The Royal Academy of Engineering

Transport 2050:

The route to sustainable wealth creation

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Foreword

Transport is the lifeblood of the nation; all our other achievements, in science, medicine and the arts, are diminished if people cannot gain access to them. Rudyard Kipling even wrote that transport "is" civilisation. It is well established that there is a strong link between the increase in the movement of people and goods and the growth of GDP. Over the past 50 years the number of vehicles has grown almost sevenfold, and traffic by a factor of eight.

Unfortunately, transport policy and investment have failed to respond adequately to this growth. As a result Britain's roads are the most congested in Europe, costing us an estimated £15 billion each year, a sum that is likely to double in the next decade unless action is taken. Road accidents result in over 3000 deaths each year, and road travel is eight times as dangerous as the rest of everyday life. Transport already accounts for 28% of all CO2 emissions, and the projected growth in its contribution to global warming is at odds with Government targets.

We can do better than this. The Royal Academy's vision is of a world-leading transport system that underpins our economy, meets social needs, enhances quality of life and the environment, and contributes to long-term sustainability. Achieving this vision will require action on several fronts. Improving our infrastructure and making better use of technology – the traditional focus of engineering – will play a part, but the key requirement is to introduce effective "true cost" charging for the use of all forms of transport. Better management and regulation and closer integration of transport and land use planning will also be important. Our report advocates action on all of these fronts. Above all it argues, drawing on the principles of systems engineering, that these actions must be planned, designed and implemented together as a coherent strategy. This holistic approach is essential if transport is to operate effectively as a system.

Improved governance of the transport system is also essential. National government needs to provide long term and stable leadership. Regional and local strategies must be consistent with the national vision. Implementation should be the responsibility of effective agencies and the private sector, who must work within the guidelines set by national, regional and local strategies. The report advocates the establishment of a National Roads Corporation and a National Rail Corporation, operating at arm's length from government, and the adoption, throughout the country, of London's successful system of regulated competition for bus services. The introduction of true cost charging will revolutionise the ways in which the transport system is financed, and send clearer signals for investment.

Everything in our society depends on transport – schools, hospitals, industry, the retail and service sectors, culture, entertainment and sport. There is virtually nothing in our society that cannot be enhanced – or harmed – by the way in which our transport system operates. If we do not wake up to the need for a long term and coherent plan for our transport system, and ensure that it is implemented, our society, and our international competitiveness, will be diminished. The Royal Academy of Engineering takes this challenge seriously, and stands ready to work with government, the public and private sector, in ensuring that it is met.

Lord Broers FREng FRS
President
The Royal Academy of Engineering

Executive Summary

Transport is essential to Britain's economy and to the ways in which we live. The increased opportunities for travel have led to an eightfold increase in the movement of people and freight in the last fifty years, bringing with it significant enhancements in wealth creation and the quality of life.

But the investment in transport infrastructure has not kept pace with this rate of growth, and our approaches to the management and maintenance of our transport system have left much to be desired. As a result we have the most congested roads, the highest public transport fares and among the worst provision for those without cars of any country in Western Europe. Despite significant advances in vehicle technology and traffic management, transport still accounts for around a third of accidental deaths, is the largest source of many serious pollutants, and is increasingly being identified as a major contributor to ill health.

There are many factors that affect future traffic growth, but in the absence of major shocks we can expect that road traffic will grow by at least a half by the middle of the 21st century with rather more growth in interurban and rural traffic than in the inner parts of large cities. This growth will be equivalent to adding the amount of traffic on the roads in 1977 to current levels.

Such further growth will aggravate the two most serious impacts of our transport system: congestion and global warming. Congestion already costs the UK an estimated £15bn each year, and that figure is expected to double over the next decade as more of our transport system reaches capacity. Transport already accounts for 28% of all CO_2 emissions in the UK, and that percentage is set to grow. Carbon dioxide emissions are one of the principal causes of global warming, and the government has rightly set a target of a 60% reduction in emissions over the next fifty years. Targets can be expected to vary between sectors depending on the relative difficulty of achieving them. It is clear that the resulting target for transport will not be achievable through technological advances alone; significant changes will also be needed in the ways in which we use transport.

Transport policy must rise to these challenges. Our vision is of a land, sea and air transport system that underpins the continuing prosperity of the UK, supports wealth creation and enhances quality of life, while respecting the environment, meeting social needs and contributing to long-term sustainability. We have set a fifty year horizon, but action is needed now if our vision is to be realised in this timescale.

No single engineering solution, fiscal regime or organisational structure will be sufficient to achieve this vision. An effective transport strategy must combine appropriate charges for travel, new infrastructure, enhanced technology and better management and regulation. Strategies for land use and transport need to support and enhance one another.

Within this holistic approach, the most fundamental element is a comprehensive revision of the ways in which we pay for travel. Current transport charges are inconsistent, fail to reflect the real costs of travel, and hence send the wrong messages to transport users and providers. We should move as rapidly as possible to a system of true-cost charging, in which those who use the transport system pay the true costs of their journeys.

Those costs should include the direct costs of providing, maintaining and enhancing the transport system, and the indirect costs of congestion, pollution and accidents. Most charges should relate to the distance travelled, with additional charges in the most congested parts of the network and where environmental impacts are more severe. The technology to facilitate such charges is well advanced, and we see no case for delaying its introduction. There may be a case for selective subsidies where the transition to this new charging regime causes hardship, but such subsidies should be targeted and transparent.

True-cost charging will change the pattern of transport use. Journeys will be shorter, there will be less travel on congested roads, and public transport use in and between towns will increase but, conversely, there will be some increases in private transport in rural areas where costs will fall. These changes will not remove the need for new infrastructure, but they will affect where it is required. In due course infrastructure planners will be able to use the amount that people are willing to pay as a guide to the locations where investment is needed. But infrastructure investment is needed now, and should not be deferred while the new charging regime is developed and implemented. A real increase in the resources committed to infrastructure maintenance is also crucial.

Much can be achieved by better management of the existing infrastructure. The UK is already a world leader in innovative urban traffic management, and must continue to apply its skills to get the most out of the infrastructure that we have. At the same time we need to do more to protect people and the environment from intrusive traffic, and to intensify the application of highly cost-effective accident remedial measures. Traffic management, reallocation of road space and better urban design can also make walking and cycling more attractive and contribute to an enhanced quality of life in our towns and cities.

International regulation will continue to be an important means of achieving environmental and safety benefits, and the UK needs to encourage the EU and international agencies to adopt more demanding requirements. Changes in the regulation of our public transport systems are urgently needed; in particular the system of regulated competition for bus services which has proved successful in London should be extended to the rest of the country.

Technological developments are essential on a number of fronts. Information technology will be key to the implementation of our charging policy, but will also serve to improve the information available to users, enhance the safety of their journeys and offer alternatives to travel. In the longer term it may provide new and automated modes which reduce the need for new infrastructure. Vehicle, propulsion and fuel technologies will continue to be the main means of environmental improvements, and will be increasingly important in contributing to reduced CO_2 emissions. Infrastructure technology can reduce the costs of construction and maintenance, and contribute to environmentally enhanced designs.

This holistic strategy will only be implemented effectively if a similarly holistic approach is taken to the governance of transport. The Department for Transport needs to retain overall responsibility for long term strategy, and must have a greater influence on those decisions taken by other government departments and agencies which affect the transport system. It should also take a stronger lead in increasing public engagement and stakeholder involvement in the development and implementation of transport strategy.

Implementation at a national level should be in the hands of public interest corporations, operating at arm's length from the Department but answerable to government. A National Roads Corporation should manage, maintain, develop and charge for the use of the national road network, which should be redefined to include all roads throughout the country which are of national importance. There is a strong case for implementing similar institutional arrangements for the national rail network. The Department for Transport should be responsible for ensuring inter-modal consistency between these national corporations, and with the operators and users of major ports and airports.

Consistency is also needed between the national, regional and local management of transport. Each region should develop a regional transport and spatial strategy which is consistent with the national strategy, but reflects the particular aspirations of that region. Local transport and spatial strategies then need to be developed together by each local authority in ways which reflect the requirements of the regional strategy. Except in London and the largest conurbations, we do not see a need for regionally managed infrastructure

and services; these should continue to be the responsibility of local government. However, there is a strong case for extending the concept of conurbation-wide public transport planning, reflected by the Passenger Transport Authorities, to all modes and to more conurbations.

The financing of transport will be revolutionised by our proposed charging system. Most of the costs of providing, operating, maintaining and enhancing the transport system will be met by the users, and it will be for the national corporations and local authorities which receive this income to demonstrate that they are using it effectively. There will be a case for continued national and local government support for selected infrastructure projects, backlog maintenance and some socially necessary public transport services, but such support should be fully justified and transparent. Approaches to the financing and appraisal of transport projects should be consistent across the modes and between types of intervention. In return for the increase in direct user contributions, government should reduce its demands on transport as a source of general taxation. Those taxes that remain should apply to the point of use rather than to the ownership of vehicles and infrastructure.

All of the agencies involved need to plan on a consistent basis. The adoption of concurrent and compatible five year plans is strongly advocated. Consistent and comprehensive supporting data will be essential in ensuring that these plans are soundly based and effectively monitored. The private sector will have an important role in the implementation and operation of these plans, but should operate within the strategy and priorities determined by the public sector.

No strategy for transport can succeed without a skilled work force to ensure its effective implementation. The continuing shortage of engineers poses a particular challenge. The Department for Transport should forecast skills requirements, and should actively encourage action to fill any gaps.

Further research is needed, particularly into solutions to the challenges of congestion, accidents and global warming. The Department for Transport should continue to stimulate and support such research, and help sustain the UK's leading position in international research. It also needs a more effective approach to the exploitation of new technologies, by committing itself to sharing the development risks with the private sector.

We cannot pretend that these recommendations will answer all of the challenges which the country's transport system will face over the next fifty years. In particular it may well be that the challenge of global warming will require more draconian action. But our recommendations should provide a strategy and approach for governance better suited to the needs of our country, and should enable this fifty year vision to be realised. However, they will only do so if action is taken now, particularly on our recommendations for charging, infrastructure and governance. We commend our strategy to government, and intend to review progress against it in five years' time.

1 A vision for transport

Efficient transport is essential to Britain's economy. As individuals, we use the transport system to get to work, to shop, to socialise and for recreation. Transport also delivers products and services, and generally ensures the efficient operation of business, government, education and many other activities that are important to society.

Comparisons with continental Europe show that the UK has the most congested roads, the highest fares for public transport and some of the poorest access to transport for people without cars[1]. Thus the state of the transport system in the UK is an obstacle to wealth creation and jeopardises the country's competitive position.

Over the last few years the government has produced a number of White Papers and statements on key aspects of transport strategy. During the last year it has published *The Future of Transport: a network for 2030*, *The Future of Rail* and *The Future of Air Transport*. These look forward thirty years within an overall concept for transport and as such provide the best basis we have seen for addressing the country's transport problems for many years. Whilst the Academy applauds Government for squaring up to what is one of the most challenging areas of public policy and supports much of what is proposed, we believe that an even longer term strategy is needed. Moreover, there are some difficult problems on which action is needed now if that strategy is to be realised.

The central role of transport prompted the Royal Academy of Engineering to set up a working group to investigate the challenges and opportunities for transport in the UK. The members of the working group are drawn from many disciplines and include people with an intimate knowledge of each transport sector.

We naturally recognise the important part that engineering will play in the future of transport. However, we are well aware that engineering is a part of a bigger picture. We have, therefore, considered the wider economic, social and political context within which the country's transport system operates.

A 50-year vision

Transport faces challenges both in the immediate future and in the longer term. Such is the nature of the infrastructure that it takes many years to bring about substantial changes. For this reason, we need to look forward over the next 50 years in developing an effective strategy.

Before we can provide a plan of action for the future of transport in Britain, we have to ask ourselves what the country expects of the nation's transport system over the next 50 years. Our vision for 2050 is of a land, sea and air transport system that underpins the continuing prosperity of the UK, supports wealth creation and enhances the quality of life, while respecting the environment and meeting social needs. Such a vision requires harmonious management and development of all forms of transport, making full use of technological and engineering innovations, so that each mode plays a full role.

[1] Commission for Integrated Transport (2001) European Best Practice in Delivering Integrated Transport, http://www.cfit.gov.uk/research/ebp/key/. Accessed 6 February, 2005.

Our report

Our analysis concentrates on transport in Great Britain and its links to the continent. We exclude Northern Ireland partly because the arrangements there are different, and partly because a study covering the whole of Ireland has been undertaken by the Irish Academy of Engineering[2]. However, we hope that much of what we recommend will have relevance there also.

In Chapter 2 we describe the context within which the transport system operates, and consider the demographic and economic changes that transport must accommodate and, where possible, anticipate. In Chapter 3 we describe the challenges facing transport, including the pressures on the economy, environment and health, safety and security. Chapter 4 sets out our strategy to meet these challenges; Chapter 5 identifies the institutional and financial changes required to achieve this strategy. Chapter 6 summarises our recommendations.

[2] Irish Academy of Engineering (2004) *A Vision of Transport in Ireland 2050*. Dublin.

2 Context

Introduction

The demand for passenger and freight transport depends on many factors. In particular, the development of the economy and the size and make up of the population influence the transport required. Providing and operating the transport infrastructure inevitably draws on many resources, from the land occupied by roads, railways and other modes of transport, to the energy consumed, not forgetting the skilled workforce required to make everything work. This chapter considers the factors that drive the demand for transport and shape its supply.

The economy and transport

There is a strong link between the increase in movement of people and goods and the growth of the national economy. The demand for transport and growth in GDP have kept broadly in step for many years (see Figure 1). Rising GDP per head will lead to significant further growth in demand for transport, but projections simply based on past trends may overestimate future growth. Moreover, appropriate policies could help to weaken the link between transport demand and economic growth in the interests of sustainability.

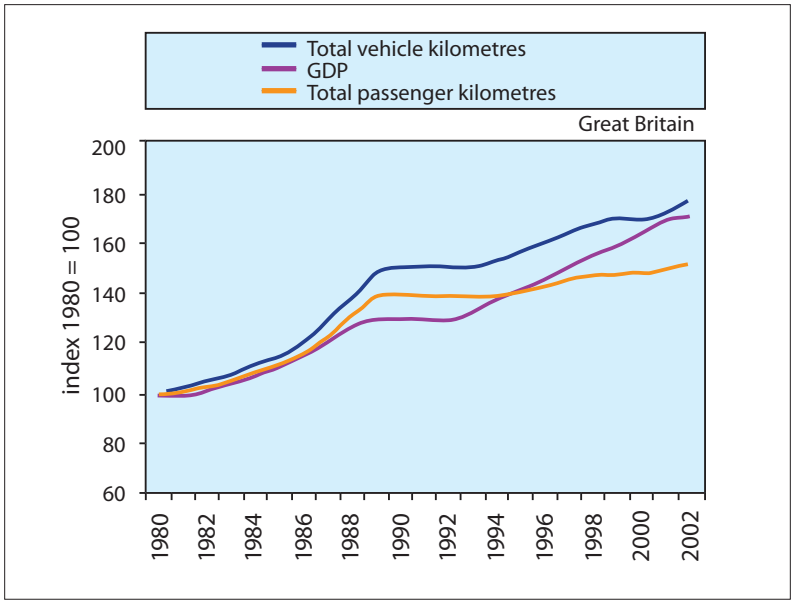

Figure 1: Trends in traffic, passenger-km and GDP

Source: Transport Trends 2003, Department for Transport

Economic development changes the nature as well as the demand for mobility. Higher incomes have tended to bring with them increased car ownership and use, and an associated reduction in how much we use buses and how often we travel by train. But three quarters of households now have at least one car, so the growth in the number of vehicles may be slower in future as ownership reaches saturation. Despite this, car use and road traffic will continue to increase.

Over the last fifty years the number of road vehicles has grown almost sevenfold, and traffic by a factor of eight. Most of this growth has been in car and van traffic, although commercial vehicle traffic has almost trebled. Today there are around 8,500km per year per person travelled on road of which around 80% are by car.

There are many factors that affect future traffic growth, but in the absence of major shocks we can expect that road traffic will grow by at least a half by the middle of the 21st century with rather more growth in interurban and rural traffic than in the inner parts of large cities[3]. Such growth will be equivalent to adding the amount of traffic on the roads in 1977 to current levels.

Air travel increases as incomes rise. Over the past 30 years, air traffic increased by a factor of five[4]. The UK's airports accommodated nearly 200 million terminating passengers in 2002, with Heathrow and Gatwick carrying half the total. A growth rate of 2% in GDP/capita would increase air travel by about 60% over just 15 years[5] – an additional 120m journeys/year. Demand could treble by 2050[6].

Freight traffic also rises with increasing prosperity. The movement of goods by all modes has increased substantially over the past half century, from 89 bn tonne-km in 1953 to 254bn tonne-km in 2002. While this relationship may weaken in future, partly because of higher ratios of value-to-weight in the goods moved, there will still be substantial growth over the next 50 years. Over half of this increase was due to goods travelling longer journeys, up on average from 72 kilometres in 1953 to 122 kilometres in 2002. The greatest growth has been in road haulage, up by 127bn tonne-km, almost fivefold, helped by a transfer of about 15bn tonne-km from rail during the 1950s and 1960s[7].

Short-sea, that is non-ocean going, shipping between ports in the UK and with Europe and Ireland carries a higher percentage of freight in the UK than in any other EU state, and is growing at more than 3.4 per cent per annum. Over 90% of the country's imports and exports, by weight, pass through the UK's ports. In 2001, some 550 m tonnes went through major ports, of which 29% by volume was domestic, 38% to/from the rest of the EU and 33% to/from beyond the EU[8].

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[3] Department of the Environment, Transport and the Regions (1997) National Road Traffic Forecasts (Great Britain). London. Tables 2, 4 & 9.

[4] Department for Transport (2003) Transport Statistics Great Britain 2003. London, TSO. Table 9.13.

[5] Department for Transport (2000) Air Traffic Forecasts for the UK. London, TSO. Table 3.1 and Annex 2.

[6] Department for Transport (2003) The Future of Air Transport. CM 6046. London, TSO.

[7] Department for Transport (2004) Transport Statistics Great Britain 2004. London, TSO. Table 4.1.

[8] Department for Transport (2004) Maritime Statistics 2003. London, TSO.

Demography and transport

The demand for transport clearly depends on how many people live in the UK. There were nearly 60 million people in the UK in mid 2003[9]. Over the past 50 years, the UK's population increased by 8.8 million. It could increase by a further 6.2 million between 2001 and 2051 (Figure 2).

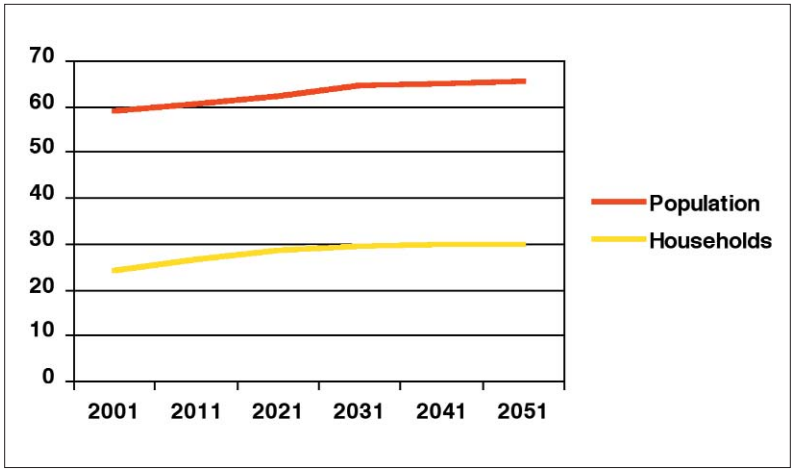


Figure 2: Forecast changes in UK population and household numbers 2001 to 2051 (millions)

Source: Digest of Environmental Statistics, Department for Environment Food and Rural Affairs. November 2002.

The demand for transport is not a simple reflection of the population. Age distribution, household size and geographical spread also exert a powerful influence. Forecasts suggest that there will be fewer children and workers, and a sharp increase in the number of pensioners, who make different demands on the transport system. Household size has fallen from an average of 2.9 people in 1971 to 2.4 today[10]. Meanwhile the number of licensed car drivers has increased from 6.6 million in 1952[11] to 32.1 million in 2002[12].

Rising wealth, population and the availability of cars and trucks have produced major changes in travel patterns over the past 50 years. The changes have been mostly due to people taking longer journeys rather than more journeys (see Figure 3). Between 1975/76 and 2003, the annual average distance travelled grew from around 7700 to around 11,000 kilometres per person per year. This was mainly due to more people acquiring cars, and switching from walking, cycling and bus to travel by car (Figure 4). The highest percentage growth was in taking children to school, personal business and shopping. Highest absolute increases have been in commuting, business and again shopping[13].

[9] www.statistics.gov.uk/cci/nugget.asp?id=6. Accessed 6 February, 2005.

[10] National Statistics (2004) Social Trends No 34. London, TSO. Table 2.1.

[11] Department for Transport (1976) Transport Statistics Great Britain 1964-1974. London, HMSO. Table 57.

[12] Department for Transport (2004) Transport Statistics Great Britain 2004. London, TSO. Table 9.16.

[13] Department for Transport and its predecessors (1993, 1995, 2001, 2004, 2004) National Travel Survey 1989/91, 1992/94, 1998/2000, 2002, 2003. London.

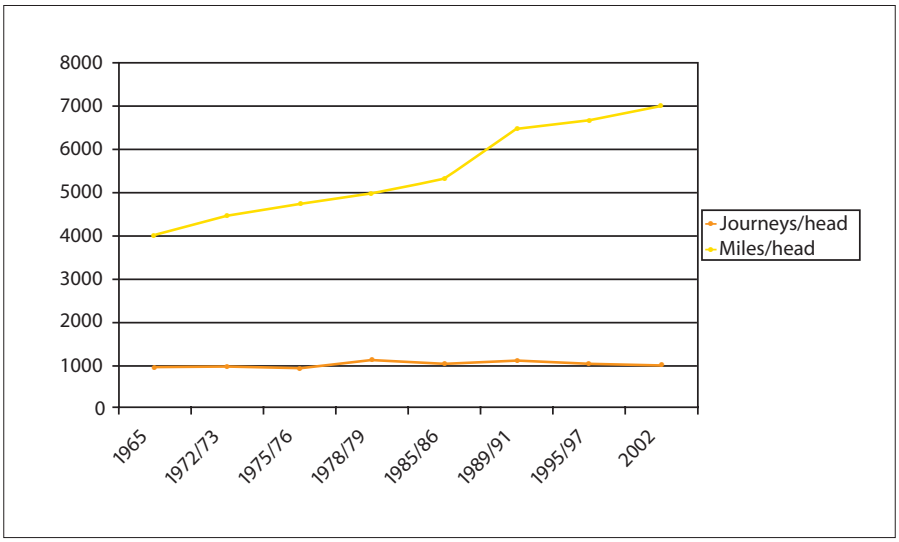


Figure 3: Personal travel trends in GB

Source: National Travel Survey, 1989/91, 1992/92, 1998/2000 & 2002. Table 2.1. Department for Transport

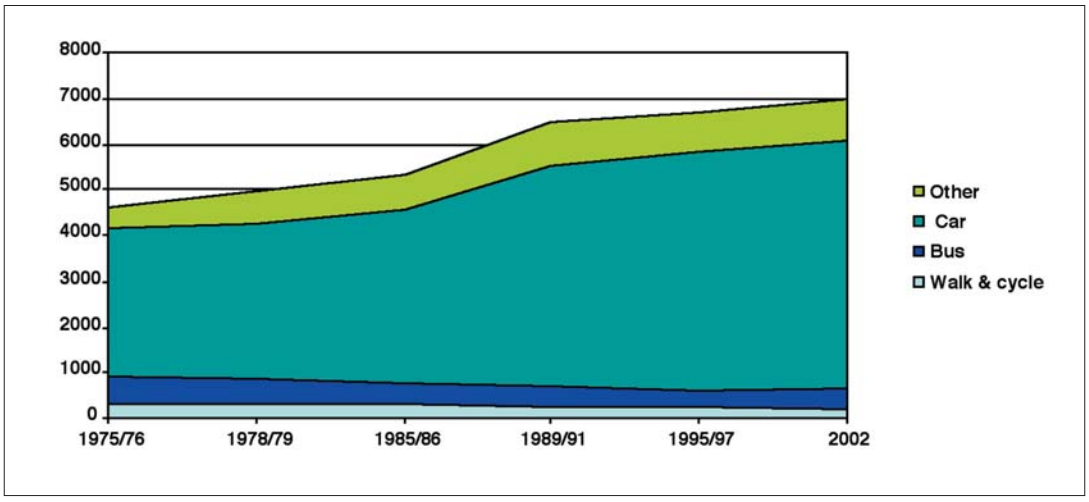


Figure 4: Changes in personal travel modal usage, person miles

Source: National Travel Survey, 1989/91, 1992/92, 1998/2000 & 2002. Department for Transport

Given this range of influences, it is difficult to be precise about the rate at which demand for person and freight movement will increase, but substantial further increases are inevitable. That does not mean that all of this demand needs to be accommodated; as we highlight in Chapter 4, managing demand is a key element of a holistic strategy. But we cannot simply assume that all of the additional demand can be curtailed; personal aspirations and commercial need will dictate that our transport strategy must cater for more movement than we do today.

Resources for transport

In occupying under 2% of land, much of this as access roads to residential and commercial premises, the transport system is not a major drain on land availability. But most of the congested transport infrastructure is in highly populated areas where land values are high. The cost and availability of land is therefore important for the hardest pressed parts of the transport system.

Transport and land use are also inextricably connected because how we use land determines much of the demand for travel. For example, higher residential densities lead people to take shorter trips and use their cars less. Out of town shopping centres, on the other hand, can add to the car journeys that people make.

Transport also consumes substantial quantities of materials. While most of these are relatively abundant and readily recycled, the major exception is oil. Transport is uniquely dependent on easily transportable fuels, of which oil is the most widely available. The continuing demand for fossil fuels, especially oil and gas, naturally raises questions about their long-term availability. The suggestion that we will run out of oil and gas is often made. And yet the rate at which we find new oil reserves has kept up with consumption. Indeed, the ratio of oil reserves to consumption is higher now than it was in 1980. At the end of 2003, known oil reserves were enough to meet annual consumption rates for over 40 years (see Table 1 and Figure 5). However, rapid increases in consumption in China and other parts of the world will put pressure on supplies.

If oil becomes scarce, prices will rise, in turn prompting increases in the energy efficiency of transport, moderating demand and stimulating exploration and substitution of other energy sources. Alternative energy sources based on fossil fuels other than oil – such as natural gas, oil shale, tar sands or 'liquefied coal' – could reduce transport's dependence on oil. As discussed in Chapter 3, these fuels will also create greenhouse gases. For reasons of both climate change and resource availability in the longer term, transport policy should promote non-carbon based and renewable energy sources for transport as quickly as is economically feasible.

Table 1: World Oil Proven Reserves and Consumption 1980-2003

Year	Proven Reserves (10^9 tonnes)	Consumption (10^9 tonnes)	Ratio of proven reserves to consumption
1980	89.6	2.972	30.1
1990	137.0	3.135	43.7
2002	156.7	3.657	41.0

Source: BP Statistical Review of World Energy 2003

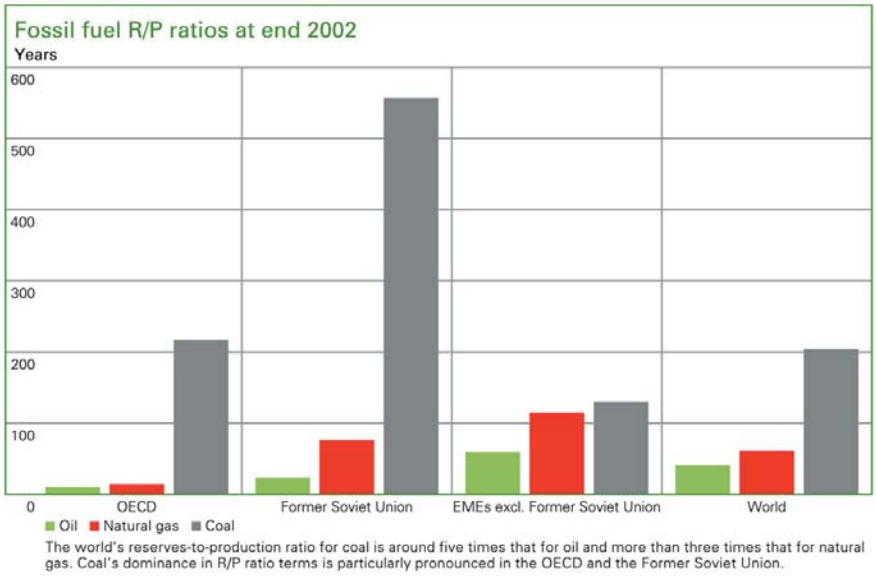


Figure 5: Fossil Fuel Reserves/Production

Source: BP statistical review of world energy 2003

As well as land and materials, transport requires labour. However, the 1.3 million people engaged in transport account for less than 5% of the 29m jobs in the UK[14]. Transport management and operations require some special skills, but there is no reason to believe that transport differs greatly from other industries in attracting suitable labour. It is, however, competing with other sectors for a dwindling supply of engineering graduates. There is a real danger that the sector will not have the engineering skills needed for effective design and implementation of transport strategies. This is part of a wider problem, which the engineering profession recognises and the nation needs to tackle urgently.

The stop-go nature of investment and the past absence of a clear strategy also affects the ability of the transport sector to recruit skilled workers. One benefit of the Department for Transport's 10-year plan has been the longer term commitment to transport. Future transport strategies need to consider more carefully the staff resources and skills needed to implement them.

Infrastructure

Roads are the most extensive and important component of the transport system. Almost 400 thousand kilometres of roads provide access to practically every property in Great Britain as well as carrying the journeys made by the 31 million road vehicles, making up 93% of all travel. Roads also provide most pedestrian routes as well as the rights of way for our gas, telephone, electricity, water and sewage systems. Some 87% are minor roads while motorways represent less than 1% of all roads by length. Over the past 50 years, the amount of traffic using our roads has increased almost eightfold. The network has grown by 30% in length, mainly to provide access to new development. Many busy sections have also been improved and, of course, the motorway system has been built during that period. However, expansion of the strategic road network has been limited over the last two decades. Since the mid-1980s, the motorway network in the rest of the EU, before its recent enlargement, grew by over 50 km/million population, compared with 10 km/million population in Britain.

[14] MacGregor, D (2001) Jobs in the Public and Private Sectors. Economic Trends No. 517. Pages 35-50.

A similar picture emerges for rail. Britain's rail routes and basic structural infrastructure date largely from the 19th Century. Around 30 per cent of Britain's rail is electrified, compared with some 50 per cent in the rest of the EU, and Britain has only 74 km of Europe's 3000 - km high-speed rail network[15]. While there has been steady, but very slow, improvement to the track and signalling on the rail system, growth in rail traffic since privatisation has made the bottlenecks and shortage of train paths all too apparent.

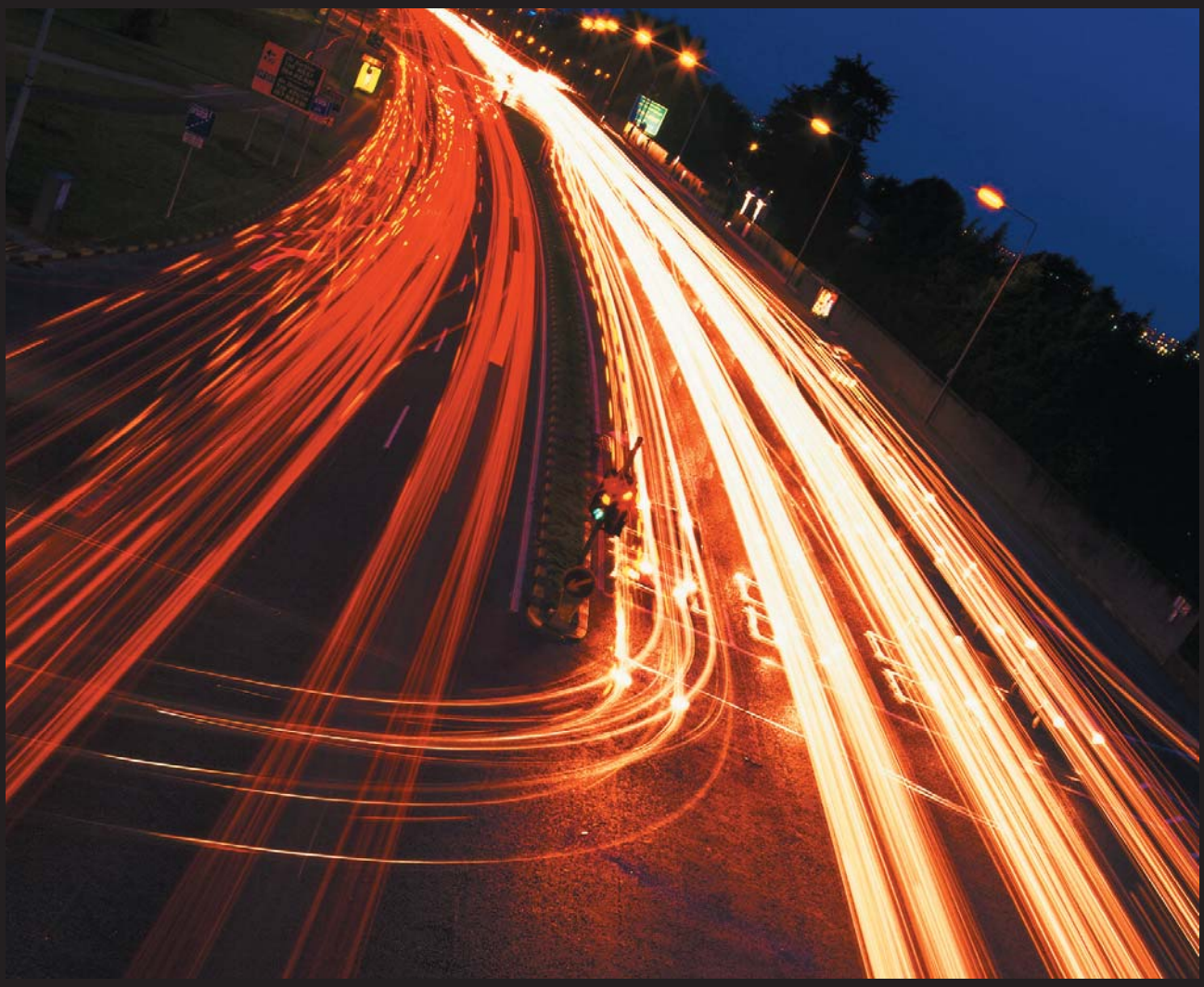
Airport operators have been more successful than other agencies in developing new infrastructure and in achieving a more integrated approach to provision of services. Surface access to the main airports has improved markedly in recent years. The four busiest airports in the UK have direct rail links with the nearest large population centres. Bus and coach services serve most other airports. The UK's air-traffic control system meets international standards. The EU's Single European Sky initiative[16] will reduce fragmentation of air traffic control and will increase the capacity of European airspace.

UK ports are characterised by the wide range of cargoes and the large number of ports, with no single port or cargo being dominant. Thus in 2003 some 550m tonnes went through UK major ports. There were 47 UK ports with traffic tonnage of 1m tonnes or more, of which 16 had tonnages of over 10m and three (Grimsby & Immingham, Tees & Hartlepool and London) had over 50m tonnes each. Unitised freight, comprising containers and Roll-on Roll-off transhipment, was some 25% by weight of this total, with two ports dominating this high value end of the market: Felixstowe with 17% (nearly 2 million units, mainly containers) and Dover with 14% (nearly 1.8 million units, largely Roll-on Roll-off)[17]. This very mixed economy requires a sophisticated port infrastructure, the ability to handle larger ships, and above all an improved road and rail access network.

[15] European Union (2004) Energy and Transport in Figures. Brussels. Tables 3.2.1 & 3.2.2.

[16] European Union (2004) The Single European Sky. Brussels.

[17] Department for Transport (2004) Maritime Statistics 2003, London, TSO.



3 Challenges for transport

Introduction
As we have seen, the demand for travel has continued to grow, and to outstrip the provision of new infrastructure. In this chapter we consider the challenges which we face as a result, and the extent to which they will be aggravated by future increases in demand.

Congestion
Congestion is a major drain on the economy and a hindrance to efficiency and effective wealth creation. A recent European comparative study[18] put the additional costs of congestion on roads in the UK at almost £15bn p.a. at 1998 prices, 1.5% of GDP. This was higher in both absolute and percentage terms than both France and Germany – about £12bn each, or 1.3% and 0.9% respectively – and for no other northern European country did the cost exceed 1%. The European White Paper[19] predicts that congestion costs throughout Europe will double over the next decade.

It would neither make economic sense, nor be practicable, to aim for a congestion free transport system. However, the Department for Transport's recent feasibility study of road pricing[20] estimates how much a practicable approximation to marginal cost pricing could reduce the external costs of road congestion. With the traffic levels and road network currently envisaged for Great Britain in 2010, the estimated reduction is about £11bn p.a. at 1998 prices. We recommend that this reduction be set as a target to be achieved over the next 25 years.

Any plans to deal with congestion must recognise that it reflects demand. Road congestion is gradually expanding in time and space but is worst in major cities and on heavily used sections of the national network. While road congestion is the major concern, and limits effective access to ports and airports, problems are also increasing on the railways and in air transport.

Recurrent and non-recurrent congestion require different remedies. Recurrent congestion results from high demand and usually occurs on a daily basis in peak hours. Non-recurrent congestion arises through unpredicted events such as accidents or breakdowns and from temporary conditions like road works. Congestion disrupts the flow of traffic and makes conditions unreliable making it difficult to predict journey times.

Non-recurrent congestion can be tackled by using traffic management and new technology to reduce occurrence of incidents, and to reduce severity and response times for those that still happen. Recurrent congestion is a greater challenge. To some extent it can be relieved by making better use of the road network and by increasing road capacity, although this will attract some additional traffic. Alternatively, we can reduce demand to a level that the system can accommodate. An effective strategy needs to reflect both approaches.

Wealth creation
Transport is a significant part of the UK economy. Households spend almost 17% of their outgoings on transport[21], and transport accounts for a similar proportion of the UK's GDP. But these are gross figures, and only give the broadest indication of appropriate levels of government investment. Of more direct concern

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[18] Nash C A et al (2003) UNITE – unification of accounts and marginal costs for transport efficiency: final report for publication. Institute for Transport Studies, University of Leeds, Leeds. http://www.its.leeds.ac.uk/projects/unite/. Accessed 6 February, 2005.

[19] European Union (2002) White Paper on the Common Transport Policy. Brussels.

[20] Department for Transport (2004) Feasibility study of road pricing in the UK. London, TSO.

[21] Department for Transport (2003) Transport Statistics Great Britain 2003. London, TSO. Table 1.15.

are the indications that the current transport system adds to the cost of wealth creation, and limits its increase by discouraging investment.

The most obvious way in which transport adds to the cost of wealth creation is through increases in transport costs. Freight transport costs vary widely by type of commodity, but on average account for around 7.5% of GDP[22]. Even a 5% improvement in the efficiency of freight transport, through reduced congestion and enhanced reliability, would be worth around £4bn annually. Such savings will usually go straight to the bottom line and increase profitability and competitiveness.

The private sector needs to be able to plan with reasonable certainty. To do this effectively, it needs not only to know the government's plans but to have confidence that they will be carried out. The Freight Transport Association estimates that UK industry will invest £850bn over the next decade in its supply chains[23]. The unreliability of the transport network has a significant impact on the investment required to meet contractual "just-in-time" obligations. At present over 85% of senior business people believe that investment decisions are influenced by the quality of transport, while almost 70% consider the UK's transport system to be poor[24].

Changes in the transport system can change the economic geography of the area served. In the early stages of development, better transport access can provide the catalyst for economic growth. In a well developed country with an extensive transport system, the opportunities for such impacts are relatively small, and transport investment which increases economic activity in one region is most likely to draw it from another. While there will be benefits to the economy, they may therefore be relatively small. But in an international economy, firms are choosing between countries rather than between regions, and our relatively congested and inefficient transport system may well discourage investment in the UK. It is difficult to estimate the scale of this impact. However, a recent study of factors influencing firms' location choices among European cities concluded that access to markets was the single most important factor, and that communication factors more generally were very important determinants of choice[25].

The international challenge is changing as the centre of gravity of Europe moves to the east. The UK must take a leading role in the development of the trans-European network if it is to continue to operate as a European gateway to North America, and if it is to offset growing competition within Europe. The lack of a positive strategy on the development of our ports and of access to them is a significant hindrance.

Poor access and exclusion

As shopping and leisure become more car-oriented, some people experience greater hardship and poorer opportunities for travel and social interaction. For example, many elderly people remain socially active beyond the time when it ceases to be wise for them to drive. This proportion is likely to increase as the population ages. Many young people are old enough to travel independently but too young to drive. These obstacles are a particular issue for people who cannot reasonably afford a car – likely to remain at around one eighth of all households in the Britain in 2050 - or who are too impaired to drive. These people depend on friends and family, public and social transport and taxi services. Lack of access is also an extra burden on people with reduced mobility and their carers. Some individuals may be in more than one of these groups.

Around 20% of the population have some long term disability[26], a proportion that could increase as the population ages. Technology and adaptations to vehicles and infrastructure can bring easier access to

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[22] Department for Transport (1986) Transport Statistics Great Britain 1975-85. London, HMSO. Page 7.

[23] Freight Transport Association (2003) Tackling Congestion on the Motorways and Trunk Roads in England. Submission to the National Audit Office Value for Money Examination. Tunbridge Wells.

[24] Confederation of British Industry (2003) The UK as a place to do business. Volume 4: Is transport holding the UK back? London.

[25] Crushman & Wakefield Healey and Baker (2004) European Cities Monitor Highlights. London.

[26] Department for Transport (2004) Overview 2003 & Forward Look 2004/5. Mobility and Inclusion Unit. London. Page 2.

transport to people with reduced mobility. The main issue is a willingness to allocate resources – human as well as financial.

Lack of suitable transport also contributes to social exclusion through restrictions in access to work, learning opportunities, healthcare, shops, friends and family, and leisure activities. The quarter of households now without a car includes two thirds of those in the lowest income quintile, and one third of those in the next lowest[27]. Two in five jobseekers cite lack of transport as a barrier to getting a job, particularly as a result of services not being available at the right places and times; nearly half of 16-18-year-old students have difficulty with the cost of education-related transport. Of people without a car, nearly a third have difficulty reaching their local hospital and one in six in reaching a supermarket; these proportions are roughly twice those for people with a car[28].

Climate change

The pursuit of sustainability involves ensuring that future generations are not unfairly restricted in their opportunities by actions we take today. Transport threatens sustainability principally by harming the environment, globally and locally, and by consuming non-renewable resources. For transport, the biggest challenge to sustainability is its contribution to the greenhouse effect and climate change, predominantly through emissions of carbon dioxide, which is the most significant greenhouse gas.

Transport contributes 28% of all the UK's CO_2 emissions, and that percentage continues to increase (Figure 6). Both the European Commission[29] and the Royal Commission on Environmental Pollution[30] have advocated an upper limit on atmospheric concentration of 550 ppm CO_2. On this basis, the UK Government has set a target of a 60% reduction in CO_2 emissions by 2050. That target has not yet been differentiated by sector. Targets may well differ between sectors depending on the diffculty of achieving them. Even so, a target of this order represents a major challenge for transport, which cannot be achieved by improved technology alone, and will imply significant changes in the way that we travel.

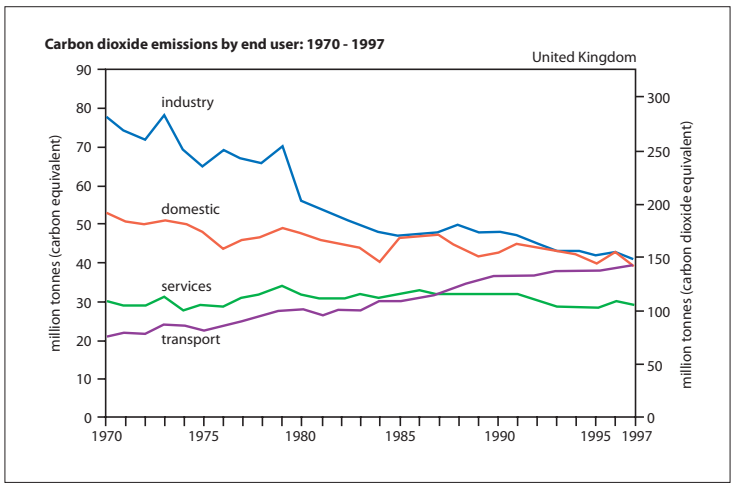

Figure 6: UK carbon dioxide emission by end user

Source: The Environment in your pocket 2002, Department for Environment Food and Rural Affairs

[27] Lucas K (ed) (2004) Transport and Social Exclusion: A survey of the Group of Seven Nations – Summary Report. London, FIA Foundation

[28] Social Exclusion Unit (2003) Making the connections: final report on transport and social exclusion. London.

[29] European Community (1996) Climate Change – Council Conclusions 8518/96 (Press 188-G) 25/26.VI.96.

[30] The Royal Commission on Environmental Pollution (2000). Twenty Second Report – Energy The Changing Climate. CM 4749. London, TSO.

Accidental death and injury

Some 12,000 people die accidentally each year in Great Britain. At some 3,600 victims, transport is by far the largest single cause of these deaths. Roughly 3,400 people die on the roads, 130 as trespassers on the railways, 40 in other railway accidents, 30 in aviation, and five in UK merchant shipping, that is for vessels over 100 tonnes. For every person killed in road and rail travel, around ten are seriously injured and 100 slightly injured. In aviation the ratio is different, with only around three people injured for each one killed[31]. Transport is, therefore, a cause of much tragedy and grief.

Per billion hours spent travelling, there are about 170 deaths in road accidents, 25 in rail travel, and fewer than ten in travel by bus, coach, ship or scheduled aircraft. By comparison, for people under 75 there are around 20 deaths per billion hours in the rest of everyday life. It can be seen that road travel therefore carries a disproportionate risk, of around eight times that of everyday life. Only for people over the age of 75 at home, is the public exposed to a comparable risk of accidental death[32]. And yet the government seems to be prepared to invest a disproportionate amount on reducing rail accidents, while under investing in relatively inexpensive measures that could have a powerful effect on road safety.

Under the current national strategy for road safety, progress is being made towards the target to reduce the number of people killed or seriously injured by at least 40 per cent by 2010 compared with the average for 1994 – 1998[33]. But even if this is achieved with a proportionate reduction in the risk of death on the roads, this will still be about five times that in the rest of everyday life, and road safety will remain a substantial policy concern. New roads and modifications of the existing infrastructure, along with changes to vehicles and the behaviour of road users, can play a large part in reducing road accidents.

However, it does not help that projects to improve safety have to satisfy more demanding appraisals than other interventions. Engineering schemes to increase road safety have typically been regarded as affordable only if they cost less than a tenth of their estimated benefits. By contrast, road construction projects are usually approved if their cost is less than a third of the value of the expected benefits[34, 35].

The picture is even more skewed for rail safety. Train collisions are rare and make up only a small proportion of risk in the rail system. And yet the high profile of rail safety means that investment in the train protection and warning system, which will certainly make rail travel safer, come at a cost per life saved that is nearly ten times the value used to assess safety measures on the roads[36].

In aviation, it is probably realistic to think in terms of holding the average number of deaths per year steady, despite the rapid growth in air travel. Accident and incident rates in commercial air transport have fallen to an extremely low level in the UK and across Western Europe as a whole. Continued research is needed, particularly in regard to human factor effects, which are now the dominant cause of aviation accidents.

There has also been a marked downward trend in marine accidents to merchant vessels registered in the UK. In maritime transport, environmental consequences of accidents are, because of their potential scale, at least

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[31] Department for Transport (2004) Transport Statistics Great Britain 2004. London, TSO.

[32] Evans A W (2003) Accidental Fatalities in Transport. Journal of Royal Statistical Society A 166 (2). Pages 253-260.
Ward H, R Allsop, B Turner and A Evans (2003) A review of delivery of the road safety strategy. UCL Report to the Motorists' Forum of the Commission for Integrated Transport. http://www.cfit.gov.uk/mf/reports/roadsafety/ucl/index.htm. Accessed 6 February, 2005.

[33] Department for Transport (2004) Tomorrow's roads – safer for everyone: The first three year review. London, TSO.

[34] Allsop R E (2001) Road safety – willing the end and willing the means. Crowthorne: Transport Research Foundation.

[35] Evans A W (2001) Economic evaluation of road traffic safety measures – United Kingdom. ECMT Round Table 117. Pages 77-99. Paris: OECD

[36] Evans A W (2004) Fatal train accidents on Britain's main line railways: end of 2003 analysis. Imperial College London, London.

as great a public and policy concern as death or injury. Loss of vessels, even without loss of life or limb, is also very costly. Concern about these material consequences of accidents at sea may therefore be greater than concern over the numbers killed or injured[37]. Now that the industry has effectively eliminated the hazards associated with roll-on roll-off ferries, the biggest threats to the safety of passenger transport by sea are now susceptibility to rapid sinking, fire and, potentially, terrorism.

Local environment and health

Transport affects our local surroundings and our health. It does this through noise, exhaust emissions, visual intrusion, and by splitting communities and polluting groundwater and watercourses. The BMA has highlighted the wider impacts on health of current transport policy[38], and a more detailed analysis for West Yorkshire suggests that deaths brought forward by atmospheric pollution may be as much as four times those arising from road accidents[39].

Noise affects people's health. It is annoying, causes stress and disrupts sleep patterns. Traffic noise may also contribute to learning difficulties and the early stages of hearing impairment[40]. Technology has substantially reduced noise from individual road vehicles and aircraft. In terms of aircraft noise, 90% of aircraft movements at Heathrow are less noisy 'Section 3' aircraft, compared with only 50% in 1992[41]. The number of people exposed to noise levels of 57dBA or more around airports in the UK has fallen from 600,000 in 1988 to fewer than 300,000 today[42]. Traffic management and control can influence noise emissions. Barriers, other features and the design of buildings can also reduce noise from roads and railways. But growing traffic has been offsetting these reductions, so that the daytime incidence of noise outside dwellings decreased only slightly between 1990 and 2000, and the number of people hearing or being affected by aircraft and road traffic noise rose slightly over the same period[43]. Measures to reduce noise must do more than keep pace with increases in the use of vehicles and other transport systems. Even within a context of falling noise emissions per vehicle, we should also continue to protect particular locations and affected people.

Transport also produces atmospheric pollutants that can harm health, especially for those with chest conditions, as is reflected in hospital admissions and premature deaths[44], and can damage the environment, for example through acid rain. Technology has already done much to reduce noxious emissions from transport (see Figure 7). Emissions of pollutants from transport have declined with the introduction of new control technologies. Over the past 10 years alone, emissions of nitrogen oxides (NO_x) have fallen by 34%, volatile organic compounds (VOCs) by 40%, carbon monoxide (CO) and particulates by 42%, smoke by 50% and lead by over 90%[45].

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[37] European Transport Safety Council (2003) Assessing risk and setting targets in transport safety programmes. Brussels

[38] British Medical Association (1997) Road Transport and Health. London.

[39] West Yorkshire Transport and Health Group (2000) Health Impacts of Transport in West Yorkshire.

[40] Department for Environment Food and Rural Affairs (2000) Noise and nuisance policy, health effect based noise assessment methods: a review and feasibility study. London

[41] Department for Transport (2003) Noise Exposure contours for Heathrow Airport 2002. London. Figure 2.

[42] Department for Transport (2003) Noise Exposure contours for Heathrow Airport 2002. London. Figure 9.

[43] Building Research Establishment (2002) The National Noise Incidence Study 2000. Watford.
Department for Environment Food and Rural Affairs (2003) The Environment in your Pocket 2003. London.

[44] Committee on the Medical Affects of Air Pollutants (1998) Quantification of the effects of air pollution on health in the United Kingdom. London, TSO.

[45] Department for Transport (2003) Transport Statistics Great Britain 2003. London, TSO. Table 2.9.

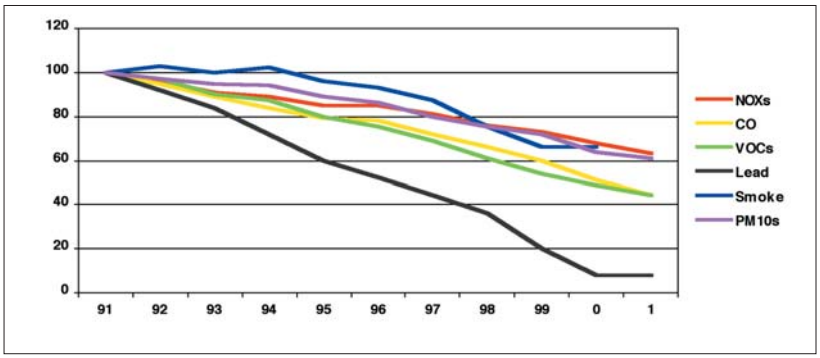

Figure 7: Trends in noxious transport emissions 1991-2001. (1991 = 100)

Source: Transport Statistics Great Britain 2003, Department for Transport

Further reductions are likely, although more challenging[46]. Over the next 10 to 15 years, emissions from the UK road vehicle fleet are likely to fall below those in 1970, when road traffic was only 40% of today's volumes[47]. If, despite growth in traffic, controls are to continue to reduce air pollution, measures to reduce emissions must more than keep pace with increased vehicle use. There must also be reductions in emissions from diesel-powered rail and sea operation and in aviation. Civil aircraft technology is also improving fuel efficiency, which has increased over the past 30 years and is forecast to rise by a further 6 to 12% in the next 20 years[48].

In addition to reducing the adverse impacts on health, transport policy can provide opportunities for people to make choices favourable to their health, mainly by encouraging walking or cycling as part of their travel. Transport policy can also promote healthy living beyond physical exercise, for example, in the healthy social development of children and the social climate of neighbourhoods[49].

Transport can also harm the local natural environment, as rainwater runoff can carry oil, rubber particles and other pollutants into watercourses and groundwater. Ecological damage can be caused not only directly by construction and use of transport infrastructure, but also indirectly as habitats become isolated and reduced below a viable size. Disposal of unwanted vehicles and construction waste also imposes a significant ecological burden.

Personal security

The threat of crime and antisocial behaviour worries passengers and staff on public transport. Pedestrians and cyclists express similar concerns. More recently, the threat of terrorism has come to the fore. Through such measures as the design of transport related public spaces and of vehicles, staff presence and CCTV surveillance, we can increase security and reassure people so that they can benefit fully from public transport[50].

It is impossible to predict whether today's concerns for personal security will still be with us 50 years from now, but the precautionary principle dictates that security should be a key consideration in the design and operation of transport systems. Such is the importance of transport in the smooth running of society that there is also a case for designing and managing the network to reduce reliance on critical and vulnerable elements.

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[46] Department of the Environment, Transport and the Regions (2000) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. London, TSO

[47] Department for Transport (2003) Transport Statistics Great Britain 2003. London, TSO. Table 9.7.

[48] Royal Academy of Engineering (2002) Response to the Royal Commission on Environmental Pollution Study "The Environmental Effects of Air Transport", Memorandum submitted by the Royal Academy of Engineering. London. Para. 2.1.

[49] Tolley R (ed) (2003) Sustainable Transport: Planning for walking and cycling in urban environments. Cambridge: Woodhead.

[50] PRISMATICA (2003) Guidelines and Recommendations for the Improvement of Personal Security in Transport. PRISMATICA Deliverable 17. http://www.prismatica.com. Accessed: 6 February, 2005.

Uncertainty and risk

Any 50-year look forward in as complex a field as transport involves significant uncertainty. We can forecast some uncertainties, such as the likely population and its make up. We cannot forecast war or radical political change, or even substantial swings in public attitudes. However, through systematic risk management, with regular reviews to recognise and allow for technical uncertainties, fluctuations in economic growth rates and changes in fuel prices, we can reduce the risk of policy failures. For critical factors, we should establish ranges of sensitivities and assess the robustness of critical decisions[51].

In addressing uncertainty, we must remember that there may be a divergence between objective assessment based on science and engineering and subjective assessments made by the public at large, or their elected representatives. It is important to address these different assessments and, as far as practicable, to reconcile them to achieve agreement on a way forward.

[51] Royal Academy of Engineering (2003) Risk Report Number 2: Common Methodologies for Risk Assessment and Management. London.

4 A strategy for the future

Introduction

Among the challenges addressed in the previous chapter, the following appear to us particularly serious, and have influenced the development of our holistic strategy:

- congestion, which is costing the UK more than other European countries, and is likely to worsen considerably unless action is taken;
- transport's production of greenhouse gases, which is rising, and needs to be reduced substantially if national targets for 2050 are to be met;
- hardship for those denied the use of a car, who will remain a substantial minority of the population;
- the risk of accidental death on our roads, which is still eight times that of everyday life;
- the continuing need to reduce noise and pollution from all forms of motorised transport;
- the threat to personal security from antisocial behaviour locally and terrorism internationally.

These problems affect all areas of public policy, threatening our economic potential and adding to resource costs. They directly affect public health, worsen the environment and undermine the goal of social inclusion. The solutions to them will to some extent be in conflict; in particular there remains a tension between actions to enhance wealth creation and those aimed at longer term environmental sustainability. Such tensions are central to much of public policy. Transport policy warrants equal priority with education, health, the economy and social policy, all of which depend on a coherent transport policy.

The challenges arise at all levels, from local to international, and for all forms of transport. Congestion is as much a problem in city centres as it is on the inter-urban road and rail network. Accidents are an issue for all forms of transport, from residential roads to international flights. The environment, particularly the global environment, is at risk from growth in travel. Moreover, what we do at one level, or for one form of transport, will affect the system as a whole. Disruption on the rail network adds to pressure on the road system. Growth in car use threatens the efficiency of freight distribution. Road congestion directly affects the efficiency of ports and airports. Promoting low-cost air travel will affect the profitability of the rail network.

These complex feedback loops are evidence of a system at work. Transport performs as a system: the UK must plan and operate it as one. Transport strategies must be developed consistently at all levels – national, regional and local – and must cover all modes of transport.

Past experience shows that we cannot solve our transport problems simply by building more infrastructure or with new technology. Neither can we rely solely on pricing or regulation. A successful strategy will deploy all of these approaches. We must invest in new infrastructure and promote new technology. We must improve the management and regulation of our transport system and strengthen the links with land-use planning. But above all, price signals to all users must reflect the real costs of journeys to themselves and to society. Only then will people be encouraged to make better decisions on how, when and where to travel.

There are three ways in which we can improve the balance between demand and supply: by restraining demand through pricing or regulation; by maximising the use of existing capacity through management, regulation and technology; and by the creation of new capacity through infrastructure and technology. A judicious mix of all three is necessary, which will vary by area and type of network. The debate on transport strategy must concentrate on the balance between these three, rather than engaging in unproductive argument about which we can do without.

The RAC Foundation, in *Motoring Towards 2050*[52] examined the possible trade-off between a steady increase in motoring charges and a continuing investment in road capacity. It suggested that, if there were no further investment beyond that envisaged in the Ten Year Plan, the charges for motoring would need to rise by 6% per annum simply to keep congestion at the current level. Equally, to attempt to contain congestion simply by expansion of the road network would require an unprecedented financial commitment. They concluded that a balance must be struck between these two approaches. We concur. It is for Government to strike that balance, and the challenge will become greater the longer the delay in action either on investment or on effective charging.

Pricing

A more efficient form of pricing is fundamental to our vision for the future of transport in the UK. Existing charges for passenger and freight transport – a mixture of taxes, government subsidies and user payments – do not reflect the inherent cost of providing that transport, or the indirect cost of travel on society as a whole. For example, bus and rail fares have risen rapidly in real terms, while the costs of car use have stayed broadly constant. These differences are not related to the true costs of these modes of transport and send the wrong signals to transport users and providers.

Wherever possible, transport users should pay the true costs of their journeys. We call this "true-cost charging". Charges for transport should reflect the direct costs incurred in providing those journeys, and the indirect costs they impose.

Users should pay the direct costs associated with the operation, maintenance and renewal of the part of the network they are using, along with a component for future investment. The willingness of travellers to pay under such a charging regime will provide an indication of where investment is needed. The funds raised through true-cost charging will mean that the costs of investment do not simply fall to general taxation.

Indirect costs arise principally through the impacts of journeys on congestion, pollution, noise, accidents and global warming. While users suffer directly from congestion, they also add to the congestion costs of others, and it is these external congestion costs which should be charged. Similarly, users should be made directly aware of the external costs imposed on others' health, environment and quality of life.

For private use of roads, distance-based charges can reflect many direct and indirect costs and should depend on the type of road, vehicle and engine. Some costs depend on levels of congestion and should be higher in congested areas and at busy times. London's congestion charge is a partial application of this principle. Equally, some costs will depend on the location and its environmental sensitivity. Some costs, particularly the costs of global warming, could remain as charges on fuel consumption rather than distance travelled. Distance-based charges would require new technology and the development of an appropriate charging formula, both of which the Department for Transport has recently considered[53].

For public transport, the charging principles are simpler. Much of the direct costs are already passed on to passengers through fares, which reflect the relative cost of peak and off-peak operation. However, where the community benefits from people using public transport, it may be appropriate for services to be subsidised, and fares may then be considerably below the true direct cost. Operators should pay the indirect costs and pass them on to users. For bus and rail travel, these costs are likely to be small, particularly outside peak periods. While these principles should determine the overall level of bus and rail fares, there is much to be said for introducing simpler, integrated fare structures that reflect these charging principles while simplifying the task of paying for the use of public transport.

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[52] The RAC Foundation for Motoring (2002) Motoring towards 2050. London.

[53] Department for Transport (2004), Feasibility Study of Road Pricing in the UK, London, TSO.

Much of the UK's use of air and maritime transport is international. This makes it harder to impose purely national charging regimes. However, the indirect costs, particularly of air travel, are significant and may well justify higher fares. Ideally indirect costs of pollution would be covered through the imposition of fuel duty, which would be passed on to passengers. We support the government's aim of seeking international agreement on such taxes[54]. The indirect costs of noise arise primarily at airports, and could be addressed through differential landing fees for noisier aircraft.

The aim of true-cost charging is not to increase the revenue from transport, but to ensure that users meet the full costs of their journeys. Thus we expect current levels of taxation on vehicle ownership and fuel purchase to fall substantially as a result of the introduction of true-cost charging. Governments may wish to continue using transport as a source of general taxation. However, such taxes can have an adverse impact on the economy and can send inappropriate signals to users. They should be kept to the minimum necessary to meet the needs of the Exchequer and should, where possible, apply at the point of use by being based on fuel consumption rather than vehicle ownership. As a general principle, travel should not be taxed at a higher rate than the average across all sectors.

The main effects of true-cost charging will be on busier urban roads, particularly in the peak periods. Busy sections of interurban motorways and main roads will also see reduced traffic as the charges for using them increase. On many other roads there will be little change. Traffic reductions will result from people changing when and where they travel, the routes and types of transport they use, or sometimes not making a journey at all. Overall, we expect that the net reduction in predicted road use will be about 5%; and 80% or so of road travel will cost no more than would otherwise be paid in fuel duty. A larger share of journeys will be on foot, cycle and by bus and train. Conversely, road use in rural areas may increase as net costs fall. Where public transport fares rise to meet the direct costs of provision, there could be a reduction in patronage, which could lead to reductions in service provision.

Any substantial change in the costs of travel will cause some hardship in the short term, while people are adjusting to any increases in cost. Those who are likely to be the most affected will be drivers travelling on congested roads at peak times, and users of lightly used bus and rail services. It will be important to provide prior warning of the anticipated charge levels, so that people have time to adjust. In the longer term, some people may need to be protected by continuing subsidies, particularly if they are on low incomes or have particular mobility handicaps. Care will be needed to ensure that such concessions are appropriately targeted and transparently identified.

Infrastructure

Even if, as we expect, true-cost charging reduces road use in the short term, demographic and other influences will eventually offset any decline. There will thus be a continuing need for new road infrastructure and action should not be delayed until true-cost charging is introduced. Future investment in infrastructure should anticipate the effects of road pricing on demand, and the likely effects on usage patterns that we have outlined above. The precise levels and locations will depend upon a detailed review of need and the costs of provision.

Considerations of security and risk may justify additional investment that does not arise in direct response to changes in demand. Loss of a key link in the road network – through flooding, structural damage or terrorism – can cause serious disruption. Most of our road network has an inbuilt resilience through the existence of alternative routes. Where this is not the case, there may be a justification for investment to provide alternatives, particularly at crossings of barriers to movement and on freight routes to Europe and beyond. A similar argument applies to the rail system. Indeed, the Government should consider security at the system level rather than for individual modes of transport.

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[54] Department for Transport (2004), The Future of Transport – a network for 2030, CM6234, London, TSO.

Even with substantial new road construction, there will be a continuing need for infrastructure improvements to reduce the environmental impacts and hazards on the existing road network. Expenditure should increase on such improvements, drawing directly on the revenues from user charges. There should also be greater emphasis on improving the infrastructure for walking and cycling, and on enhancing the quality of the street scene through better design and maintenance.

A similar approach should be taken to rail investment. The main focus should be on relieving physical and operational bottlenecks and on appropriate upgrading of heavily trafficked corridors. Where it is inefficient for passenger and freight traffic to compete for the same heavily used track capacity, there will be a case for creating occasional passing loops and parallel lines.

We are not convinced, at present, of the case for investment in new high-speed railway lines. Their costs seem likely, on the basis of current appraisal principles, to exceed their benefits. However, further consideration of the case may be justified if charging transfers demand from road and air, or if the development of a high-speed network in continental Europe threatens to change the location of economic activity.

In some urban areas metro and light-rail schemes already provide high quality services on busy corridors, and can be an attractive alternative for users of cars and conventional buses. European experience demonstrates that they can also contribute to the quality of city centres. However, high quality guided buses, running partly on exclusive rights of way, can provide many of the advantages of these systems to larger parts of urban areas at lower cost. Large conurbations should consider developing light rail or guided-bus systems as the core of their public transport networks. In London, the Underground and the commuter rail network should be modernised and their capacity increased.

The UK faces a challenge in meeting the growing demand for air travel. The main constraints on airport capacity at present are surface access and runway capacity. The planned expansion of airports should provide sufficient runway capacity in the medium term. Beyond then, there will be a need for more runway and terminal capacity, and further improvements in air-traffic control to accommodate higher demand.

We welcome the Government's White Paper on the future of air transport and its commitment to balanced expansion of the UK's airports. We recognise that, while there should be maximum use of existing runway infrastructure, we will require two additional runways in the south east by 2030, firstly at Stansted and subsequently, subject to environmental constraints, at Heathrow. To reduce the pressure on the over-crowded airports in the south east, the UK should promote the role of regional airports in meeting demand. Greater emphasis is needed on the provision of multi-modal surface access facilities.

Marine transport does not receive the same support as road, rail and airports. The mixed economy of the UK's ports requires a sophisticated infrastructure to cope with larger ships. This will place increasing demands on dredging, ship control, security, berthing and crane capacity. Infrastructure to provide access to ports should be planned as part of a multimodal land/sea/land route which minimises the costs of congestion and transfer as far as possible. Leading ports should receive strategic national investment, both for port infrastructure and for road and rail connections.

Poorly maintained infrastructure inevitably reduces the performance of the transport system. Many major and minor roads have serious defects. The maintenance backlog on local authority roads alone now stands at some £8bn[55]. Failure to maintain the infrastructure now will lead to more rapid deterioration and higher future costs. The value of preventative maintenance is well understood but rarely reflected in national and local budgets.

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[55] Institution of Civil Engineers (2003) Local Transport and Public Realm Survey 2003. London. Page 4.

Much the same can be said for the rail network, where increases in traffic have exposed the problems associated with lack of maintenance. Remedial costs have escalated following privatisation. It will be important for Government and Network Rail to take unit costs under closer control.

Traffic management

However much we are able to invest in new and improved roads, there will be sections in which demand exceeds supply, or where accidents and pollution are at unacceptable levels. Our proposed charging policy will reduce the scale of these problems, but it can never wholly eliminate them. Traffic management offers a range of tools which allow us to address such problems at relatively low cost.

The UK has been particularly successful in developing ways of increasing the capacity of the existing urban road network. We agree with the National Audit Office that the Highways Agency has been less effective in applying innovative management measures to the national road network[56]. With our charging structure in place, there is an even stronger case for using such techniques to enable those who wish to travel to do so efficiently.

Nationally, we have been less adventurous in managing the environmental impact of traffic. Local authorities are unnecessarily constrained by traffic management regulations and by the use of regulations which depend on police enforcement. We have much to learn from continental European practice. A critical review is urgently needed in this area.

Better design of areas used by pedestrians and cyclists improves conditions for them and can increase levels of walking and cycling. For this to happen, the UK needs conveniently located pedestrian and cycle routes and better design of these areas to eliminate fears of insecurity and physical danger. Pedestrian streets in town centres, and pedestrian routes between residential areas and schools, shops and leisure facilities, are key elements in such a strategy, and can often be provided at relatively low cost.

There should be much more effective use of low-cost remedial measures to reduce road accidents. These include adaptation of junctions on local roads, treatment of bends on rural roads, traffic calming in residential areas and in villages, improved crossing places for pedestrians and reserved areas for cyclists at traffic lights. As we note in Chapter 3, the investment hurdles for such measures are much more demanding than those for new road construction. This should be remedied urgently, so that a greater investment can be made in some of the most cost-effective ways of reducing the toll of road casualties.

A coordinated policy for parking could supplement real-cost charging in managing demand. Parking, on and off street, should be at commercial rates that keep demand below supply, but with priority for local residents and traders. New parking provision in private developments should be limited by standards which are applied consistently throughout each region.

There is also a range of relatively inexpensive measures that would encourage people to make better choices in their use of the transport system. These measures include real-time information, individualised marketing to make people more aware of the options available to them, and company travel plans through which

[56] National Audit Office (2004), Tackling congestion by making better use of England's motorways and trunk roads. London.

organisations aim to reduce their impacts on the transport system. These are all ways in which individuals and organisations can help to achieve a more sustainable transport system. The UK needs a coordinated strategy to develop and apply measures of this kind.

Regulation and service provision

Regulation of air and sea transport is essentially international, while legislation on motor vehicles is European. Regulation of rail safety, now under Government review, is currently national, but will become European. For road vehicles, international regulatory control has contributed significantly to improved designs that reduce fuel consumption, emissions, noise and the severity of accidents. National governments are responsible for vehicle and driver registration and for ensuring that vehicles are adequately maintained. They also influence the provision of transport services.

In this latter area, the policy in the UK over the past two decades has been to reduce regulation of transport and to rely increasingly on the market. This has not, however, eliminated complex and often inconsistent regulatory structures.

With the notable exception of bus services in London, the private sector largely determines when and where to provide public transport. While this has resulted in some new services not identified by local authority planners, the general outcome has been that service patterns have been designed more to reflect commercial priorities than to meet social needs. Experience from the route tendering model in London, where bus use has increased by 48% since 1986 (as compared with a 37% reduction elsewhere)[57], and from franchising on the continent demonstrates that, on balance, local authorities are better able to identify service patterns that reflect local need. We therefore advocate a change to regulated competition, which would transfer back to local and regional authorities responsibility for bus and local rail service planning.

A further benefit of the franchising model is that fares, ticketing and service information can be coordinated, and the benefits of smart-card ticketing realised. Local or regional public transport bodies should implement such approaches, adopting fare structures that reflect a policy of true-cost charging. Such a move should also enable local public transport to contribute fully to achieving acceptable levels of access and social inclusion for those without the use of a car.

Relief of social exclusion will require an imaginative mix of approaches, most of which will also benefit others in society. We can achieve much by improving public transport and by building houses and other developments which permit access to local facilities without a car. Transport policy must also combat social exclusion in other ways, for example through targeted subsidies to make taxis affordable and more widely available to people with low incomes.

True-cost charging would increase fares and could reduce demand on many rural rail lines. In purely economic terms, there is a strong case for replacing these lines with appropriate coach and bus services. Where this is unacceptable for broader public policy reasons, the costs of subsidising these rail services should not be imposed on other rail users but should be separately identified and met from taxation.

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[57] Department for Transport (2003) Bulletin of public transport statistics: Great Britain 2003. London, TSO. Table 10. Department for Transport (2004) Statistical Release Bus Passenger Journeys 2003/04. London, TSO.

Technology

As the Academy has shown in its papers 'Cars of the Future'[58] and 'The Future of the Railway',[59] over the next 50 years we can expect technology to bring about new sources of power and energy and new materials. We can also expect information and communications technologies (ICT) to have a profound influence on most modes of transport. New technologies for vehicles and infrastructure will also make significant contributions.

From the simple beginnings of electromechanically mediated steering and braking, modern vehicles now have many assisted and automated functions, leaving the driver to concentrate on controlling speed and direction. Such technology offers several other benefits, including intelligent speed adaptation, inter-vehicle communication, freight management and the potential for automated driving. In particular, intelligent speed adaptation could bring about significant reductions in road casualties and increase the capacity of the road network.

Implementation of true-cost charging for transport will require distance-based charging for road travel. This will entail the use of global positioning systems (GPS), electronics and mobile communications to identify and determine the location of vehicles, technologies that are already available on some new vehicles. It will be particularly important to focus resources on these developments.

ICT can also increase the capacity of existing infrastructure. Improved traffic management would allow existing networks to carry more traffic. In air transport, improved air-traffic control in the UK, integrated into the European Single Sky Initiative, will reform the architecture of European air-traffic control to meet future needs. At sea, smart card technology could facilitate management of individual containers with faster handing and enhanced security. On the roads, traffic management is developing to include real-time responses to incidents and congestion. As drivers come to accept more and more electronic input in their vehicles, there will be opportunities for greater automation of road traffic.

Advances in ICT will also alter the demand for transport. For example, the availability of broadband communications, and the increasing use of computers in business and at home, give people more freedom on when and how to travel, and where to live in relation to their place of work. However, it would be imprudent to rely on improved communications substantially reducing travel; communications and travel are strongly symbiotic.

The most obvious way to reduce energy consumption by vehicles is through more efficient engines and transmissions. While fuel efficiency rose rapidly in the early 1980s, it has stagnated since (Figure 8). Improved fuel efficiency and reduced pollution could also come about through novel drive trains, such as hybrid vehicles with internal combustion engines linked to batteries and electric motors and generators. Early examples of hybrid cars are already in the market place; the Toyota Prius and the Honda Insight claim a fuel economy of 80 mpg (3.53 litres/100km) and emissions of 80g/km CO_2[60]. Evidence from the US suggests that in urban use an electric-petrol hybrid Honda Civic consumes only 72% as much fuel as a petrol version, increasing to 85% on high speed roads. Fuel-cell buses now operate in nine cities in Europe,[61] including London, with more due to appear in British towns over the next few years.

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[58] Royal Academy of Engineering (2003) Evidence submitted to the House of Commons Transport Committee inquiry into 'Cars of the Future'. London.

[59] Royal Academy of Engineering (2003) Evidence submitted to the House of Commons Transport Committee inquiry into 'The Future of the Railways'. London.

[60] http://www.honda.co.uk/front.html. Accessed 6 February, 2005

[61] http://www.tfl.gov.uk/buses/fuel-cell-buses.shtml. Accessed 6 February, 2005.

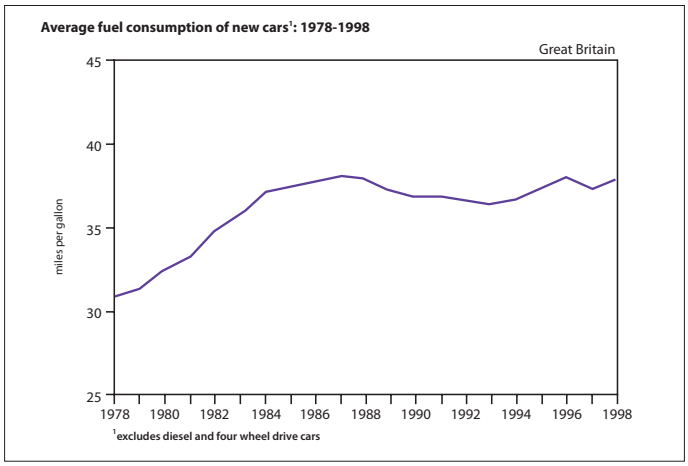

Figure 8: Average fuel consumption of new cars
Source: Quality of life counts 1999, Department of the Environment, Transport and the Regions

Some fuels, such as LPG, contain less carbon than oil and can reduce greenhouse gas emissions by replacing petrol and diesel in traditional engines. Other fuels, such as methanol and ethanol produced from biomass, can be considered as re-circulating CO_2 absorbed during photosynthesis.

In the longer term, hydrogen as a fuel could have an even greater effect. In theory at least, a "hydrogen economy," perhaps with fuel cells powering electric motors, could operate without fossil fuels as the primary energy source, with negligible emissions of noxious pollutants and greenhouse gases. However, from the perspective of global warming, hydrogen has no advantage over conventional engines unless it is produced from renewable sources or nuclear power. In addition there are the problems of storing hydrogen at roadside filling stations and using it within vehicles at ambient temperatures in a compressed state.

A combination of smaller, lighter and more aerodynamic vehicles, engine management systems, hybrid engines and biomass fuels would reduce the CO_2 emissions from transport. The Government, in *Powering Future Vehicles*[62], sets targets for 2012 of 10% of all new car sales emitting under 100g/km of CO_2, and 600 new low carbon buses sold each year. We support such targets and recommend that they be made increasingly demanding over time. However, these technological changes will not be sufficient to meet climate change obligations. If transport is expected to meet demanding reductions in CO_2 emissions we will have to reverse the 50-year trend in transport growth.

Technical advances can improve marine transport. New mono-hull and multi-hull vessels, initially deployed for passenger transport, are entering service for freight transport. Improved logistics and container systems are increasing efficiency of maritime transport. The European Commission is promoting the development of 'Motorways of the Sea,'[63] with the aim of removing freight from major European trunk road routes. If successful, these developments will increase the attractiveness of short-sea shipping as part of multi-modal freight systems. Water transport will benefit from faster craft and vessels with more energy efficient and cleaner propulsion systems as well as improved ports, with more efficient access and IT to manage and secure freight movement. Here the maritime equipment industry in the UK can make a significant contribution.

[62] Department for Transport (2004) Powering Future Vehicles Strategy. Second Annual Report 2004. London, TSO.

[63] European Commission (2001) European Policy for 2010. Brussels. Section II.

Air travel has perhaps seen the greatest benefits of technological progress in recent years, with quieter and less polluting aircraft. That progress will continue with new generations of civil aircraft. New aircraft designs will provide greater load capacity with proportionally lighter aircraft, better engine efficiency and drag reduction. Here too there is room for technology to improve the reliability and capacity of the system through advances in air-traffic control and navigation.

As in the past, we can expect market forces to encourage the development and take up of new technologies, as car makers strive to differentiate their products from those of their competitors. When it comes to safety and the environment, market forces are rarely enough on their own. Regulation and legislation have proved essential in reducing casualties and the environmental impacts of transport. There is a strong case for governments to promote regulations that encourage technological change, through such measures as imposing progressively more stringent safety and emissions standards for new road vehicles, trains, planes and ships.

Technology has an important contribution to make in improving transport infrastructure, by reducing construction and maintenance costs, improving safety and reducing environmental impact. Enhanced tunnelling technology could contribute significantly to the provision of environmentally less intrusive infrastructure. Cost escalation has become endemic in construction projects, partly as a result of uncertainties over decision-making. The challenge is to reverse this trend and to reduce how long it takes to plan, design and complete new projects.

Technology can increase the capacity and improve the reliability of the rail network. In particular, we can expect progress in the technologies used in track and structures, signalling and operations, and traction and rolling stock. Reductions in energy consumption will come about through such developments as power-electronic drives, perhaps with improved on-board energy storage. Rail technology can also benefit from the same improvements in efficiency that lightweight materials and composites are bringing to cars, and that are also a key feature in the next generation of civil aircraft and fast ships. Systems to monitor the condition of track, structures and vehicles could deliver substantial changes in maintenance practices and important improvements in system reliability. Linked to this is the need to consider, as a system, the interactions between trackbed, rails and carriages. This too will have implications for design and maintenance.

Land use

Land-use policy interventions can influence the length and mode of journeys, although they are unlikely to affect the number of journeys. These policy interventions include increased housing density, mixed development of housing and commercial premises, development in conjunction with public transport, development in larger conurbations and closer to city and district centres, redevelopment of brownfield sites, reductions in parking provision and controls on the way in which new developments are used. In principle land-use taxes could reinforce any of these interventions, though there is little experience of their use.

Recent research[64] demonstrates that policies to increase density or achieve mixed land use will have only limited effect unless they are accompanied by measures to make car use less attractive. Conversely, transport policies to make car use less attractive are very effective in reducing congestion and pollution, provided that development is not too dispersed. For this reason, supportive land-use policies are very important in the longer term in maintaining the effectiveness of transport policies. Policies that reflect higher density, mixed development in association with public transport and limited private parking provision should be central to the development of Regional Spatial Strategies.

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[64] Greiving S and Wegener M (2003) Integration of transport and land use planning: state of the art. Proceeding of the 9th World Conference on Transport Research, Elsevier.

5 Making it happen

Introduction

Transport in the UK currently operates under institutional and financial regimes that are not conducive to effective and consistent development of a coherent and holistic long term strategy. Road and rail often find themselves in competition when collaboration would be more sensible. The fiscal regime encourages air travel, a form of transport that raises worrying environmental questions. Also, it is often easier to fund major investments in infrastructure than it is to pay for lesser measures that could deliver significant gains more effectively and at much lower costs. In this chapter we consider ways in which institutional structures, financial regimes and public awareness could best focus on delivering our vision of transport in 2050.

Transport in the UK has for too long been dogged by a lack of a long-term vision, inconsistencies and changes in approach. Many of our Continental neighbours have benefited from consistent and coherent strategies for transport and land use. The UK, in contrast, has seen major changes with each new government. Road investment has gone from being the dominant element – for example, in the 1989 White Paper "Roads for Prosperity"[65] – to being largely discounted immediately after the 1997 election. Management of the rail network has been in continuous flux for a decade or more. Investment in London Underground fluctuated widely throughout the 1990s. Deregulation dramatically reduced the contribution of local bus services to transport services outside London. The lack of a national strategy on port expansion has already been highlighted. Transport needs a commonly agreed core strategy that can be planned and implemented consistently over several decades.

Government and agencies

Transport has a significant impact on the government's policies for wealth creation, education, health, social inclusion and sustainability and those policies will be more effective if transport's contribution is clearly identified. The Department for Transport has a key role in ensuring that this happens. Similarly, policies in other government departments can have adverse impacts on transport. The Department for Transport needs to be directly involved in all such decisions, so that its overall transport strategy can develop consistently with strategies in other government departments.

The Highways Agency has, within the constraints imposed upon it, proved effective in implementing the Government's strategy for the trunk and motorway network. However, the agency's network is too limited to meet the national needs for inter-urban travel. There is a case for a new self-financing National Roads Corporation, operating at arm's length from government, and responsible for operating, maintaining and developing the national road network. The national network should be redefined to include all roads which have a significant national role in England, Scotland and Wales. We envisage a network of around 50,000 km of roads on which priority would be given to the movement of people and goods.

The Strategic Rail Authority has proved less effective than the Highways Agency. We see a strong case for establishing a body to mirror the National Roads Corporation. This body, a National Rail Corporation, would manage, maintain and develop the rail network in accordance with national and regional transport strategies. It would be the Corporation's role to ensure that train operators provide safe and reliable services. We accept that this is a step beyond the institutional arrangements proposed in the recent White Paper, but consider that it would be preferable to the split between strategy and execution envisaged there.

The agencies responsible for roads, rail, maritime and air transport must work together to consider the effect of each transport mode on other modes. It should be the responsibility of the Department for Transport to ensure that this happens.

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[65] Department for Transport (1989) White Paper - Roads for Prosperity. London, HMSO.

Regional and local transport
Responsibilities for local transport are currently complex and fragmented. Local authority boundaries rarely match travel-to-work areas, and transport and land use responsibilities are often divorced. We welcome the requirement for Regional Assemblies to produce statutory Regional Spatial Strategies and Regional Transport Strategies. However, these Regional Strategies need to be consistent with national strategy.

While Regional Transport Strategies should indicate the priorities for investment in regional transport networks and services, and for the management of demand on those networks, responsibility for implementation should normally lie at the local government level. Local authorities should therefore retain the responsibility for local road provision and management, and for the specification and support of local public transport services. Where travel-to-work areas include a number of local authorities, there is a case for these responsibilities to be executed for the conurbation as a whole. This could be done by extending the responsibilities of existing Passenger Transport Authorities, and by introducing similar arrangements in additional conurbations.

Finance
Historically, finance for transport in the UK has fluctuated as governments' priorities, and the state of the economy, have changed. This has made it difficult to sustain investment on the timescales needed and to commit sufficient resources to maintenance. Our proposed pricing strategy would provide predictable and secure income for transport.

Revenues from user charges should accrue to the National Roads Corporation, its rail equivalent and the regional and local transport authorities in direct relation to the use of their networks. The National Roads Corporation should be responsible for collecting all road user charge revenues on behalf of regional and local authorities. The revenues should be used to finance transport infrastructure, maintenance, management, service provision and research and development. We anticipate that as a result the National Roads Corporation would be self financing. However, its rail counterpart would almost certainly not be, and would need financial support to cover backlog maintenance and socially necessary but unprofitable services. The same may well be true of regional and local authorities, particularly in the more rural areas. The National Road Corporation should be permitted to finance other agencies and authorities in relation to actions which reduce demands on the national road network.

All of these bodies would be able to seek financial support from the Department for Transport, which would be funded through taxation. They would also have the ability to raise finance for new investments, secured against future user charge revenues, either directly or though bond issues.

The proposed charging regime will provide a pointer to where best to invest in transport, although final decisions would be influenced by the costs of such investment. In an area with no congestion, the revenue from road pricing would simply maintain the existing infrastructure. Where there was congestion, the revenue would fund measures to alleviate that congestion through whichever mechanism proved most cost effective, be it better highway management, more road capacity or improvements to public transport. The National Road Corporation and local authorities would reflect these priorities in their spending on transport, parking, highway maintenance and environmental improvements. The exception would be improvements for non-paying road users, such as pedestrians and cyclists, where the agencies would have a duty to provide facilities at appropriate standards.

Consistent planning
Effective national and local management of transport is difficult when different agencies work from different information and on different timescales. The Highways Agency, Strategic Rail Authority, regional assemblies and local authorities currently produce forward plans that differ in their time horizons and content. All such plans should cover a consistent time period. We consider that five years is a sufficiently long period to achieve stability of implementation, while still allowing regular reviews of the content of the strategy. The plans, reinforced by

evidence from users' choices, will identify the most important infrastructure projects. This would be a transparent process which should reduce the need for intensive public inquiries on each project. Additional compensation should be provided where it is impossible to avoid adverse impacts, in order to improve public acceptance of new investments and reduce the time it takes to approve and implement a scheme.

Effective planning requires comprehensive data on the state of the infrastructure, the patterns of transport movement and the responses of users to different types of policy intervention. Such information provides the basis for assessing needs for action, selecting the most appropriate interventions, and monitoring their performance. Recent experience, for example with the need for rail maintenance, has demonstrated that such information is not complete. Moreover, as more of the system is managed by the private sector, some data vital to transport planning is being treated as commercially confidential. Government should ensure that the data needed for formulating its strategy and that of regional and local authorities is collected consistently and made publicly available.

The private sector will play an important role in achieving our vision. As we stressed in Chapter 3, it needs a consistent and clear long term strategy if it is to be effective. Public agencies and authorities can benefit from the private sector's ability to raise investment capital, to deliver infrastructure and to operate services efficiently. However, these agencies should specify the overall strategy, and the requirements for infrastructure projects, services and charges, rather than leaving these to be determined by the private sector.

Appraisal

While the Department for Transport has a detailed appraisal procedure, it is still not applied consistently for all types of scheme. The procedure fails to address some of the broader social objectives of transport policy. As a result, there is a tendency to place too much emphasis on investment in infrastructure and too little on low-cost remedial measures that may well offer much greater value for money. Similarly, it may well be more difficult to justify schemes that support environmental and health objectives, but have little impact on travel time and congestion. As the range of objectives of transport policy widens, and the nature of the solutions changes, it will be important for the DfT to ensure that it, its agencies and regional and local government adopt appraisal methods that are consistent with one another and comprehensive in their coverage.

Awareness and acceptability

Any new strategy for transport will need public support if it is to succeed. We can see the value of enlisting public support for new transport measures by considering London's initial congestion charging scheme. It became clear to the public and to the local business community that revenues from charging could make it easier to finance improvements in transport. It will be important to inform the public, and the media, of the arguments in favour of a coherent strategy. The lead for this should come from the Department for Transport, but support can come from professional bodies, individual experts and, above all, from authorities that pursue successful policies.

Our proposed strategy also relies on the myriad decisions of individual members of the public, which can have a significant impact on congestion, pollution and casualties. Buying a more fuel-efficient car, choosing a home close to work and school, and combining journeys are all ways in which individuals can contribute to a more sustainable transport system. To influence those decisions, and to achieve support for the radical change in transport strategy that we advocate, it is important to increase awareness of problems and possible solutions, and to develop attractive solutions.

Surveys regularly demonstrate that the public and the business community prefer solutions that improve the transport service, whether by building new infrastructure, running more services or charging lower fares. Conversely, the public and business are likely to oppose measures that limit, or charge more for, the opportunity to travel. While it is essential to communicate transport strategy to the public, it is also important to understand public attitudes through stakeholder involvement and active public participation in policy formulation and implementation.

Consultation is only one stage in the process of public participation. At its most effective, participation can include public identification of problems, possible solutions, and preferred approaches. This broader approach has been effective in local planning and area safety schemes, but has proved less successful when applied to the design of road schemes. Experience in other sectors demonstrates clear benefits in terms of the richness of the solutions suggested and the level of acceptance of the chosen policy.

Skills

As we indicated in Chapter 2, effective strategy development and implementation is dependent on the availability of a cadre of skilled professionals. There remains a serious shortage of such skills, particularly in the engineering profession, and the nature of the skills required is changing as the transport system becomes more complex. The Department for Transport has a responsibility to forecast the skills required and to encourage action to fill the gaps.

Innovation

There are many opportunities, and needs, for technology to contribute to our vision of transport in 2050. The challenge will be to realise those new technologies in time, and to integrate them into a coherent transport system. Successful innovation is often best pursued through demonstration projects in which the private sector develops the technology, but in which Government provides support for research, testing and demonstration.

The UK is an acknowledged world leader in research into transport systems, spearheaded by TRL Ltd, several academic research groups and some sections of industry. In addition to technological developments, the UK has made significant advances in techniques for managing congestion and enhancing safety, more efficient operation of public transport systems and improved understanding of user behaviour and systems economics. These research programmes are supported principally by the Engineering and Physical Sciences Research Council, the Department for Transport, the Highways Agency and the European Commission. Such research will continue to be important in the development of our proposed strategy, and should focus particularly on the challenges of congestion, accidents and global warming. The institutional changes we advocate in this section should lead to more effective exploitation of that research. Continued government support will be important in securing a successful programme of exploitable research.

We welcome the proposal for a Transport Innovation Fund[66] as a means of bridging the gap between research and implementation. Many of the proposals in our strategy, and particularly those for true-cost charging and the wider application of technology, merit support in this way.

While the UK has played a leading role in the underpinning research for transport, it has been less effective at turning new ideas into commercial technologies. Institutional and political barriers often lead to slower exploitation here than in other countries. In-vehicle route guidance and smart-card fares systems are cases in point. Innovation and development inevitably entails risk, and that risk must be shared between the private sector and government. The government needs to develop a much improved understanding of these requirements for transferring research into practice.

[66] Department for Transport (2004) *The Future of Transport* – a network for 2030, CM6234, London, TSO.

6 Recommendations

The Nation's transport system faces a number of significant challenges, both immediately and over the fifty year period which we have considered. The most serious are congestion, which already costs the UK more than its European neighbours, and is likely to worsen considerably unless action is taken; transport's production of greenhouse gases, which is rising, and needs to be reduced substantially if national targets are to be met; hardship for those denied the use of a car, who will remain a substantial minority; the risk of accidental death on the roads, which is still eight times that of everyday life; the continuing need to reduce noise and pollution from all forms of motorised transport; and the threat to personal security. We have developed our strategy to address all of these, but note that they are to some extent in conflict in the solutions which they require.

A national transport strategy designed to tackle these challenges must take a holistic approach, treating transport as a system. Action is needed to provide new infrastructure, manage the existing infrastructure more effectively, improve the regulation of transport services, make more effective use of new technology, and change the way in which transport use is paid for. A balance needs to be established between these approaches, all of which are essential to an effective strategy.

Transport users should be expected to pay the true costs of their journeys. True-cost charging should cover both the direct costs of travel and the indirect costs which arise in the form of congestion, pollution and accidents. In parallel, existing taxes on transport use should be reduced to the minimum, and should apply at the point of use, rather than on vehicle ownership. Concessions may be needed for people with particular needs, but should be carefully targeted and fully transparent.

A programme of road infrastructure investment should be designed to meet those needs which remain once true-cost charging is in force. Rail investment should focus on relieving bottlenecks; new high speed lines are unlikely to be justifiable in the short term, but may be worthy of reconsideration as patterns of demand change. Underground and commuter rail lines in London require modernisation, and there is a case for some further light rail and bus infrastructure in provincial cities. The airports strategy needs to promote the role of regional airports as well as increasing the capacity of the London airports. A parallel strategy for the enhancement of national ports is urgently needed. Investment is also needed to overcome the backlog of infrastructure maintenance.

Low cost management measures will continue to play an important role in making better use of existing infrastructure. Greater flexibility is needed in the use of management measures to improve the local environment. The threshold cost/benefit ratio above which investment is approved should be the same for management measures and infrastructure investment. In particular, far greater investment should be made in accident remedial measures. Measures which encourage individuals and firms to make better use of transport through so-called "smarter choices" show considerable potential and should be further promoted.

The form of regulated competition for bus services, which has operated effectively in London, should be extended to the rest of the country. Within this context, fares, ticketing and service information should be coordinated. Where true-cost charging leads to reduced patronage, lightly used rail lines should be replaced by appropriate bus services.

Advances in information and communications technology will be needed to support true-cost charging, and should be channelled also towards improving the efficiency, robustness and safety of transport systems. Improvements in engine performance, fuel technology, noise, emissions and vehicle safety should be encouraged by setting increasingly demanding targets for the new land, sea and air vehicle fleet. Infrastructure technology should focus on improved tunnelling methods, increased use of recycling, and reduced costs.

Land use and transport should be planned together, with increased emphasis on higher density, mixed development.

A holistic national transport strategy based on the above principles needs to be planned and implemented consistently over a period of decades. The Department for Transport should have overall responsibility for this, and for working accordingly with other government departments.

While the Department for Transport should be responsible for determining the national transport strategy, implementation should be the responsibility of agencies operating at arm's length from government. A National Roads Corporation should take responsibility for operating, maintaining and developing the national road network. That network should be redefined to include all roads with a significant national role, and include some 50,000km of highway. A National Rail Corporation should be introduced, with similar responsibility for the national rail network. The Department for Transport should ensure that these two Corporations, and the bodies responsible for national ports and airports, collaborate effectively on multi-modal issues.

Regional Transport Strategies should continue to be developed, in ways which are consistent with the national transport strategy, while allowing regional priorities to be emphasised. In most cases, implementation should be the responsibility of local government, whose Local Transport Plans should be compatible with the Regional Transport Strategy. There is a case for extending the principle of Passenger Transport Authorities to more conurbations, and empowering them to manage all modes of transport.

The National Roads Corporation should be responsible for collecting true-cost charges on the roads, and transferring revenues as appropriate to local highway authorities. It should be permitted to finance other agencies for actions which reduce demand on its network. While the National Roads Corporation is likely to be self financing, the National Rail Corporation and some local authorities would need financial support to cover backlog maintenance and socially necessary services. They should be able to seek such support from the Department for Transport and to raise finance through bond issues. Such financial support, and the appraisal methods used to justify it, should be applied consistently across all agencies, modes and types of policy intervention. In particular, consistency is needed in the cost-benefit thresholds adopted for approving investment in low cost management measures and larger infrastructure projects.

All agencies should adopt a common five year business planning period, and demonstrate consistency between their plans and the longer vision of the national transport strategy. The Department for Transport should ensure that the information needed for the development and monitoring of these plans is made publicly available. The private sector will continue to have an important role in the implementation of these plans, but should work within the publicly developed strategy and its implementation priorities.

The Department for Transport should take the lead in increasing the awareness of the need for the national transport strategy among members of the public and stakeholder groups. It should encourage support for the strategy, and actions by individuals and firms which reinforce the strategy.

The Department for Transport should forecast the requirements for skills in the transport sector, and should encourage action to fill any gaps. Particular stress needs to be placed on the need to increase the pool of engineering skills. It should continue to support a research programme which focuses on the challenges of congestion, global warming and accident reduction. The Department should review best practice in the exploitation of research findings, and should share the risk with the private sector in applying relevant new technologies.

We cannot pretend that these recommendations will answer all of the challenges which the country's transport system will face over the next fifty years. In particular it may well be that the challenge of global

warming will require more draconian action. But our recommendations should provide a strategy and approach to governance better suited to the needs of our country, and should enable our fifty year vision to be realised. However, they will only do so if action is taken now, particularly on our recommendations for charging, infrastructure and governance. We commend our strategy to government, and intend to review progress against it in five years' time.

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The Royal Academy of Engineering

The Royal Academy of Engineering - Britain's national academy for engineering - brings together the country's most eminent engineers from all disciplines to promote excellence in the science, art and practice of engineering. Our strategic priorities are to enhance the UK's engineering capabilities; to celebrate excellence and inspire the next generation; and to lead debate by guiding informed thinking and influencing public policy.

Strategic Priorities
The Academy's work programmes are driven by three strategic priorities, each of which provides a key contribution to a strong and vibrant engineering sector and to the health and wealth of society.

Enhancing national capabilities
As a priority, we encourage, support and facilitate links between academia and industry. Through targeted national and international programmes, we enhance – and reflect abroad – the UK's performance in the application of science, technology transfer, and the promotion and exploitation of innovation. We support high quality engineering research, encourage an interdisciplinary ethos, facilitate international exchange and provide a means of determining and disseminating best practice. In particular, our activities focus on complex and multidisciplinary areas of rapid development.

Recognising excellence and inspiring the next generation
Excellence breeds excellence. We celebrate engineering excellence and use it to inspire, support and challenge tomorrow's engineering leaders. We focus our initiatives to develop excellence and, through creative and collaborative activity, we demonstrate to the young, and those who influence them, the relevance of engineering to society.

Leading debate
Using the leadership and expertise of our Fellowship, we guide informed thinking; influence public policy making; provide a forum for the mutual exchange of ideas; and pursue effective engagement with society on matters within our competence. The Academy advocates progressive, forward-looking solutions based on impartial advice and quality foundations, and works to enhance appreciation of the positive role of engineering and its contribution to the economic strength of the nation.

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