activities, including shipping traffic. The most affected areas occur where several human activities have combined to amplify the usage – these include the North Sea.

Noise

2.23 'Environmental noise' is defined in the European Environmental Noise Directive as 'unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic, and from sites of industrial activity...'[43] The World Health Organisation[44] states that 'to protect the majority of people from being seriously annoyed during the day-time, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB LAeq[45] for a steady, continuous noise... At night, sound pressure levels at the outside facades of the living spaces should not exceed 45 dB LAeq... so that people may sleep with bedroom windows open.'

19 Global marine pollution



Source: From A Global Map of Human Impact on Marine Ecosystems, Science 2005 reprinted with permission from AAAS

2.24 The UK National Noise Incidence Study[46] estimated that 55 per cent of the population of England and Wales live in dwellings exposed to external day-time noise levels above 55 dB LAeq. The same study also found that 68 per cent of the population of England and Wales live in dwellings exposed to external night-time noise levels above 45 dB LAeq. The National Survey of Attitudes to Environmental Noise[47] survey found that between 1991 and 2001 there had been:

- an increase in the number of people hearing road traffic, from 48 per cent to 54 per cent;
- an increase in the proportion of people reporting noise from road traffic sources: private cars/vans (11 to 13 per cent), and motorways (1 to 3 per cent);
- an increase in the proportion of people reporting that road traffic noise made them depressed (2 to 5 per cent);
- no statistically significant change in the proportion of people reporting hearing noise from aircraft; and
- an increase in the proportion of people reporting hearing noise from private or commercial helicopters (10 to 16 per cent).

2.25 Legislation and technological progress have achieved significant reductions of noise from individual sources, such as an 85 per cent reduction of noise from individual cars and a 90 per cent reduction from lorries since 1970. However data covering the past 15 years do not show significant improvements in overall exposure to environmental noise except from aircraft. While these initiatives have been successful in reducing source levels, it is believed that in many areas there has been no significant reduction in exposure levels because of an increase in the number of sources.[48]

2.26 As a requirement of the EU Environmental Noise Directive, Defra have produced noise maps covering all major road, rail, air and urban areas with a population of over 250,000 in England. Noise Action Plans will then be designed based on the maps to manage noise issues and effects including noise reduction where necessary. These will include measures to protect quiet areas from an increase in noise. Defra is also working on a National Noise Strategy covering both environmental and neighbourhood noise.

Responsibilities and policy instruments within government

Introduction

3.1 This Part of our review looks at what government is doing to influence trends in transport and its impact on the environment. This is a large policy area, as nearly all of the Government's transport policies have some impacts on the environment. **Figure 20** shows the programmes and policies that will be discussed in this Part.

3.2 Most transport policy aims to support or facilitate travel by different modes – for example road building, support for the rail network, and airport expansion. But policies may also have an environmental angle, because they:

- seek to discourage or render unnecessary some journeys;
- promote switching to greener modes of travel; or
- reduce the environmental impacts of each mode of travel.

Responsibilities

3.3 Responsibility for transport is dispersed between many parts of government and society. National road networks are owned and maintained by central government. Transport services are mostly provided by the private sector. Many key decisions on international aviation and shipping are made by the UN. Decisions on some road and rail regulations are taken at a European level. Local authorities and Transport for London are responsible for planning and procuring most local transport services. Regional bodies have responsibility for strategy setting and some prioritisation of funding at a regional level. And devolution means that Scotland and Wales are largely responsible for their own transport.[49] **Figure 21 on page 26** shows the main public bodies involved in transport policy in England. In addition to these organisations, which have direct responsibility for transport infrastructure and its operation, the Treasury influences travel and transport choices through a number of fiscal measures.

Finance

3.4 Government spends around £20 billion on transport each year **(Figure 22 on page 27)**:

- £6 billion of this is spent by local authorities and the devolved administrations on local transport infrastructure and services.[50]
- £5 billion is spent by the Highways Agency on maintaining motorways and major trunk roads in England.[51]
- £4 billion is spent by DfT on rail, through funding to both Network Rail and the train operating companies.
- £3 billion funds Transport for London.[52]

20 Outline of Part 3

Introduction	• Responsibilities	
	• Finance	
Department for Transport and its agencies	• Long term planning and policy formulation	• The Eddington transport study
		• Towards a Sustainable Transport System
		• New Approach to Transport Appraisal
	• Rail policy	• Delivering a Sustainable Railway
	• Road policy	• Road building
		• National road pricing
		• Advanced motorway signalling and traffic management
		• EU target to reduce new car emissions
		• Renewable Transport Fuel Obligation
	• Air policy	• The Future of Air Transport
		• Inclusion of aviation in the EU Emissions Trading Scheme
	• Bus Policy	• Putting Passengers First
		• Bus Service Operators Grant
	• Cycling policy	• A Sustainable Future for Cycling
	• Ports and shipping policy	• The MARPOL convention
	• Freight	• Sustainable Distribution Fund
	• Behaviour change and information campaigns	• Smarter Choices
		• Sustainable travel towns
		• Act on CO_2
Local and regional government	• Spatial planning	• Planning policy guidance
		• The Planning Bill
	• Housing and transport	• 2 million new homes by 2016
		• Thames Gateway Growth Area
		• Eco-towns
	• Local transport plans	
	• London	
The Treasury	• Vehicle excise duty	
	• Company car tax	
	• Air passenger duty	

- £2 billion covers the rest of DfT's annual budget – which includes some additional grants to local authorities, the Bus Service Operator's Grant, a number of transport NDPBs, the Driver and Vehicle Licensing Agency (DVLA), the Maritime and Coastguard Agency, freight grants and many other smaller projects.

The Department for Transport and its agencies

3.5 The Department for Transport has overall responsibility for central transport policy in the UK. Most of its work is delivered through other bodies, notably the Highways Agency, Network Rail, the train operating companies and Transport for London. It also has a role in allocating funding to local authorities, working with CLG. It has a lead role in strategic planning for international and

21 Government transport responsibilities in England

Organisation	Network	Modes	Responsibilities
DfT	International networks	Air, shipping, rail	Planning and strategy
	National and inter-regional networks	Rail and roads	Planning , strategy, funding, regulation
	Regional and local level	Local roads, bus, taxi and light rail services and walking and cycling	Guidance, regulation and some funding
Highways Agency	Inter-regional networks	Roads	Improvement, maintenance and regulation
Network Rail	Inter-regional networks	Rail	Owns and operates network
Regional Bodies (Regional Development Agencies, Regional Assemblies)	Regional networks, projects which cross local boundaries	Roads and public transport	Planning and strategy
County and unitary authorities (outside London and the six metropolitan counties)	Local networks	Local roads, bus, taxi[1], light rail services, walking and cycling facilities	Planning, strategy, procurement, ownership and maintainance of local highway network
Metropolitan Borough councils (in six metropolitan areas)	Urban networks	Local roads, taxi, walking and cycling facilities	Planning, strategy, procurement, ownership and maintainance of local highway network
Passenger Transport Authorities (in six metropolitan areas)	Urban networks	Public transport bus, light rail, limited powers over mainline rail services	Planning, strategy, maintenance, procurement
London (The Mayor of London and the executive body Transport for London)	Urban networks	Local roads, bus services, London Underground, light rail, tram, taxi, river and some heavy rail services	Bus services, London underground and overall planning and strategy

Source: National Audit Office, DfT

NOTES

1 Unitary authorities are responsible for taxis, however, in the county authorities the shire district councils are responsible for them.

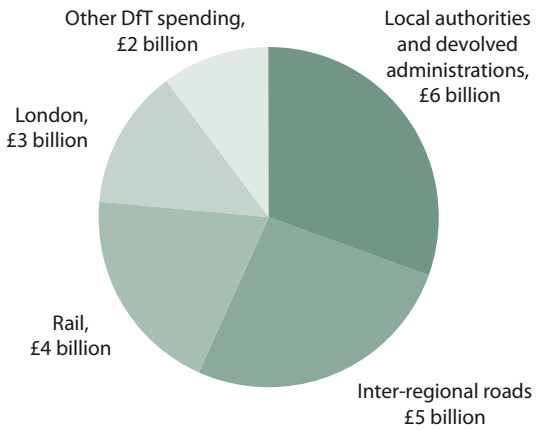
2 The Local Transport Bill, introduced to Parliament in November 2007, allows for some local reorganisation of transport responsibilities, potentially affecting Metropolitan Boroughs, County, Unitary and Passenger Transport Authorities (the last of which are to be renamed "Integrated Transport Authorities").

inter-regional transport, and it provides guidance to local authorities and regional government in their strategic planning. In addition the Department also sponsors a number of other public bodies including the Commission for Integrated Transport. This section first looks at some central and coordinating policy mechanisms for the Department, before looking at more specific policy instruments.

3.6 The Department has four strategic objectives, which were introduced in January 2007:

- To sustain economic growth and improved productivity through reliable and efficient transport networks.
- To improve the environmental performance of transport and tackle climate change.
- To strengthen the safety and security of transport.
- To enhance access to jobs, services and social networks, including for the most disadvantaged.

22 Total UK government transport funding 2006-07



Source: DfT resource accounts, CSR 2005

NOTE

Local authorities and devolved administrations spending is an estimate taken from the Comprehensive Spending Review – it is not possible to disaggregate further.

3.7 On the objective to improve the environmental performance of transport DfT has, in the past, focused on the two main air impacts associated with increased traffic levels: greenhouse gas and local air quality. This is partly a result of the Public Service Agreement (PSA) system where, under the old system, DfT was subject to two PSAs on climate change and air quality. These were:

- Improve air quality by meeting the seven Air Quality Strategy targets.
- To reduce greenhouse gas emissions to 12.5 per cent below 1990 levels in line with our Kyoto commitment; and move towards a 20 per cent reduction in carbon dioxide emissions below 1990 levels by 2010.

3.8 Under the new PSA system introduced in 2007, which applies from 2008-10, DfT is a delivery partner for two environmental PSAs. These targets are to:

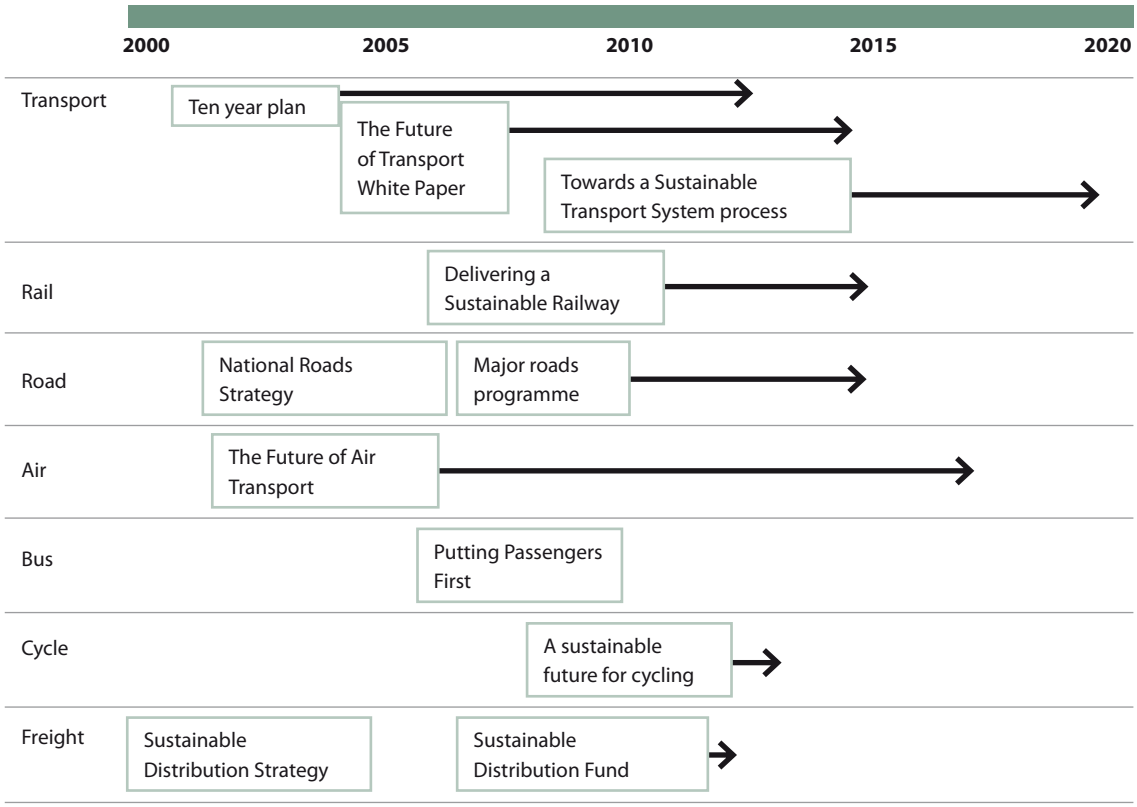
- 'lead the global fight against climate change'. DfT's role is 'to ensure that transport policies balance the increasing demand for travel against protecting the environment and improving quality of life'; and
- 'secure a healthy natural environment for today and the future'. DfT's role is to ensure necessary action to deliver the air quality indicator and to take into account impacts on land, water, biodiversity, air and the marine environment.

Longer term planning and policy formulation

3.9 Transport infrastructure takes a long time to plan and build, and it has a long lifespan. Developments in technology can take years to come to the market. As a result, programmes proposed now may not be completed for 20–30 years, whilst programmes being implemented now may have started 15 years ago. Because of this lag, most government spending on transport has already been committed until the middle of the next decade. **Figure 23 overleaf** shows some of the major transport policy announcements and their planning and spending horizons.

3.10 2008 will be an important year for transport strategy. Many current policy commitments end in 2014-15. Planning beyond that date is going on now, started and informed by the publication of the *Eddington Transport Study* and *Towards a Sustainable Transport System* (see paragraphs 3.10 and 3.11 below). The King review of low carbon cars was also published in March 2008 **(Figure 24 on page 29)**.

23 Transport policy announcements, arrows show spending commitments made



Source: Derived from the Towards a Sustainable Transport System document and other DfT documents

NOTE

There are no funding streams associated with Putting Passengers First.

3.11 The **Eddington Transport Study** was commissioned jointly between the Chancellor and the Secretary of State for Transport in 2005. The commission was to examine the long-term links between transport and the UK's economic productivity, growth and stability, within the context of the Government's broader commitment to sustainable development. That study, published in December 2006, found that sustained and targeted investment in infrastructure could be justified by the economic benefits it would bring; improvements should be aimed at making the existing system work better since the infrastructure is already fairly comprehensive; and that new capacity should concentrate on key corridors, international gateways and city catchments. It also recommended that the transport sector, including aviation, and all transport users should meet all their external economic, social or environmental costs. This study was published just after the Stern review on the economics of climate change, and aligned with Stern's finding that averting climate change is less costly than dealing with the potential impacts.

3.12 In October 2007 DfT published **Towards a Sustainable Transport System: supporting economic growth in a low carbon world**, which forms the start of the Department's next round of longer term planning **(Figure 25)**. *Towards a Sustainable Transport System* looks at how the recommendations of both the Stern and Eddington reviews can be translated into policy over the short, medium and long term. The next main steps of this process are likely to be a consultation in 2008; in

24 The King review of low carbon cars

Professor Julia King conducted a review to assess the possibilities for decarbonising road transport, for the Treasury. Her interim report, published in October 2007, found that almost complete decarbonisation of transport by 2050 is a possibility if substantial progress could be made in solving electric or other vehicle and fuel technology challenges and, critically, the power sector can be decarbonised and expanded to supply a large proportion of road transport demand. It found that biofuels must be approached with caution due to their potential to cause other environmental and social problems. In the nearer future a 50 per cent reduction in carbon emissions by 2030 is possible with technologies which are either in production or on the horizon. The final report, published in March 2008, recommended measures to incentivise both long and short term action. These include:

- the introduction of colour coded tax disks;
- the strengthening of advertising regulation to provide clearer information on vehicles;
- redesigning and making compulsory the current new car fuel economy label; and
- considering whether dashboard technology can encourage smarter driving.

Source: The King review of low carbon transport

25 Towards a Sustainable Transport System, long term planning process, 2007-2012

2007	Oct	**Towards A Sustainable Transport System published**
2008	Jan	Stakeholder dialogue begins
	Apr	**Initial consultation response published with proposals of key challenges**
	Early summer	Formal consultation begins
	Jul	**NATA refresh consultation response published**
	Sep	Formal consultation ends
2009	Early	**Final version of Transport White Paper published including 20–30 year plans**
	Ongoing	Stakeholder engagement, develop, appraise and prioritise options
2012		**A document presenting initiatives for the spending review published**

Source: Derived from Towards a Sustainable Transport System, 2007

early 2009 DfT will publish a White Paper setting out objectives, challenges and options, to be published alongside a carbon reduction strategy.

3.13 DfT rely on their **New Approach to Transport Appraisal (NATA)** to ensure that environmental, social and economic impacts are fully assessed for most[53] transport projects which require DfT funding or approval. Using the NATA framework, first introduced in 1998, transport proposals are appraised against impacts on the environment, safety, economy (financial costs and benefits), accessibility, and integration with other policies. Some impacts are expressed in monetary terms, others are expressed in quantitative terms, and others appraised qualitatively and summarised using a seven point scale. All of these impacts are presented on a single Appraisal Summary Table which includes a qualitative description of the impact, where relevant a quantitative measure, and a final assessment for each objective **(Figure 26 overleaf).**

3.14 The monetary and non-monetary impacts identified using NATA are used by DfT to reach a decision on whether the project represents value for money. However, value for money is only one of a number of factors which will influence whether a proposal will be recommended for acceptance by Ministers. Others factors include deliverability, public acceptability, distributional and equity impacts, and contribution to government objectives.

3.15 The Eddington Study reviewed the NATA process and concluded that transport appraisal was well developed and well regarded in the UK and seen as being at the forefront internationally. The Eddington and the Stern reviews also recommended that DfT tries to capture as many of the impacts from transport in their appraisals as possible. In response to these reports DfT is conducting a consultation – the 'NATA Refresh' – on developing NATA. The deadline for responses was 31 March 2008 and DfT have received over one hundred responses from a broad spectrum of stakeholders. DfT is now in the process of analysing these responses and deciding whether and how to amend the NATA guidance to address the points raised. Any revisions will affect the way programmes on the upcoming Transport White Paper are appraised.

26 NATA Summary Table

Objective	Sub-objective	Qualitative impacts	Quantitative measure	Assessment
Environment	Noise	----------	----------	net properties win/lose NPV £m
	Local air quality	----------	----------	LAQ index
	Greenhouse gases	----------	----------	Tonnes of CO2
	Landscape	----------	----------	score out of seven
	Townscape	----------	----------	score out of seven
	Heritage of historic resources	----------	----------	score out of seven
	Biodiversity	----------	----------	score out of seven
	Water environment	----------	----------	score out of seven
	Physical fitness	----------	----------	score out of seven
	Journey ambiance	----------	----------	score out of seven
Safety	Accidents	----------	----------	£present value benefit
	Security	----------	----------	score out of seven
Economy	Public accounts	----------	----------	£present value cost
	Business users and providers	----------	----------	£present value benefit
	Consumer users	----------	----------	£present value benefit
	Reliability	----------	----------	score out of seven
	Wider economic impacts	----------	----------	score out of seven
Accessibility	Option values	----------	----------	£present value benefit
	Severance	----------	----------	score out of seven
	Access to transport system	----------	----------	score out of seven
Integration	Transport interchange	----------	----------	score out of seven
	Land-use policy	----------	----------	score out of seven
	Other government policies	----------	----------	score out of seven

Source: Webtag

3.16 Some environmental campaigning groups have published criticisms of the way NATA has been used in the past. The Campaign for Better Transport's recent report,[54] based on a sample of appraisal decisions, found many schemes which increase, or at least fail to reduce, greenhouse gas emissions scored very well using NATA, and that most schemes that do reduce emissions tended to score badly. The report found this is partly because of the way NATA treats tax raised through additional fuel sales as a benefit which can offset the cost associated with emissions. In addition, Friends of the Earth have written a briefing[55] criticising the way NATA has been used to claim that the proposed Heathrow expansion would bring £5 billion of net economic benefit. Their critique questioned the way costs and benefits are reduced to a single monetary figure, irrespective of how these are distributed, and questioned the value placed on climate change impacts. However, DfT uses government-wide methodologies and values to estimate impacts. Ultimately, no single figure is used to drive decision making and final decisions are a matter of informed judgement.

Rail policy

3.17 The July 2007 Rail White Paper **Delivering a Sustainable Railway** specified what the Government wants to buy from the railway (in terms of safety, performance and capacity) for the next five years and how much money it has to spend. In the strategy the Government set out its plan to increase rail capacity to accommodate an increase in passenger demand of 22.5 per cent by 2014. To achieve this, the Government plans to invest £10 billion in enhancing rail capacity between 2009 and 2014. However, funding up to 2014 is going to be reduced, with the shortfall being made up by increased passenger fares.

3.18 This strategy was published alongside a long-term rail strategy announcing a desire to double freight and passenger traffic, although it is not specified in detail how this would be done. The long term strategy did not make any commitment to major changes to rail infrastructure such as high speed rail or electrification, but it did discuss the longer term challenges facing the railway such as increasing demand, environmental pressures and customer expectations.

Road policy

3.19 On **road building**, DfT has approved expenditure of over £577 million in 2008-09 for the development of new and existing trunk roads and motorways by the Highways Agency.[56] In addition, local authorities' five year Local Transport Plans propose spending of £1.7 billion on major road schemes up to 2010-11.[57] These projects are aimed at reducing congestion but they may also have the effect of increasing traffic, greenhouse gases and other emissions. **Figure 27** shows the list of the top ten proposed Highways Agency road building schemes in terms of estimated additional carbon dioxide impacts.

3.20 The Government has been considering the introduction of a **national road pricing system** for some time. The sort of scheme being explored would be aimed at reducing congestion rather than pollution; some analyses have suggested such a scheme could actually increase emissions because less congestion could mean a greater total traffic flow, causing more emissions. Public opinion has not been favourable to the idea, and in *Towards a Sustainable Transport System* road pricing was described as 'decision for the future.'[58] In the 2008 Budget the Chancellor 'reaffirmed the Government's commitment' to exploring national road pricing to tackle congestion and emissions and announced new funding for demonstration projects to test technology.

27 Top 10 list of carbon-emitting proposed Highways Agency schemes

Name of road	Extra CO_2 per year tonnes	Name of road	Extra CO_2 per year tonnes
M1 J30–42 Widening	100,488	M1 J21–30 (phase 1)	39,318
M62 J6 Improvement	84,380	M62 J25–27 Widening	36,450
M25 J16–23 Widening	84,273	M25 J27–30 Widening	30,760
A14 Ellington – Fen Ditton Improvement	83,950	M25 J5–7 Widening	30,272
M25 J23–27 Widening	53,682	A46 Newark – Widmerpool Improvement	20,079

Source: Campaign for Better Transport, using figures supplied by the Highways Agency

NOTE

Several of these schemes are still in the options phase, and alternative Active Traffic Management solutions are being actively considered which will alter the calculations – M1 J30–42, M62 J25–27 and A46 N-W, while two of the M25 sections (J23–27 and J5–7) are not committed to and could also be markedly different in scope.

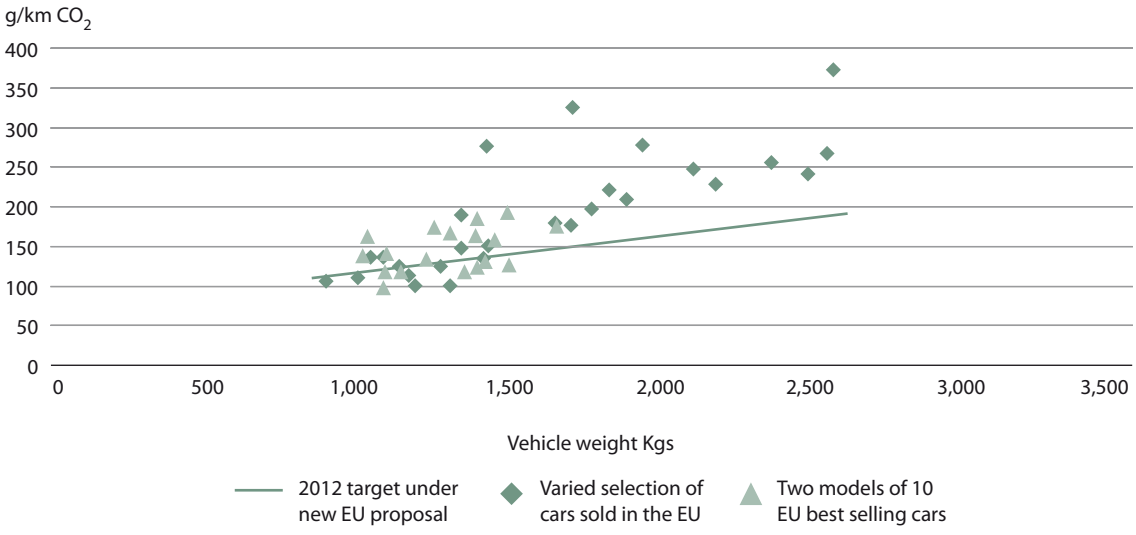
3.21 In March 2008 DfT published a feasibility study looking at **advanced motorway signalling and traffic management**[59]. The main proposal in this report was allowing the use of the hard shoulder as an extra lane on motorways during congested periods. The study found that, as a way of adding capacity, the environmental impacts of hard shoulder running were likely to be lower than those of conventional motorway widening. The report found that primarily by reducing congestion and thus inducing and enabling traffic to travel at higher average speeds, hard shoulder running was likely to lead to increased emissions compared to no additional road capacity. However, this would be slightly offset by the reduction in emissions brought about by the smoother traffic flow and reduced 'stop-start' driving brought about by hard shoulder running.

3.22 In 1995, the vehicle manufacturing industry associations signed up to **voluntary agreements to improve car fuel efficiency** (measured as grammes of CO_2 per kilometre travelled, gCO_2/km). These agreements were to take average tailpipe emissions of new cars sold from 186gCO_2/km in 1995 to 140gCO_2/km by 2008-09. They formed part of the European Union's wider strategy on CO_2 from cars that had a target of 120gCO_2/km by 2010. Some progress has been made towards the 140gCO_2/km target but it is not on course to be met.[60]

3.23 In December 2007 the European Commission published its proposal for a **new EU-wide regulation for new cars** imposing a mandatory sales-weighted average target of 130gCO_2/km by 2012. Under the proposal if a manufacturer fails to meet its target, it will be required to pay an excess emissions premium. The premium will be calculated by multiplying the number of gCO_2/km by which the manufacturer exceeded its target by the number of cars newly registered.

3.24 This proposed legislation will be introduced before 2012 but the final shape it will take is still subject to some debate – particularly between the major EU car manufacturing countries Germany, France and Italy. **Figure 28** illustrates the varying distribution of vehicles across the weight and emission spectrum relative for the utility curve setting the target of 130 g/km overall. There are currently negotiations underway about what the final slope of the target line will be – this will affect the distribution of effort between different car manufacturers.
There will also be negotiations on when fines will come into effect and how large they will be.

28 Current cars weight and carbon efficiency, showing proposed carbon efficiency target



Source: WhatCar?, European Commission, National Audit Office

3.25 The UK government has now announced that it is urging the European Commission to go further and set a longer term target to reduce the average new car carbon dioxide emissions to 100g per km by 2020.[61]

3.26 The **Renewable Transport Fuel Obligation** (RTFO) programme will, from April 2008, place an obligation on fuel suppliers to ensure that a certain percentage of their aggregate sales is made up of biofuels. The effect of this will be to require 5 per cent of all fuel sold on UK forecourts to come from a renewable source by 2010. The RTFO is expected to reduce carbon emissions from road transport in 2010 by about 0.7–0.8 million tonnes, equivalent to 2.6–3.0 million tonnes of carbon dioxide.[62] Suppliers of renewable fuels will be expected to provide a sustainability report on the environmental impact of production.[63]

3.27 In January 2008 the European Commission published a draft Renewable Energy Directive to increase renewable energy to 20 per cent of consumption across the EU by 2020. Within the draft Renewable Energy Directive the Commission proposes a binding target of 10 per cent renewable energy in petrol and diesel consumption for each member state. This 10 per cent target will be subject to the provision that biofuels will be supplied from a sustainable source and meet minimum greenhouse gas savings. There are currently negotiations underway on the Renewable Energy Directive and the targets that the member states will need to meet by 2020.

3.28 Recent developments on UK biofuels policy were set out in the 2008 budget. Ed Gallagher, chairman of the Renewable Fuels Agency, will lead a study of the wider economic and environmental impacts, including the impacts on food prices, of different forms of biofuel production and the Government has announced a new set of principles it believes EU biofuels policy should be based on. These are that:

- reducing greenhouse gas emissions must be at the heart of EU policy;
- targets must be set at the appropriate level, taking into account the indirect impacts of biofuels, and must be revised if they cannot be met in a sustainable or cost-effective manner;
- robust sustainability standards must be in place; EU policy must ensure a level playing field between domestic and international producers – in particular unfair EU biofuel import tariffs should be abolished; and
- in line with the UK's position on vehicle efficiency standards, the EU must get the balance right between encouraging biofuels and decarbonising cars.

Air policy

3.29 Aviation is an industry that operates essentially without subsidy, and all key players are either in the private sector or operate commercially. DfT's role is therefore to develop policies and long-term strategies; to facilitate their implementation; and to lead international negotiations in the aviation sector. The industry is regulated by the Civil Aviation Authority (CAA), an independent body with responsibility for economic, safety and consumer protection regulation, and airspace policy. Aviation's international nature means that there are few areas, apart from airport development, in which the UK can effectively make policy in isolation from other countries. Most new aviation legislation now originates from the EU. Globally the UK is one of 188 signatories to the Chicago Convention[64], working through the International Civil Aviation Organisation.

3.30 The 2003 White Paper **The Future of Air Transport** outlined the Government's framework for the development of airport capacity in the United Kingdom over the next 30 years. New runways were supported at Edinburgh, Birmingham, Stanstead and Heathrow if environmental constraints can be met; with runway extensions at Newcastle, Teeside, Leeds–Bradford and Bristol; and terminal expansions at several other airports.

3.31 The proposals mean that the projected future demand for air travel would almost be matched by building new capacity at a national level. Projections made by DfT are that demand would grow from 228 million passengers per annum (mppa) in 2005 to 495 mppa in 2030 if unconstrained.[65] However, continued demand growth would eventually become constrained by airport capacity. With the measures in the White Paper, capacity constraints would limit growth to 480mppa – three per cent below the unlimited capacity projections.[66]

3.32 **Inclusion of aviation in the EU Emissions Trading Scheme** is a UK Government goal. Negotiations are underway on including the sector towards the end of Phase II of the scheme. Draft legislative proposals for including aviation in the EU ETS were published by the European Commission in December 2006[67] and discussed in the Environmental Council in December 2007. The draft proposals agreed at the Council will now need to be considered by the European Parliament. The current draft of the Environment Council has agreed that:

- The scheme will cover all flights arriving at or departing from an airport in the Union as of 1 January 2012.
- The cap for the scheme would be average emissions from the 2004-06 period.
- In contrast to the existing scheme, the method of allocating allowances will be harmonised across the Union.
- Aircraft operators will be able to buy allowances from other sectors in the Union scheme to cover their emissions.
- Aircraft operators will also be able to use project credits – so-called Emission Reduction Units and Certified Emission Reductions – from the Joint Implementation or Clean Development Mechanisms.

Bus policy

3.33 **Putting Passengers First,** the Government's strategy for bus services stated that there may be a case for refocusing the subsidy, for example to provide a more direct linkage between subsidy levels and DfT's goals of increasing bus patronage, tackling congestion, improving accessibility, environmental performance, punctuality and quality of passenger experience. This document fed into the Local Transport Bill, which is currently before Parliament.

3.34 The **Bus Service Operators Grant** – formerly known as the Fuel Duty Rebate – is paid by DfT to reimburse bus operators for some of the excise duty paid on the fuel consumed in operating eligible bus services. The rebate amounts to around 70 per cent to 80 per cent of the fuel duty the operators pay. DfT is currently consulting on proposals to change the Bus Service Operators Grant, which includes environmental proposals such as a cap on payments to services with high average fuel consumption and a higher rate for the use of low carbon buses.

Cycling policy

3.35 In January 2008 DfT announced £140 million of funding for cycling over the next three years. In **A Sustainable Future for Cycling** the Government set out its plan for:

- 500,000 Year 6 children to be able to take part in Bikeability[68] cycle training by 2012.
- A new infrastructure programme.
- Up to 11 new demonstration areas (including a large conurbation) and possibly continued work in the existing six Demonstration Towns (subject to satisfactory plans from the current six and a bidding round for the new 11) to demonstrate visible change in a few key areas.
- Doubling the number of "cycling to school" champions.

- Development of a number of smaller programmes to get more people cycling.

3.36 This strategy follows the original National Cycling Strategy published in 1996 which set a target to quadruple the number of cycle journeys made. Since the earlier strategy came into force, cycle use has decreased and DfT has recognised the target will not be met.

Ports and shipping policy

3.37 The UK's shipping policy is developed in tandem with the EU and other international institutions, especially the International Maritime Organization. The most important measure introduced in relation to pollution from shipping is the International Convention for the Prevention of Pollution from Ships, 1973; this is known as **the MARPOL Convention**. This convention (later modified by a Protocol in 1978) defines international regulations in the following areas: pollution by oil; noxious liquids and harmful substances carried by sea; sewage and garbage from ship; and air pollution from ships.

Freight policy

3.38 Created in February 2005, the **Sustainable Distribution Fund** brings together into a single pot the funding of a number of separate programmes aimed at reducing the impact of freight movements on the environment, safety and other transport users so as to improve the prioritisation of expenditure on associated schemes. The introduction of the Fund has been phased and was completed in 2007-08.

3.39 The Fund comprises two programmes. The mode shift programme is intended to encourage the movement of freight from road transport to rail or water. This programme itself embraces the longstanding Freight Facilities Grant, the Rail Environmental Benefits Procurement Scheme and the Water Freight Grant. In 2007-08, schemes funded through the mode shift programme are expected to remove one million lorry journeys from the road.[69] The efficiency programme encourages greater efficiency of freight transport within the various modes. The minimum budget for the Fund for the three year period 2007-08 to 2009-10 is £76.5 million.

Behaviour change and information campaigns

3.40 A range of measures which attempt to change people's behaviour towards more sustainable travel are being tested and promoted under DfT's **Smarter Choices** programme. These seek to give better information and opportunities, aimed at helping people reduce their car use while enhancing the attractiveness of alternatives. They are a fairly new part of mainstream transport policy, mostly uncontroversial, and often popular.[70] They include:

- workplace and school travel plans;
- personalised travel planning, travel awareness campaigns, and public transport information and marketing;
- car clubs and car sharing schemes; and
- teleworking, teleconferencing and home shopping.

3.41 A 2004 study into the potential impacts of such measures conducted for DfT found that if they were much more widely prioritised and implemented their impacts could be:

- a reduction in peak period urban traffic of about 21 per cent (off-peak 13 per cent);
- a reduction of peak period non-urban traffic of about 14 per cent (off-peak seven per cent); and
- a nationwide reduction in all traffic of about 11 per cent.

3.42 DfT aims to promote these kinds of measures to local authorities for incorporation in local transport plans. In particular, since 2004, support has been provided for three **'sustainable travel towns'** (Darlington, Peterborough and Worcester) where funding has been supplied for local integrated transport projects and use of smarter choices methods. Over a three year period, Darlington aims to provide travel advice to all of its 40,000 households; so far there has been a 65 per cent increase in cycling and a 9 per cent reduction in car trips.[71]

Local and regional government

3.43 The vast majority of journeys depend on locally maintained infrastructure or local public transport.[72] English local authorities are responsible for 97 per cent of all road length, which carries about 70 per cent of all traffic. Local Transport Authorities (outside of London) are responsible for planning, procuring and maintaining, local roads, buses, taxis, light rail services, walking and cycling facilities. In most areas the Local Transport Authorities are county councils or unitary authorities. In the metropolitan counties Local Transport Authorities are made up of district councils and Passenger Transport Authorities which have specific responsibility for public transport.

3.44 **Figure 29** shows the 'two tier' system of local and regional government introduced in the late 1990s. Under this system Regional Assemblies are responsible for producing a Regional Spatial Strategy, which includes a Regional Transport Strategy. These then serve as a basis for the Local Development Frameworks and Transport Plans.

3.45 The 2007 review of sub national economic development and regeneration[73] made proposals to reform regional governance. The review proposed that Regional Assemblies be discontinued in their current form and their responsibilities on regional planning move to RDAs working with local authorities and other interests in the region. Local authorities will be given a stronger role in economic development and planning and will be encouraged to work more closely with RDAs. A consultation on these proposals was published in March 2008 which will run until June 2008.[74]

3.46 Regional Assemblies currently have a statutory duty to make Regional Spatial Strategies contribute to sustainable development. Under the new Local Transport Bill (see paragraph 3.33) which was introduced to the House of Lords in November 2007, local authorities will have a duty to take the protection and improvement of the environment into account in development of transport plans.

29 Regional and local planning

Organisation	Spatial planning		Transport planning	
Regional Assemblies	Regional Spatial Strategy 15–20 years	High level spatial plan. One statutory objective of these plans is that they must contribute to sustainable development.	Regional Transport Strategy 15–20 years	Sets out how national transport policies and programmes will be delivered in the regions, outlines the transport and related land use policies and measures required to support the spatial strategy.
Local Authorities	Local Development Framework Updated annually	This sets out core strategy and site specific allocations of land. Should be consistent with the policies and priorities set out in the Regional Spatial Strategy	Local Transport Plans 5 years	Sets out local transport strategies and policies and an implementation programme. Should be consistent with the policies and priorities set out in the Regional Transport Strategy

Source: Planning Policy Statement 11: Regional Spatial Strategies

Spatial planning

3.47 Spatial planning can change the way transport works in an area. By shaping the pattern of development and influencing the location, scale, density, design and mix of land uses, planning can help to reduce the need to travel, reduce the length of journeys and make it safer and easier for people to access jobs, shopping, leisure facilities and services by public transport, walking, and cycling. Consistent application of these planning policies can help to reduce some of the need for car journeys (by reducing the physical separation of key land uses) and enable people to make sustainable transport choices. These policies are therefore part of the Government's overall approach to addressing the needs of motorists, other road and public transport users, and business by reducing congestion and pollution and achieving better access to development and facilities.[75]

3.48 The Government policy on how transport should be considered in the planning process is in **Planning Policy Guidance 13** (PPG 13) published in 2001 by the Department for Environment, Transport and the Regions, and in various planning policy statements, which include PPS 1: Delivering Sustainable Development and its supplement: Planning and Climate Change. PPS1 takes precedence over the other PPGs/PPSs on climate change matters. Local Planning authorities must take the contents of all of this guidance into account in preparing their development plans. The guidance may also be relevant to decisions on individual planning applications and appeals.[76]

3.49 PPG 13 sets out a range of measures that local planning authorities should consider when preparing development plans and considering planning applications. The objectives of the guidance are to:

- promote more sustainable transport choices for both people and for moving freight;
- promote accessibility to jobs, shopping, leisure facilities and services by public transport, walking and cycling; and
- reduce the need to travel, especially by car.

3.50 Other guidance encourages more sustainable options. Planning Policy Statement 6: Planning for Town Centres (PPS 6)[77] asks local planning authorities to ensure that jobs, shopping, leisure and tourist facilities and a wide range of services are located in town centres. Local planning authorities are also asked to assess the distance of proposed developments from bus and railway stations and transport interchanges. And a draft Planning Policy Statement 4: Planning for Sustainable Economic Development sets out policies for achieving sustainable economic growth, including through the identification and protection of key distribution networks. This also proposes repeating the national maximum parking standards for non-residential development in PPG 13, asking local authorities to set a maximum standard at the local level.

3.51 The government's **Planning Bill,** introduced to the Commons in November 2007, aims to improve the efficiency, transparency and accessibility of the planning process for nationally significant infrastructure projects. The Bill proposes creating National Policy Statements for key infrastructure sectors, including transport, which set out a framework for making decisions. These Statements will aim to integrate social, environmental and economic considerations. Decisions on these projects will be taken by an independent body – the Infrastructure Planning Commission. In addition, the Bill introduces a single consent system repealing the separate regimes for approving infrastructure development in the energy, transport, water, waste-water and waste sectors.

Housing and transport

3.52 The Government has a target to deliver **2 million new homes by 2016.**[78] Responsibility for this target lies with CLG but most of the planning decisions will take place at a local and regional level and the majority of the building will be completed by private developers. The development of these new homes is to be done through a range of programmes:

- 1.6 million homes are already in existing Regional Spatial Strategies (RSS) and plans now in place including around 650,000 homes in Growth Areas (Thames Gateway and Milton Keynes).
- 150,000–200,000 additional homes in the new round of RSS and plans now under consideration.
- 100,000 extra homes in 45 towns and cities that make up the 29 New Growth Points.[79]
- An additional round of New Growth Points that would deliver around 50,000 new homes.
- Five new eco-town schemes, with the entire community designed to be able to reach zero carbon standards. Each scheme could provide between 5,000 and 20,000 new homes giving a total of some 25,000–100,000 homes.

3.53 In May 2007 the NAO published a report looking at the **Thames Gateway Growth Area**.[80] That report found that transport infrastructure had been the main constraint to development in the Gateway. Reasons for this included:

- Poor engagement of transport agencies into spatial planning for the Thames Gateway because the management of transport is fragmented between various bodies which lack a geographical focus on the area.
- There is a tension between providing new infrastructure and maintaining the existing network. The Highways Agency ministerial direction charges them with managing the existing strategic road network, and does not provide for the need to develop extra capacity for planned increases in population. As a result developers have to fund strengthened road infrastructure and this may work against more sustainable solutions.
- Sustainable transport models were not included from the start of the programme. There was no transport strategy for the Thames Gateway, and local modelling of the effects of development was only being put in place in May 2007.

3.54 The new **eco-towns** proposals are required to include area-wide travel plans setting out how they intend to achieve a significantly higher proportion of journeys on foot, by cycle and by public transport than comparable sized settlements. These new settlements are now at the early stages of consultation following a cross government review, including DfT and Defra, of the initial proposals which considered the viability and sustainability of the proposals. In April 2008 DfT published guidance[81] on sustainable transport in the eco-towns and Growth Points alongside practical guidance supplemented by a worksheet produced by the Town and Country Planning Association.[82] This guidance sets out advice on how to build a sustainable transport system in new developments, and recommends a variety of sustainable transport options according to the location and needs of the individual development.

Local Transport Plans

3.55 The main thrust of government policy in the delivery of local transport is to encourage local authorities to develop transport strategies that complement the rest of the regional and local spatial and transport planning. Local Transport Plans set out local transport strategies and policies and an implementation programme, over a five year period. They are not subject to formal approval by DfT, but DfT does make an assessment of each plan, and of its delivery. The last round of transport plans covered the period 2006-07 to 2010-11. The next round of plans will be produced in 2010.

3.56 DfT's assessment of delivery of the plans informs decisions on funding for local authorities – which is done with CLG. Some of the allocation for funding for larger projects in the Local Transport Plans is on the basis of a formula relating to key transport priorities – which now include reducing the impact of transport on the environment. DfT does have some influence over the Local Transport Plans and also provides guidance to local authorities on best practice.

London

3.57 Transport in London is organised in a different way to the rest of the country. The Mayor of London is responsible for London's transport strategy and Transport for London (TfL) is the executive body which runs most of London's transport and reports to the Mayor. As well as strategy, TfL is directly responsible for London's strategic roads, its bus services, the London Underground system, the Docklands Light Railway, Croydon Tramlink, taxi regulation and river services. TfL currently has an income of approximately £5 billion per year. Of this, slightly over 60 per cent comes from fares and congestion charge income, council tax precept and other sources. The rest comes from a central government block grant known as the GLA Transport Grant.[83]

3.58 London was the first city in the world to introduce a congestion charge. In the first year, 2003, levels of congestion in the charging zone were typically around 30 per cent lower than in 2002. The impact on congestion has since reduced to around 22 per cent (comparing 2005 with 2002). The congestion charge has also led to reductions in CO_2 emissions from road transport in the charging zone of around 16 per cent in 2003 compared to 2002.[84] In 2007 the congestion charging zone was expanded. In addition, since February 2008 London has introduced a low-emissions zone in which heavier lorries must pay a daily fine if they do not meet stringent European emissions standards.

3.59 In contrast with the rest of the country, London has experienced increased bus use, and cycle use has increased by more than the national rate.

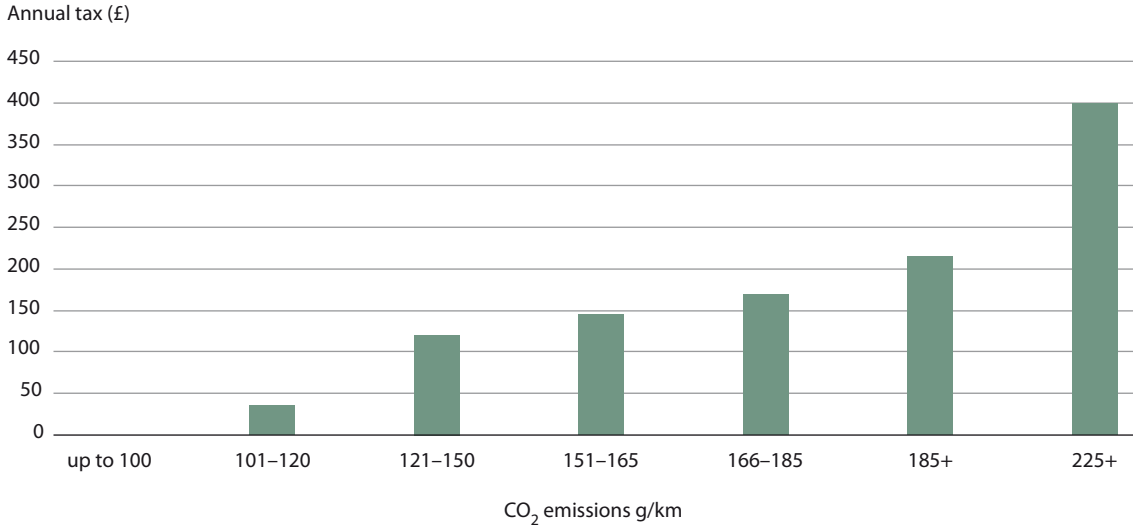
The Treasury

3.60 The Treasury uses a number of fiscal instruments to influence transport choices. For cars registered on or after 1 March 2001 there is a system of **Vehicle Excise Duty (VED)** bands based on the CO_2 emissions rating of the vehicle **(Figure 30 overleaf)**. Critics of the system have argued that the difference in tax rates between bands is too small to provide an incentive to buy a less polluting car.[85,86] In their response to the Government's Climate Change Programme, the Sustainable Development Commission[87] modelled the impact of much higher differentials between each band, and found that this would push down the average emissions rating for new cars to 146gCO_2/km compared to the current 167gCO_2/km.[88]

3.61 The 2008 Budget introduced changes to VED which will be introduced from 2010 **(Figure 31)**. These include:

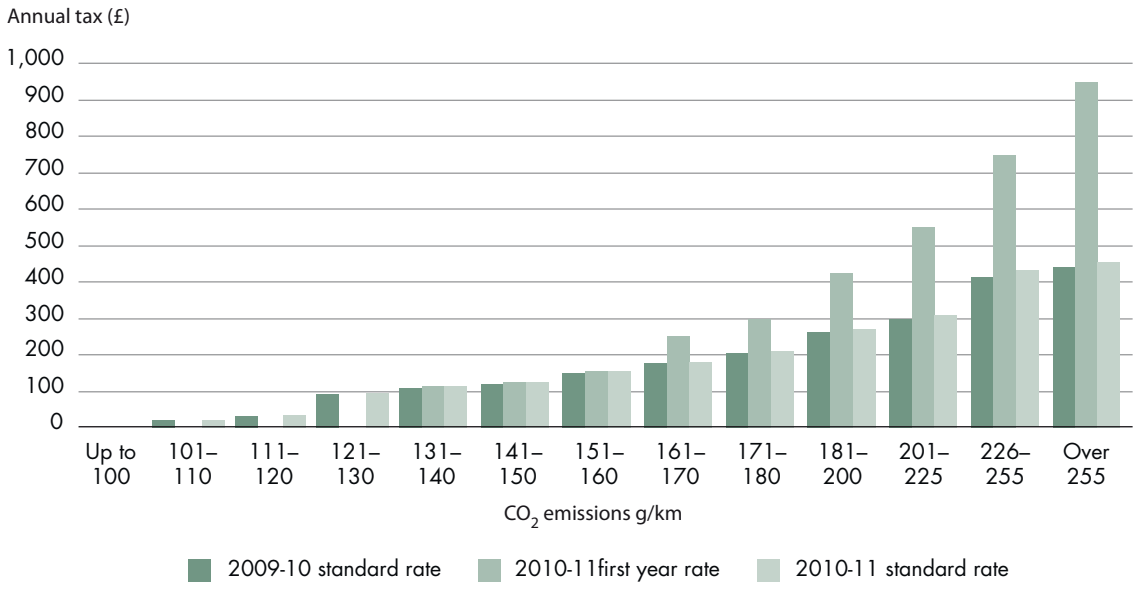
- six new VED bands from 2009-10 – including a new top band (band M) for the most polluting cars that emit more than 255gCO_2/km;
- reducing the standard rate of VED, in 2009-10, for all new and existing cars that emit 150gCO_2/km or less, and increasing the standard rate of VED on the most polluting cars to £425;
- from 2010-11, extending the zero rate of VED, during the first year of ownership, to all new cars that emit 130gCO_2/km or less – the EU proposed target for average new car emissions in 2012;
- holding the first-year rate for all new cars that emit between 131 and 160gCO_2/km equal to the standard rate in 2010-11;
- introducing for the most polluting cars a first-year rate of £950 in 2010-11; and
- providing a £15 or £20 discount for alternatively fuelled cars in 2009-10, and £10 in 2010-11; and aligning the alternative fuel and standard rates of VED in 2011.

30 Vehicle Excise Duty bands, 2008



Source: DfT

31 Vehicle excise duty bands and rates from 2009, announced budget 2008



Source: Budget 2008

NOTE

First year rates: There will also be a new VED rate for the first year of owning a new car from 1 April 2010, with higher rates for the most polluting cars.

3.62 The **company car tax** system was reformed in 2002 away from being based on engine size, to provide financial incentives for employers and company car drivers to choose cars that produce lower CO_2 emissions. It also aims to encourage car manufacturers to develop and introduce greener cars. The company car tax reform is leading to reductions in CO_2 emissions estimated at around 0.2–0.3 MtC in 2005 which may increase to around 0.35–0.65 MtC by 2010 and reach a maximum level of savings in the long run of around 0.4–0.9 MtC per year towards the end of the next decade.[89]

3.63 In the 2007 Pre-Budget Report the Government announced changes to **Air Passenger Duty** from a charge per passenger to a charge per plane. A consultation on the new duty opened on 31 January 2008 and will close on 24 April 2008. The consultation will consider including ways in which to make the new duty more aligned to environmental impacts.

Previous Committee interest

Environmental Audit Committee

Are biofuels sustainable? 2008

Reducing carbon emissions from transport, 2006

Proposals for a draft Marine Bill, 2006

Aviation: sustainability and the government's second response, 2004

Aviation: sustainability and the government's response, 2004

Pre-budget report 2003: aviation follow up, 2004

Budget 2003 and Aviation, 2003

1 ONS, *Out of town developments 1976-1999: Social Trends 31*.

2 DfT, *Transport statistics*, 2007.

3 By passenger kilometres Transport statistics, 2007

4 By goods lifted Transport statistics, 2007

5 Transport statistics, 2007.

6 ONS, transport statistics.

7 DfT, *Towards a sustainable transport system,* 2007.

8 *Delivery Chain Analysis for Bus Services in England*, NAO, 2005.

9 *Bus Services across the UK, Select Committee on Transport*, 2005. National Travel Survey, DfT, 2006.

10 DfT, *Delivering a Sustainable Railway*, 2007.

11 DfT, *Delivering a Sustainable Railway*, 2007.

12 It is projected that demand for air travel will outstrip supply if no further airport capacity in the form of new or lengthened runways or additional terminals is added. The airport expansions supported in the Government's Air Transport White Paper will supply some additional airport capacity but not enough to supply all of the projected air travel demand – thus constraining demand.

13 DfT, *Towards a Sustainable Transport System,* 2007.

14 Transport statistics.

15 International Maritime Organization website.

16 Transport Statistics, 2007.

17 Poor air or water affecting habitats, changes in land use affecting water quality and supply.

18 CO_2 emissions from transport have increased by nearly 11 per cent since 1990. See Defra *e-digest statistics, carbon dioxide emissions by source, 1990 – 2006*.

19 CO_2 projections for road transport and the rest of the economy come from (BERR 2008) Updated Energy and Carbon Emissions Projections. For aviation we use (DfT 2007) UK Air Passenger Demand and CO_2 Forecasts. CO_2 projections are also made in DfT's Road Transport Forecasts for England 2007. The BERR model provides whole economy modelling of energy use and associated emissions, of which transport is a part. The DfT aviation and road transport models allow for a greater level of detail in modelling the transport sector and specific transport policies. The DfT road transport model only covers England whereas the historic data and BERR projections cover the UK; therefore we have used the BERR projections for road transport emissions projections. However, the rate of change of emissions is similar in both models. The DfT aviation model covers UK domestic and international flights whereas the BERR model excludes international aviation; therefore we have used the DfT model for aviation emissions projections to give a more comprehensive picture.

20 Pg 10, Defra (2008) *Statistical release – UK climate change sustainable development indicator – 2006 greenhouse gas emissions, final figure*. www.defra.gov.uk/environment/statistics/globalatmos/download/ghg_ns_20080131.pdf.

21 The TRADEOFF project is a model based investigation into the atmospheric impacts of aviation carried out at Cambridge University.

22 End user emissions look at what the final use of the activity generating emissions was. For example, the source of carbon emissions may be from fuel processing industries, but the end user could be a car where that fuel is finally consumed ("well-to-wheel").

23 Defra, *e-digest of statistics,* Jan 2007.

24 The UK Climate Change Committee is likely to consider traded and non-traded sectoral trajectories, to ensure the UK meets its targets as set in the Climate Change Bill to reduce CO_2 emissions by 26-32 per cent by 2020, and 60 per cent below 1990 levels by 2050.

25 Pg 10, Defra (2008) *Statistical release – UK climate change sustainable development indicator – 2006 greenhouse has emissions, final figure*. www.defra.gov.uk/environment/statistics/globalatmos/download/ghg_ns_20080131.pdf.

26 International aviation is not included in the formal estimates of UK greenhouse gas emissions for the purposes of reporting against the UK's domestic and international targets. However, data on international aviation fuel bunkers is presented as a memo item in UK reports for the purposes of the Kyoto Protocol.

27 Defra, *e-digest of statistics,* Jan 2007.

28 Eutrophication describes the process by which nutrients such as nitrogen can cause accelerated plant growth in terrestrial and aquatic ecosystems. Over time excessive levels of plant matter can lead to oxygen depletion in lakes, and eventual infilling of the water body.

29 Data from the National Atmospheric Emissions Inventory, www.naei.org.uk.

30 Air-quality.net.

31 Sustainable development indicators, 2007.

32 Including benzene, carbon monoxide, lead, nitrogen dioxide, particulates, sulphur dioxide, 1.3 butadiene and polycyclic aromatic hydrocarbons.

33 http://www.defra.gov.uk/environment/airquality/strategy/index.htm.

34 Based on UK National Air Quality Archive, www.airquality.co.uk.

35 CO, NOx, ozone, particulates and sulphur dioxide.

36 *Sustainable development indicators in your pockets*, National Statistics, 2007.

37 Community fragmentation can have social and economic effects such as impairing people's access to amenities, goods and services.

38 Transport statistics, 2007.

39 DfT, *The Future of Air Transport*, 2005.

40 DCLG, *Land Use Change in England to 2006: Additional Tables LUCS-22A*, 2007.

41 UNEP Global Programme of Action for the Protection of the Marine Environment from Land-based Sources.

42 Science, *A Global Map of Human Impact on Marine Ecosystems*, 2005.

43 See END document at: http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l_189/l_189200207 18en00120025.pdf.

44 World Health Organisation, *Guidelines for Community Noise*, 2000.

45 LAeq measures equivalent continuous sound pressure level.

46 BRE, *The National Noise Incidence Study 2000 (England and Wales)*, Feb 2002.

47 *The 1999/2000 National Survey of Attitudes to Environmental Noise*, Building Research Establishment (BRE). Prepared for DEFRA, the National Assembly for Wales, the Scottish Executive and the Department of the Environment for Northern Ireland, 2001.

48 *The Environmental Noise (England) Regulation 2006*, Explanatory Memorandum.

49 *Towards a sustainable transport strategy*, 2007.

50 Local authority funding comes from a combination of central government funding (through DCLG) and locally raised funding such as council tax.

51 This spending includes spending on major schemes with around half relating to the cost of capital rather than direct costs.

52 The £3 billion funding for Transport for London comes through a grant from DfT.

53 NATA is used for all individual projects which directly require DfT funding and approval. However, NATA is not used for some smaller local projects which DfT partly funds but does not provide approval for at a project level. Also, DfT provide funding to Transport for London where projects do not have to go through the NATA process.

54 *Getting transport right*, 2008, Campaign for better transport.

55 Heathrow expansion – its true costs, Friends of the Earth 2008, http://www.foe.co.uk/resource/briefings/heathrow_expansion.pdf.

56 *Department for Transport: Estimating and monitoring the costs of building roads in England*, NAO, 2007.

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64 The Convention on International Civil Aviation, also known as the Chicago Convention, established the International Civil Aviation Organization (ICAO), a specialized agency of the United Nations charged with coordinating and regulating international air travel. The Convention establishes rules of airspace, aircraft registration and safety, and details the rights of the signatories in relation to air travel. The Convention also exempts air fuels from tax.

65 In making the projections DfT have assumed that after 2010 aviation will be included in the EU ETS.

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