Motoring towards 2050

RAC Foundation

The Royal Automobile Club Foundation for Motoring Limited is a charity established to promote the environmental, economic, mobility and safety issues relating to use of motor vehicles.

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Price £295

Motoring towards 2050

an independent inquiry

Report steering committee

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John Bates, consultant economist.
Bill Billington, highways consultant.
David Holmes, formerly in senior positions in the Department of Transport and with British Airways.
Richard Ide, formerly Chief Executive of Volkswagen Group UK.
David Leibling, formerly with Lex and author of the Lex (now RAC) Report on Motoring.
Professor Peter Mackie, Institute for Transport Studies, University of Leeds.
Richard Mills, Secretary General, National Society for Clean Air and Environmental Protection.
Sir Nick Monck, formerly Permanent Secretary, Department of Employment, and second Permanent Secretary, HM Treasury.
Professor Chris Nwagboso, Professor of Integrated Transport and Head of the Transport and Automotive Systems Research Centre, Wolverhampton University.
Professor Tony Ridley, Professor of Transport Engineering, Imperial College.
Robert Upton, Secretary General, Royal Town Planning Institute.
Joan Williamson, researcher.

The Department of Transport, Local Government and the Regions provided an observer who attended most of our meetings and provided factual advice.
David Holmes and **David Leibling** from the Foundation's public policy committee were joint secretaries.
Edmund King is the Director of the RAC Foundation.
Jo Abbott is the Administrator of the RAC Foundation.

The RAC Foundation wishes to thank the independent steering committee and all those who have sent in submissions or advised the steering committee on this report.

At a late stage, we gained greatly from a day's discussion of our draft report with a group of transport experts:

David Bayliss OBE, formerly Director of Planning, London Transport.
John Dodgson, Director, National Economic Research Associates (NERA).
Professor Stephen Glaister, Professor of Transport and Infrastructure, Department of Civil Engineering, Imperial College.
David Quarmby, Chairman of the British Tourist Authority and formerly Chairman of Docklands Light Railway and Joint Managing Director, J Sainsbury PLC.
W J Tyson, Chairman and Managing Director, TMG of GMPTE.
John Welsby CBE, immediate past President, Institute of Logistics and Transport, formerly Chairman and Chief Executive Railways Board.
John Wootton CBE, formerly Chief Executive of the Transport Research Laboratory and President of the Institution of Highways and Transportation.

Illustrations in this report provided by students from the Automotive Design course at the Royal College of Art. Many thanks to course director, Dale Harrow and the students: Boris Grell, Kristian Hardy, Jean-Arthur Madelaine-Advenier, Danny Ram, Dominic Nowakowski, Graham Hodgson, Benjamin Payne, Sacha Barber, Viktor Holmqvist.

The Prime Minister

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This report cannot and does not represent Government policy. But it is a well-argued and interesting contribution to the debate, and particularly so as it is from an independent inquiry by a respected motoring organisation.

Meeting the needs of modern motorists whilst fulfilling our responsibility to protect the environment is one of the biggest challenges faced by any Government. The RAC Foundation first suggested an independent inquiry into motoring issues in October 2000. In replying, I said that we would welcome a report bringing greater clarity and understanding of the issues and choices.

Eighteen months on, this Report more than meets that challenge. It argues that there are no easy answers to fulfilling our desire to travel and that we cannot solve the problem just by building new roads, or by hoping everyone will choose to use public transport for all journeys. It is essential that we make the very best use of the infrastructure we have. Technology can help with that and – through low carbon, hybrid and fuel cell vehicles – reduce environmental impacts. I want UK companies to lead the global shift to low carbon transport. We have fiscal policies and other programmes designed to bring this about, and will shortly publish a comprehensive strategy.

But the report also argues that technology on its own cannot solve all our transport problems. It highlights particularly the challenge of reducing congestion, suggesting a number of possible long-term solutions. I look forward to hearing the debate.

Tony Blair

The Rt Hon Tony Blair MP

May 2002

Executive summary

Background

After the fuel protests in 2000, Sir Christopher Foster, Chairman of the RAC Foundation, wrote to the Prime Minister asking that the Government should conduct a long-term study looking at the future of motoring within transport policy over the next 50 years. The Prime Minister suggested that the Foundation itself might undertake this task.

The Foundation commissioned a scoping study from National Economic Research Associates (NERA).

We then asked for evidence and received more than 250 submissions from organisations and individuals around the world. A full-day seminar was held to consider initial findings. Many meetings have been conducted with Government departments and other relevant organisations.

The inquiry considered the long term prospects for car ownership and travel in the UK, taking account of economic and social factors, capacity problems of the roads, impact of the car on the environment, technological changes to the car and infrastructure, growth for demand in traffic in the electronic age, the interaction between transport and land use, and the future role of other modes of transport.

Why 2050?

The inquiry is called 'Motoring towards 2050'. We chose 50 years because over that period, many of the things we currently take as constraints could change. We have not come up with forecasts for 2050, but indicate the direction in which society is moving and the implications for the medium term. We conclude that the car will remain the predominant mode of transport. We ask what actions taken now will ensure that it does so most effectively, balancing the benefits it provides against our concern for the environment.

Steering committee

To ensure the independence of the study, Motoring towards 2050 was directed by a steering group of people who together have wide experience in the relevant fields.

Report summary

History

We have reviewed how travel demand and policy have developed over 50 years to give us the most under-invested and congested transport facilities in Europe. Transport policy is undoubtedly complicated as it involves balancing irreconcilable pressures. Our approach is to learn from the past and to present positive measures.

Car ownership and traffic growth

We estimated traffic growth to 2031 and extended it to 2050. The main pressure for traffic growth will continue to be increasing car ownership, especially among the less affluent and in households with more than one wage-earner. Government imposed policies to limit car ownership are not desirable. The rate of traffic growth is already lower than it was in the 1960s and 1970s. We believe it will taper off further. Yet by 2031 we forecast a 50% increase in traffic if road capacity is increased to keep congestion no worse than today. If road capacity is not increased, worsening congestion will cut traffic growth back to about 33%.

There will be far more serious congestion on our roads than now, with adverse effects on personal mobility, environment and the economy. We should not continue to rely on congestion to limit traffic growth. A small amount of the shortfall will be diverted from road to rail, but most will be choked off. It is possible that traffic growth will be greater than our central estimates if only because car ownership in 2031 will still be low by international standards.

Environment and technology

Technology and the right policies will solve environmental problems. We consider the environmental standards (on air quality, CO_2 and noise) to be reached and the probability that vehicles will meet them fully by 2050 so that environmental factors need not be restraints on road traffic growth. A few local areas of poor air quality need to be addressed by other means. We believe that British firms could get a good share of the development of new, cleaner technology. We expect the fossil fuel economy to be replaced by a low carbon economy and that cars will be clean and efficient with advanced electronics but still effectively individual personal transport on wheels.

Land use planning

The way we live now is for most people built around the car. Congestion problems have been made worse by the imbalance between north and south. Though land use planning will have little effect on congestion in the shorter term, it can help find a balanced solution. Long term initiatives are needed to develop a national strategic framework, ways of meeting this demand for housing (and other services) which make sense in transport terms and measures to reduce the intrusion of cars into local communities.

Car dependence

The car will remain the main means of passenger transport. We discuss ways of reducing dependence through car sharing, travel plans, technology and telecommunications. A distinction should be drawn between measures reflecting greater productivity and consistent with economic growth, which are to be welcomed, and those which are dirigiste with serious economic or personal consequences. Our conclusion is that traffic growth is unlikely to be reduced much below our central estimates without severe effects on personal mobility and economic activity.

Public transport

The received wisdom has been that traffic growth can be contained by shifting demand to public transport. The motorist supports the development of a first-rate railway and other public transport systems, though many people outside London and the south east never use them. Yet to be realistic the rate of rail investment in the 10 Year Plan will have a small effect on the share of traffic carried by road (85% of passenger miles are by car and 90% of freight mileage by road). It is also much less cost effective than most other investment and measures in the 10 Year Plan. Nevertheless the need for additional transport infrastructure in general is so pressing that any investment that is in the 10 Year Plan must be completed. Neither rail nor any other public transport will have substantial effect on the volume of car and freight traffic. The position is different for traffic in most local areas.

Because the cost of increasing rail capacity is escalating, a hard look is needed at priorities, especially as capacity needed for long distance passengers, urban commuting and freight will often be in conflict. However, some of the most costly investment may prove the most necessary. Particularly in London and the south east there need to be further large investments, mostly in underground and rail, after the 10 Year Plan, if public transport demand is to be met and severe overcrowding avoided.

Local transport planning and provision

Future car traffic growth cannot be fully accommodated in many urban areas. On the basis that car ownership will continue to grow, there is a need to find other modes for types of car journeys which will prove publicly acceptable. Those solutions will vary greatly with local circumstances. Often buses are the most practical solution. Varying with population densities and other factors, there are great differences in the extent of motorisation possible or tolerable in different places. That fact reinforces the conclusion that all cities and towns with their hinterlands must consider what is appropriate for them. In separate sections we review international best practice in public transport and for walking, cycling and motorcycling.

We make recommendations on how we believe planning at the local level could be improved and why we must plan further ahead to be as effective and to achieve such good results as the best European cities. How national rail and road systems are integrated with local transport remains of the first importance. It also needs to be made easier for motorists to leave their cars outside city centres to complete their journeys by public transport.

Highway capacity

What should govern development of the national strategic road network? We review the various means by which capacity can be increased, both by facilitating operation and physical extension, and conclude that, to address the problem effectively, all available means must be used in combination. The 10 Year Plan provides the current framework. It is essential that the plan is delivered as intended, with schemes identified in multi-modal studies progressed quickly to implementation.

We return to our estimates and consider the implications for future congestion of different investment scenarios:

- no further substantial new investment after the 10 Year Plan period; congestion would increase rapidly after 2010 to such an extent that a substantial element of the demand would need to be deterred by charging for access or use to the detriment of personal mobility and economic activity

- how the network would need to be enhanced to provide for broadly free-flowing conditions in 2050; this would require an unprecedented high resource commitment
- continuing to invest until 2050 at the same rate as in the plan; provided investment is directed to the congested links, the growth of congestion should be slowed but will still remain a problem.

We note the importance of meeting demanding criteria for acceptability in any new investment and look at means by which impacts can be reduced. We see greater use of tunnels as one means of achieving this. We look at the possibility of a higher technology network in which vehicles are subject to external control and recommend that this is investigated further.

We believe that the third option is the minimum acceptable approach – involving packages of modern technology, highway investment and traffic restraint. Anything less would lead to rapidly worsening congestion.

Influencing demand

No single approach can solve the transport problem. We must improve public transport, lessen the adverse environmental impact of vehicles, increase the effective capacity of the highway system and be able to manage demand. Fuel duty has slowed demand but it is inefficient. Motorists have been reluctant to accept road pricing but when differentiated by place and time it is a better way of influencing the level of demand. Our support is conditional on measures to make it acceptable:

- Charges should be, and be seen to be, tools for reducing congestion, not for raising revenue. Their level should be evidence based, perhaps set by technical experts, and may go down as well as up
- The revenue from charges should be used for transport improvements and reductions in fuel duty
- Spending should make transport alternatives to charged roads better or cheaper, help poor or disabled people (not directly affected by charging), and tackle road bottlenecks where feasible
- Road improvements should be planned to avoid the need for high levels of congestion charges
- Reducing fuel duty would give net benefit to those who use uncongested roads especially rural drivers
- Recognition that charges would only be required on about 10% of the network and at certain times.

Public acceptability

The Report includes a review of the acceptability of our conclusions from the evidence of our own and others' surveys. More than 80% of motorists report that they would find it very difficult to adjust to a lifestyle without a car. This figure has remained fairly constant over the last 15 years.

There have been various false dawns when motorists claimed that they would use their cars less if public transport were better. Forty six percent claimed this in 1997 but after Hatfield and other problems on the railways this optimism dropped to 36% by 2001.

Our task was to come up with a package of measures which would be acceptable to the motorist, and indeed the general population. In the past motorists have been opposed to congestion charging. An NOP Automotive survey for the RAC Foundation in 1999 found that 75% of motorists thought it unfair to charge motorists to drive into towns and cities. Even when motorists were told that the charges would go back into improving transport only 51% were in favour, with more opposition in the north of the country.

Prior to the launch of this report we commissioned NOP Automotive to put some of our proposals to the test.

When motorists are asked whether they would be willing to pay tolls to drive in city centres or on motorways only 43% are in favour. However, if the charging package includes a reduction in fuel duty, support jumps to 76%. Even if other taxes are not reduced but tolls are introduced as a package of better roads, public transport and traffic management, then 71% find this acceptable.

The survey also shows a resurgence of support for road improvements with over half of respondents opting for better roads and road maintenance. One third opted for investment in public transport and one in eight wanted money from tolls spent on public services.

In summary the motorist will accept charging as part of a package if the benefits are transparent and immediate.

Conclusions and main recommendations

In conclusion the report finds:

- The car will remain the main form of personal mobility in 2050
- It will be clean, green and safe
- The challenge is to minimise adverse effects of traffic growth and congestion
- It is vital to implement the 10 Year Plan
- It is essential to speed up delivery of road schemes by streamlined processes and better compensation
- Rail must be improved but do not expect to avoid the need to improve roads
- Technology will help to reduce traffic growth but not enough
- A very high level of road investment would be required to avoid congestion charges to restrain traffic
- A lower highway spend would require higher congestion charges
- The planning system must be revolutionised to speed up developments at local level
- The UK will require increasing levels of investment in transport infrastructure
- A package of measures, including extra capacity on road and rail, better traffic management and traffic restraint linked to fuel tax reductions will be required.

Among our principal recommendations are:

- A regular longer-term look at the country's transport strategy
- The commitment of substantial investment in the country's transport network
- Urgent attention to the diverse challenges of switching from fossil fuels to environmentally-friendly means of propulsion
- Gearing up our spatial planning processes to handle the impact of traffic growth more effectively
- Developing packages of technology, increased capacity and traffic restraint to contain the spread of traffic congestion.

We see no good reason why the UK should be condemned to poorer transport systems than our continental European neighbours.

Our report addresses the longer-term, but the long-term begins today.

Introduction

Terms of reference

The Report's aim is to take a long term view of transport policy, well beyond the horizons of the Government's 10 Year Transport Plan, which itself makes a far longer commitment to transport policy than has been made before.

Much attention has properly been focussed on the badly needed improvement of the public transport system – how public transport can be made more attractive, how the massive resources needed for that can be secured – and how walking and cycling can be encouraged. But the car makes by far the biggest contribution to people's mobility – 85% of the miles that people travel by mechanised transport are by car, and 73% of homes now own one or more cars. Car traffic is forecast to continue to grow. This study recognises the reality of the role of the car, the benefits it brings and the problems it causes. It examines how a balance can be struck between the legitimate desire for mobility and concern about the environment, both locally and at the global level, and about the quality of life. At various points we consider the role and importance of transport in the lives of socially disadvantaged groups and communities.

If we had been looking back 50 years from 1900 to 1850 and then forward to 1950, we would have seen a more dramatic change in travel patterns. In 1850 most journeys were local and on foot or horse, with the railways beginning to make an impact. By 1900 the railways were providing cheap and accessible transport, but the car was a novelty. In 1950, cars were more common. From 1950 to 2000 the great change in travel came from much wider access to cars and better roads on which to use them, at the expense of travel by bus and walking, with the train providing a small but relatively constant proportion of travel. The car itself has become safer and cheaper, more comfortable and reliable, but the basic concept of a box on four wheels has not changed.

This study looks at how travel might develop over the next 50 years. It is not a forecast of what will happen by 2050. That date has been chosen to indicate a period sufficiently far in the future when new technological developments will have become common-place, when a new generation of travelling public will have been brought up with different expectations of how to travel and when major changes could have been made to the infrastructure, both in terms of the modes of transport themselves and the systems on which they run.

The conclusions are designed to demonstrate the range of possible outcomes based on different assumptions about changes in technology and policy. It provides practical proposals to resolve the present problems with transport policy. These should influence government thinking and lead to an intelligent debate before the 10 Year Plan comes up for review.

Structure of the report

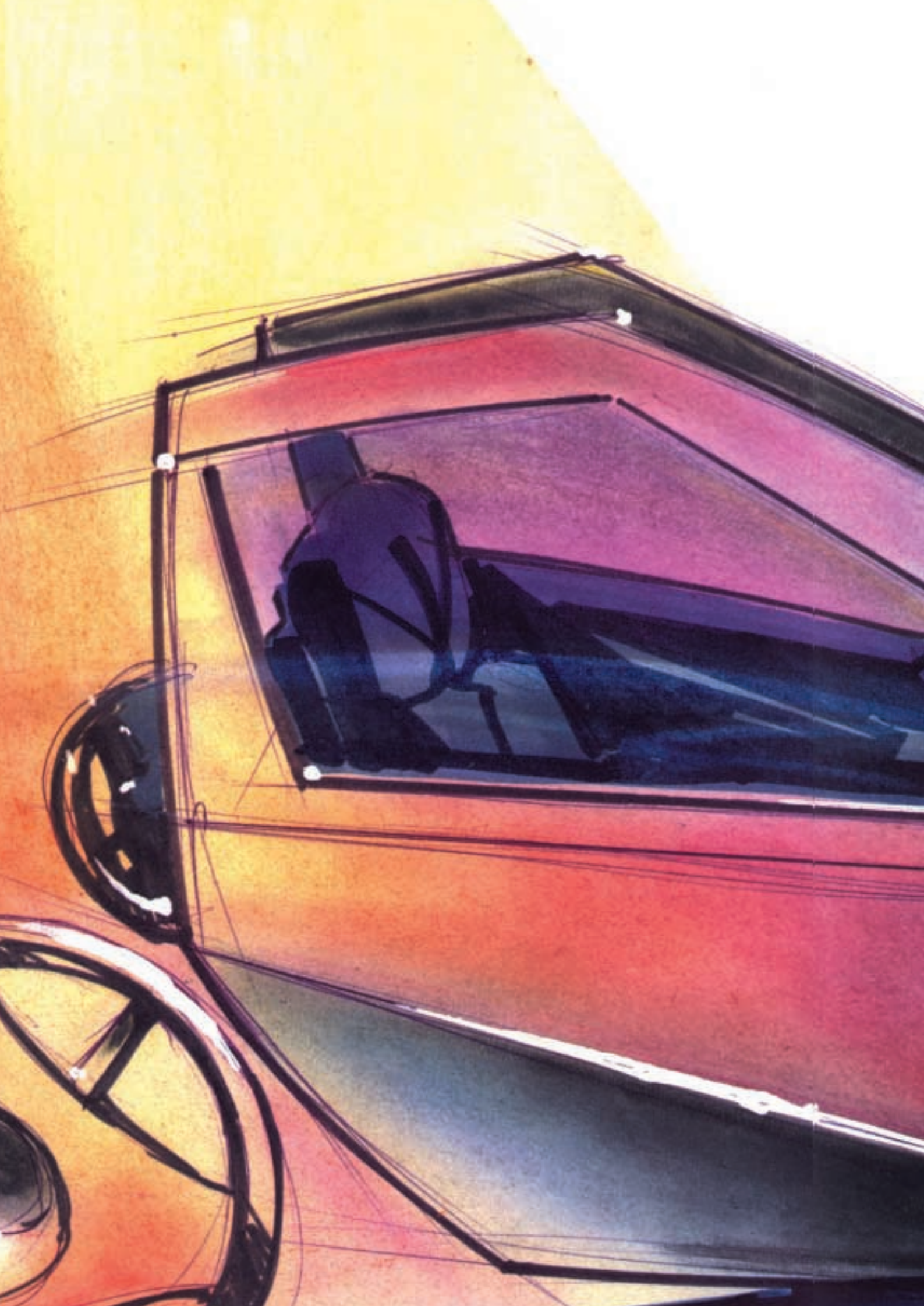
Chapters 1 to 4 set the scene. They review the history of transport and planning policy over the past 50 years and then forecast what drives the demand for travel and hence car ownership. Chapter 3 examines the problems that transport causes to the environment, particularly to air quality, global warming and noise. One of the major drivers of demand for transport is land use planning (Chapter 4).

The second section asks how things could be different. Chapter 5 demonstrates how car technology can address environmental concerns while continuing to provide enhanced safety and reliability. Heavy freight makes a small contribution to total vehicle kilometres (6%) but its impact is much greater on road space and congestion (Chapter 6). Rail freight is only equivalent to 11% of road freight, a proportion that is unlikely to change significantly. Other chapters deal with reducing car dependency, the opportunities for modal shift and novel public transport options such as car pooling and shared taxis. Car parking, park and ride and the impact of cycling, walking and motorcycling are also considered. Demand will continue to grow but home shopping and tele-commuting should reduce transport dependency in total. Then we address new modes of transport and give some examples of European best practice.

Finally we present a set of options for the way ahead. Chapter 10 shows that public transport is unlikely to replace the car in making such a significant contribution to our travel patterns at the national level. We examine problems in urban areas in Chapter 11. Chapter 12 reviews existing road capacity and the current levels of congestion, and shows how road capacity can be increased by a mixture of physical improvements and technological innovations, under three different investment strategies. Chapter 13 takes these inputs and looks at the different policy options for solving congestion on inter-urban roads, local control and charging mechanisms such as road pricing, access permits and ownership controls. In Chapter 14 we report on the public acceptability of different policies, based on consumer research specially conducted for this report by NOP Automotive.

We then list our conclusions and recommendations.

Motoring towards 2050
Part 1: Setting the scene



1 History

- Travel has grown threefold over the past 50 years
- 85% of total travel is by car
- People and jobs have moved out of city and town centres, making the car the most convenient form of travel
- Traffic has grown much faster than road capacity because of low investment in both road and public transport
- Despite growing shortfalls in capacity, governments have not attempted to control demand
- Road congestion is now worse than elsewhere in the EU

1 History

This chapter summarises the changes in transport and transport policies over the last 50 years. The future need not follow the past; but understanding why and how changes have happened might help us avoid mistakes and think more clearly about future challenges.

People travel much more, mainly by car, and for many purposes

The growth in travel and car ownership

The continuous growth of travel and of car ownership and use have been striking in the last 50 years, opening up opportunities for most people and dramatically changing the challenges for Government. In the 1950s, long journeys, most by public transport, were typically the annual holiday and occasional visits to friends and relations. Now people travel much more, mainly by car, and for many purposes: 85% of travel (in passenger-kms) is by car, compared with about 30% in the 1950s. Public transport – rail, bus and tram – carried about 60% of all travel, now it is only 13%.

In 1950, fewer than 49 million people in Great Britain had about 2 million cars. In 2000, 58 million people had 24.5 million cars. In 1950, 86% of households did not have use of a car: now only 27% do not have one. Responsible for these changes have been income growth, falling costs of ownership and usage, and the car's increased importance for business and leisure activities. Car numbers grew faster than incomes, while annual mileage per car slowly increased at about 0.4% a year.

So car travel measured in passenger-kms was in 2000 over 10 times higher than in 1950.

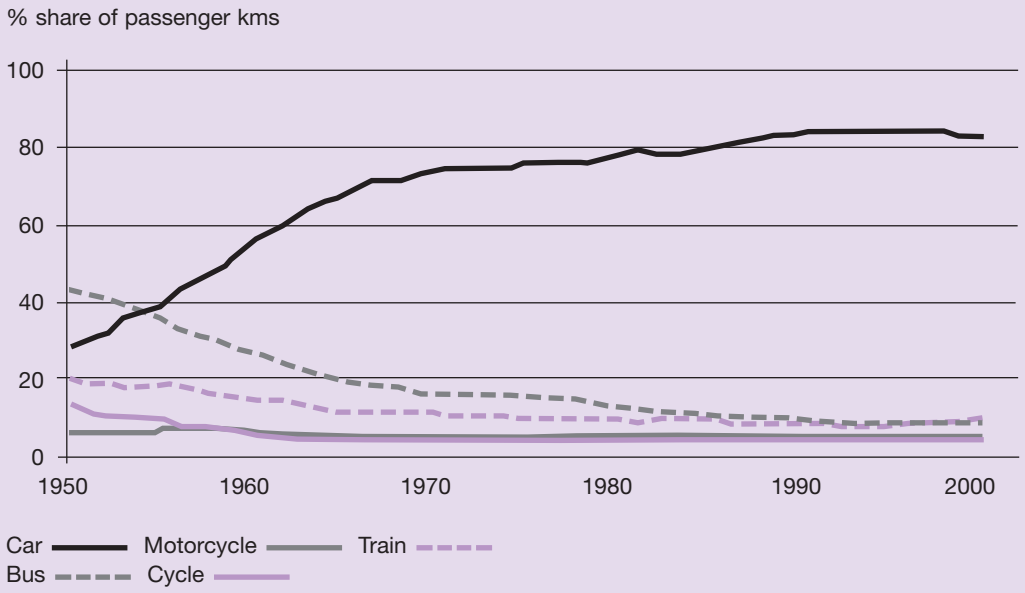
Changes in where and how people live

The UK industrial and employment base has changed. Population and employment have been decentralised from city centres to suburbs and villages, as people have looked for lower-density housing and a better style of life. Factories and mines, which traditionally relied on local workers walking or taking public transport to work, have closed. Cars mean people no longer need to live close to their work or on a public transport route. Catchment areas for jobs are wider and hours of work more varied since workers are not tied to public transport schedules.

Car ownership has helped expand the employment choices of women. The range of jobs they do is far more extensive than 50 years ago. The reasons go far beyond the greater ease of travelling to work. With a car, women second earners in a household are much less constrained in where and what hours they work. Women holding driving licences have increased by 135% over the last 25 years compared with a 36% increase for men.

People over 60, many retired, with full driving licences have more than doubled over 25 years. The size of this group continues to grow relative to the size of the population. Meeting the needs of those who are used to cars but whose ability to drive is declining is a new but foreseeable problem.

Figure 1.1
Share of surface transport in Great Britain



By shortening journey times, cars help people to do far more things in their day, whether work, family business or entertainment. Where they need to go has become more dispersed. Hospitals have been rationalised into fewer, larger units serving wide areas. Shopping centres and leisure complexes are now often on main roads out of town with large free car parks. From safety, convenience, or educational choice, children commonly go to school by car.

The car has brought people advantages only the rich once enjoyed. The RAC Foundation's study of car dependence[1] concluded that about 20% of journeys were unarguably necessary and must be done by car. For many more journeys the poor alternatives available mean it would take longer and cost more not to use the car. To shift many would have needed substantial investment in public transport over a long period, but concentrated on improving the quality of what public transport does well: commuting and other urban flows by bus and rail, and inter-city journeys by rail.

People make journeys and do things very difficult to do by public transport

To say that the lack of good public transport has forced people to own and use cars is a misleading oversimplification. Rather people make journeys and do things very difficult to do by public transport.

Technological change

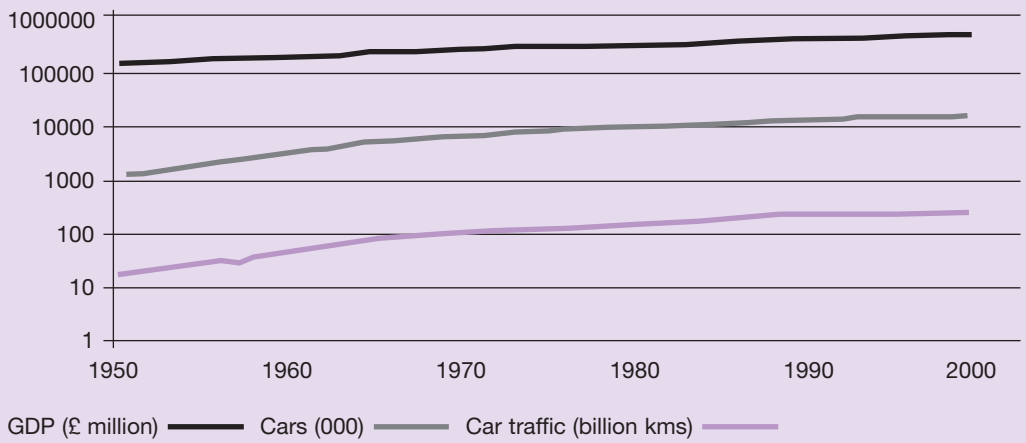
There have been larger technical advances in transport over the last 50 years than in some other fields, but less so than in, for example, telecommunications. Cars are still powered by internal combustion engines, as for a hundred years; but cars in current production are far more fuel-efficient, cleaner in terms of pollutants emitted, safer, more reliable and more comfortable than in the 1950s. New materials, electronics and innovations like the catalytic converter have stimulated these changes, driven forward by manufacturers, regulators and researchers pursuing similar environmental, efficiency or commercial goals.

The greatest changes have been in road freight transport where the market has been deregulated. That has encouraged change: maximum weights have been raised progressively and controversially from 32 tonnes in 1980 to 44 tonnes at present, in line with European standards. The heavy lorry has changed from typically a two axle rigid truck to a five or six axle articulated lorry with great improvements in efficiency, power to weight ratio, braking, steering systems and emissions.

These changes and motorway development have made possible large changes in the distribution systems of manufacturing and service industries. Transport is integrated into the operation of business. Lorries are moving warehouses. 'Just-in-time' operation puts a premium on reliability of deliveries. As a consequence, road freight transport has increased fivefold (in tonne-kms) since the 1950s though the number of heavy goods vehicles is no higher than 50 years ago. Road transport's share of the surface transport of freight (excluding shipping and pipeline) has grown from 46% in the 1950s to 90% currently. Rail's share has fallen from 54% to 10%. Despite substantial investment in innovations such as Freightliners, rail did not capture enough general merchandise to increase its share.

Figure 1.2
Growth in cars and traffic in Great Britain compared with GDP

(logarithmic scale to show growth rates)



Technologically, better track and signalling and more powerful locomotives have increased inter-urban service speeds. Train ride has greatly improved. But railways have not been able to compete effectively in most markets with road transport's ability to provide a door-to-door service in a single vehicle. Many rail passenger services remain vulnerable to competition from road; and rail freight has continued mainly a specialist carrier for bulk loads.

Altogether technological advances provide the potential for higher environmental standards, communication and information systems, not only for cars, but also buses, freight vehicles and trains.

The physical environment

Despite massive house building since 1950, large parts of our cities – their houses and streets – are much as they have been for the last eighty years and more, long before motor cars. Most new building has been in suburbs, rural areas and new and expanded towns. But while many 1950s urban streets were quiet and uncongested places where people could walk and cycle and children play safely, many streets in London and other large cities are now lined with parked cars and heavily used by traffic. Many local authorities have responded with residential parking schemes and road humps which help residents find somewhere to park but can add to noise and pollution.

Government policies and action

Households spent in 2000 about £30 billion on buying vehicles and another £33 billion operating them.[2] About 14% of total household expenditure goes on motoring – the third biggest item after housing and food.[3] Companies also spend large sums on transport. Private companies, many of them multinational, do almost all the design and building of vehicles of increasing sophistication, and the research and development needed to support this work.

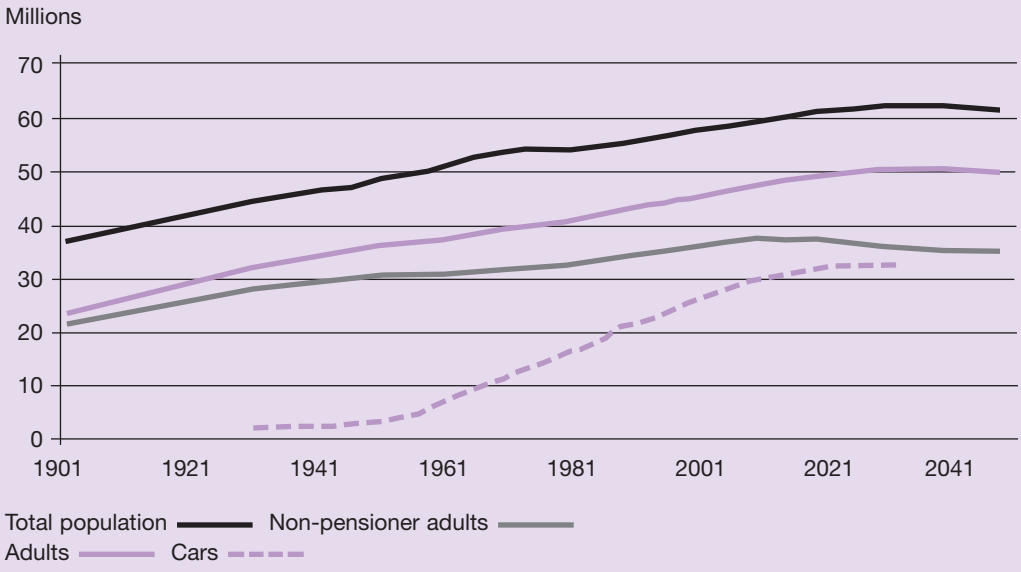
The provision of roads is a state monopoly, financed from taxation

The State plays a decisive part, though public expenditure on roads, at £4 billion is much less than private spending. The provision of roads is almost completely a state monopoly, financed from taxation, and the state also intervenes to regulate transport in the interests of the community. Regulation has extended over the last 50 years further into matters such as vehicle performance, road safety and environmental standards. Both central and local Government have attempted to influence behaviour:

- successive Governments have affected motoring costs by consistently increasing fuel duty
- local authorities have restricted car movement in urban areas by parking controls and measures like pedestrianisation.

Even so, the general right of individuals to own and use vehicles on the road has hardly been infringed.

Figure 1.3
Population and cars in Great Britain



Road policies and plans

The Coalition Government's Reconstruction Committee in 1942 prepared the original plans for a modern national road system, which were published by the post-war Labour government in 1946. They envisaged 800 miles of new and improved roads, shaped like an H, as an integral part, along with the Distribution of Industry Act and the New Towns Act, of a national strategy to reconstruct the country on more rational and efficient lines following the destruction of the Second World War.

The first 1,000 miles of motorways was completed in the 1960

But because of deterioration in the economy from 1947, nothing was spent on this plan until the mid-1950s, when the then Ministry of Transport and Civil Aviation began systematic planning of the road system. In 1958 the first motorway and in 1959, 72 miles of the M1 were opened. The first 1,000 miles of motorways was completed in the 1960s. The manifest inadequacy of the road system and growing pressure from industry and motorists gave road-building some political priority; but expenditure was repeatedly cut as a result of the stop-go cycles which beset that period.

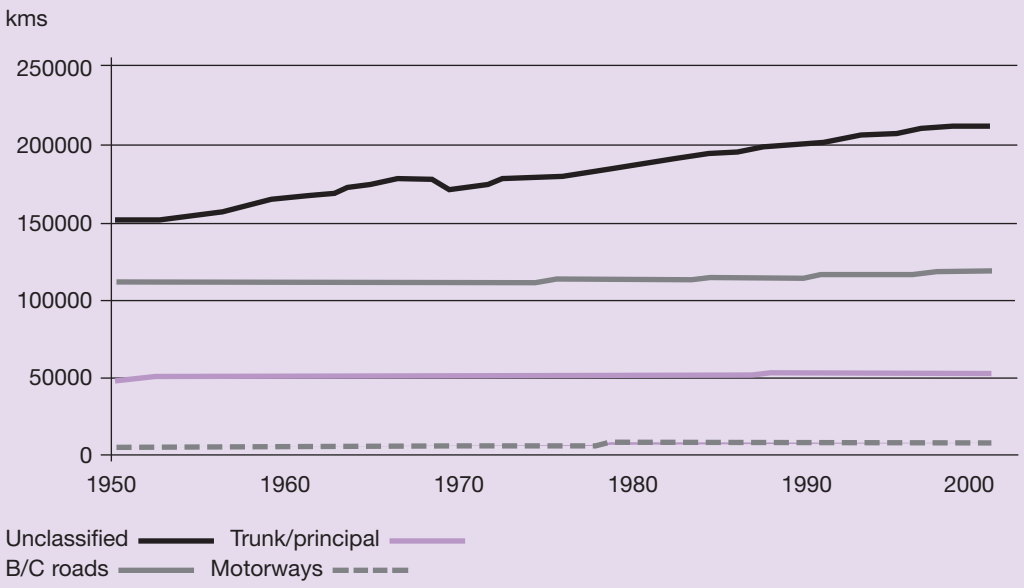
The 1970 White Paper 'Roads for the Future'[4] proposed expanding expenditure on inter-urban roads to provide a strategic network of 4,200 miles by the mid 1980s. But this plan too was frustrated by spending cuts caused by the economic difficulties of the 1970s. Groups opposed to road building began to disrupt public inquiries.

Yet by the mid 1970s, 1,360 miles of motorway were open and 1,400 miles of trunk road improved to dual carriageway standard, changing the map of Britain in fundamental ways.

Urban policies

Urban transport policies were less consistent. Before the mid 1960s road building was usually based on the 1947 Ministry of Town and Country Planning recommendation that towns needed an inner ring road and improved radial spokes. Not much road construction was afforded, though some towns and cities were indelibly scarred by inappropriate inner ring roads. In some cities, the abolition of trams eased congestion. London, where the Ministry of Transport was the traffic authority, pioneered by introducing parking meters in 1958 and creating the London Traffic Management Unit in 1960. It produced an increase in capacity and traffic speeds through the large-scale system of one-way streets and prohibited turns which is the basis on which London and other towns and cities work now.

Figure 1.4
Road lengths in Great Britain



The Buchanan and Crowther reports envisaged towns redesigned to accommodate growing car ownership

The Buchanan and Crowther reports in 1963[5] broadened and enlivened the debate. Their vision was of towns, redesigned to accommodate growing car ownership and use through building environmental areas served by a hierarchy of distributor routes. Primary routes could be placed below decks providing access to buildings and facilities for pedestrians. But massive road building and redevelopment would be needed at huge financial and environmental cost. When the reports were written, there were 6 million cars, compared with over 24 million today. The Crowther Report recognised universal car-ownership as a possibility and that road building alone would not avoid urban congestion. More public transport and some limitation of car use would both be needed in city centres and some smaller towns. The report coincided with an impetus towards 'scientific' planning, typically using land-use/transportation studies. Originating in the United States, where the studies were almost entirely road-based, public transport options too were considered in Britain. 1964 saw the Smeed report,[6] containing ideas now long considered by academics but only recently in policy-makers' toolboxes.

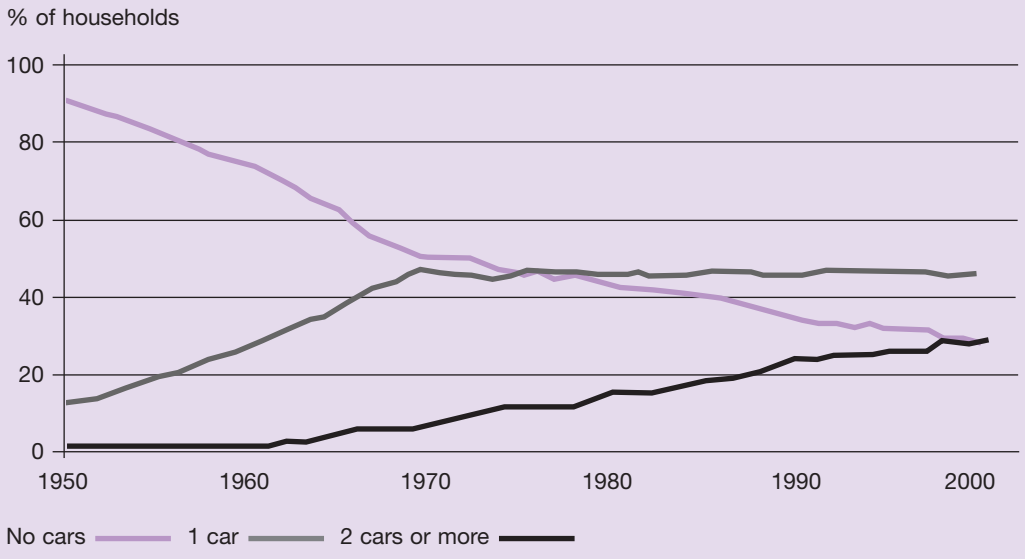
Separating through traffic from where people lived seemed an attractive way of accommodating the car and was reflected in the design of the West Midlands and the north west motorway systems. In 1969 the Greater London Council's development plan included the Motorway Box. The 1970 White Paper 'Roads for the Future' promised to devote a substantial and growing part of the programme to urban roads in areas after the inter-urban network was largely completed, when more could be afforded.

But it turned out differently. The construction of the elevated section of the M4 through west London, the M40 Westway through Kensington and the M8 round central Glasgow showed the brutal effects of driving motorways through residential areas without fitting them into the surrounding neighbourhoods. Public opinion turned against urban motorways. In 1972 the Motorway Box was abandoned after Labour won control of the GLC. The large-scale redevelopment Buchanan recommended was not carried out. Few large urban road schemes proposed by the land-use transportation studies were built. The reasons were a combination of:

- cost
- the effect on neighbouring communities
- concern that the extra traffic which urban motorways brought into cities would create too much congestion on the rest of the network.

A new transport block grant in 1972 provided central support for public transport subsidy. So city authorities gave public transport higher priority. The Conservative Government formally abandoned the policy of switching money to urban road building in 1973, though some large-scale urban road building schemes continued, for example to regenerate deprived inner city areas, as in Liverpool, Newcastle and London Docklands.

Figure 1.5
Household car ownership in Great Britian



But it marked an end to attempts at coherent, comprehensive urban transport policies.

The 1977 White Paper said that 'we should aim to decrease our absolute dependence on transport'

The managed market – an economic framework for road transport

Another transport policy review in 1976[7] was followed by a White Paper in 1977.[8] The environmental effects of road use and the problems of people without cars received more prominence than before. A central idea, based on a concept developed in the 1960s, was that of the managed market in which users of transport pay the full economic and social costs they impose on society with road taxation, alongside charges and subsidies for users of public transport, as the main instruments. If taxation were at the level at which each class of road vehicle met the fully allocated costs of the roads and measured social costs and if an adequate array of measures to protect the environment were enforced, car ownership should be encouraged since it would be wrong to deny poorer people, for whom owning a car was just becoming affordable, the mobility the better-off already enjoyed.

Moreover a good indicator that more road investment was justified was that people would pay more and more money in road taxation. In the background to the review, however, was another economic crisis resulting again in public expenditure cuts insisted on by the International Monetary Fund, reinforced by the prospect that oil prices might double by the end of the century as oil became scarcer. (In fact, the real cost of fuel and the real index of all motoring costs have remained remarkably steady for the last 40 years.) The White Paper announced that Government would continue the interurban road programme, but at a lower level, concentrating money on bottlenecks rather than entirely new routes. The White Paper proposed stronger powers for local authorities to manage urban traffic, including powers to control private off-street parking but not powers to impose congestion charges, which it thought premature. In the event, the change of government in 1979 meant that no extra traffic powers were given to local authorities.

A new idea in the 1977 White Paper was that 'we should aim to decrease our absolute dependence on transport'. Nothing came of that: in the 1980s and 1990s:

- out of town shopping centres continued to be approved
- local hospitals continued to be closed
- the car became still more deeply embedded in the way that people lived.

During the 1980s, the balance of interurban road building shifted towards south-east England, until then relatively neglected in favour of the north and midlands, Scotland and Wales, where new roads were judged necessary for economic regeneration. Some large projects were completed, including the M25 in 1986.

But the capacity of the road system failed to keep pace with demand: high traffic growth and low investment meant congestion continued to spread over many sections of the motorways and trunk roads.

Roads for Prosperity

The White Paper 'Roads for Prosperity'[9] contained the largest road construction programme ever, with emphasis on:

- widening the most congested routes
- bypasses to improve the environment of towns and villages.

It would add over 2,700 miles of new or widened roads to the network. Other possible routes would be studied for the longer term. The 1989 roads budget was increased by over 20%.

A companion White Paper 'New Roads by New Means'[10] detailed proposals for introducing private capital into road design and construction following the successful financing of the Queen Elizabeth bridge at Dartford (completed in 1991). One reason behind this initiative, enacted in the New Roads and Street Works Act, was to attempt to insulate the road programme from public expenditure cuts.

By the mid-1990s economic, political and environmental pressures led Ministers to abandon this programme too. The Government's traffic forecasts of 2-3% annual growth of traffic indicated a need for road building on a scale which they considered unrealistic. The Bruntland report and the Rio Summit highlighted concerns in the scientific community about global warming, while controversial decisions about bypasses for Winchester and Newbury fuelled opposition from political and environmental interests. The traditional assumption in road planning that the volume of traffic was independent of the capacity and quality of the network came under challenge and was referred for investigation to the Standing Advisory Committee on Trunk Road Assessment. The road building programme was again stalled and many planned road improvements abandoned or put into cold storage.

But no alternative policy for dealing with traffic congestion was enunciated.

The 2000 10 Year Plan proposed an integrated approach with a heavy investment programme in the railways and better roads

Integrated transport policy

The present Government's policies published in the 1998 White Paper on Integrated Transport[11] and in the 2000 10 Year Plan shared a diagnosis with those of its predecessors, Transport – the Way Ahead (1994) and Transport – the Way Forward (1996). They argue that building new roads cannot on its own be a sustainable long-term solution to the problems of traffic growth and congestion. The White Paper accordingly announced the end of 'predict and provide' (though this had been a lifeless corpse for some years). The 10 Year Plan contains a sizeable programme of inter urban road investment, though much smaller than that proposed in Roads for Prosperity, as part of an integrated approach including heavy investment in railways and better management of the road network, such as:

- speed limits
- rationing access to motorways
- better information for drivers

and so on. The outcomes expected from this programme include a 5% reduction in congestion below current levels and a 33% reduction in deaths and serious injuries on the strategic road network.

How successful have Government policies been?

Running a successful transport policy is acutely difficult. It involves balancing conflicting considerations, such as:

- people's wish for affordable, high quality, door-to door transport
- their lifestyles wishes reflected in lower density living and more freedom of choice in the places and the houses they live in
- relatively permissive attitudes to the location of shops, offices and other developments which attract travel
- a wish to avoid large infrastructure projects at all if possible, and certainly not in people's backyards
- a deeply held belief that the motorist is already soaked and should not have to pay more
- a wish that better public transport would solve the problem of congestion, especially for other people
- a belief that public transport must be perfectly safe, highly reliable and not overcrowded
- a resistance to paying the necessary price, whether through fares or taxes.

These conflicts, always there, have become more acute. Some sympathy with successive Governments who have grappled with them is in order. We should not just shoot the messenger. But minimum requirements for policies on public services such as roads to be successful are:

- that the policy objectives and means of achieving them should be consistent and clearly stated
- that enough money and skilled people should be provided to carry out the policy as announced: a reasonable probability that that will not happen should mean the policy should be changed to be realistic
- to the extent that demand will not be met, either because of a policy not to meet it or because of insufficient resources, there must be effective policies for managing demand.

Against these criteria, all Governments have failed. Successive plans have been announced to catch up with existing demand – more or less. All have been frustrated by public expenditure cuts.

Investment in the road system – national and local – has been determined by public expenditure considerations more than by need. Because road maintenance was also starved of money, the condition of the roads, both national and local, deteriorated. As it became obvious that public expenditure crises were endemic, the probability of their occurring could have been foreseen. And yet up to now no serious attempt has been made to manage demand, despite the increase in congestion as the growth of traffic has persistently outstripped the growth of road capacity. Governments have relied on people adapting their travel patterns, or simply putting up with growing congestion, using old-style Eastern European queuing as a method of rationing road space.

Investment in transport infrastructure in Britain lags far behind that in Europe

Neither have British Governments performed well in comparison with those in continental Europe. International comparisons should not be taken too far because countries differ widely in size, shape, density of population and many other relevant factors. But the Commission for Integrated Transport has reported that Britain has the worst traffic congestion in Europe, several times worse than that in Germany, Italy and France. Almost a quarter of the most used links in the UK suffered congestion at a particular defined level, whereas in Germany and France less than one in ten links suffered such delays; and in several countries this yardstick of congestion was not reached at all. The Government's 10 Year Plan forecasts, as the baseline case, that congestion will grow by 15% across the whole network and by 28% on the interurban road network.

The Commission's report shows that in 1996 investment in transport infrastructure in Britain lags far behind that in our main competitors: 45% less than France, 48% less than Germany, and 52% less than Italy.[12] These differences have persisted for many years. The accumulated investment deficit without doubt amounts to several billion pounds.

Urban roads are mainly the responsibility of local authorities. Need is difficult to determine and impossible without a clear policy framework indicating the outcomes are to be achieved. National policies on urban roads, frequently changing, have never been clear enough or sufficiently resourced.

Why this neglect? Some points are worth noting:

- transport is not the only public service to suffer from persistent under investment over decades: investment in health and education in Britain have also been much lower than in our main continental competitors, perhaps in part reflecting our poorer economic performance
- even so, transport has not been high among political priorities for most of the last 50 years
- no distinction was made between public expenditure on current consumption and that spent on investment to produce a return. When cuts were required, as they frequently were, it was much easier to defer capital expenditure on roads than to put up public transport fares or sack staff
- the preparation of road schemes takes years, as does the build-up of the skills needed to implement a large programme. Repeated cuts cause waste, hardship to those with property under indeterminate threat from postponed road improvements and prevent the build-up of the skills needed to prepare road schemes to the high standard required.

If the road programme is important to the economy of the country, its visionary and sensitive planning and efficient execution needs more stability than it has had.

The safety record

Britain's record in road safety has improved over the years and compares well with that of other European countries

In 2000, 3,400 people were killed, 38,000 seriously injured and 279,000 slightly injured. 5,200 children were killed or seriously injured. Though the consequences to anyone who has had a loved one killed or injured are dreadful, and occasionally particular road accidents arouse public concern and anger, society has come to accept, however reluctantly, this continuing toll as part of the price for mobility. By contrast, society insists that the safety standards to be met by the operators of railways or civil aircraft must be very much higher.

Britain's record in road safety has improved over the years and compares well with that of other European countries. Though road traffic has increased nine times since 1950, the number of deaths and serious injuries is nearly a quarter less than it was in 1950, indeed lower than in 1937, because of:

- safer vehicles with generally higher standards of maintenance
- safer roads and better lighting
- more responsible driver behaviour

- acceptance of tougher laws on drinking and driving, and the wearing of seat belts.

The Government has set ambitious targets for further reductions in casualties both for its own roads and for local authorities.

Public attitudes

For the past hundred years the car has been and remains a symbol of personal freedom. Though attitudes are not easily changed, people have accepted substantial restrictions of their freedom over the past 50 years. Among them have been:

- tests of blood alcohol levels
- the 70 mph maximum speed limit for all roads
- automatic cameras to enforce speed limits and other infringements
- requirements for motorcyclists to wear crash helmets and people in cars to wear seat belts
- acceptance of the principle of paying to park on the road
- segregation of parts of the road as bus lanes
- reserving town centre streets for pedestrians and cyclists.

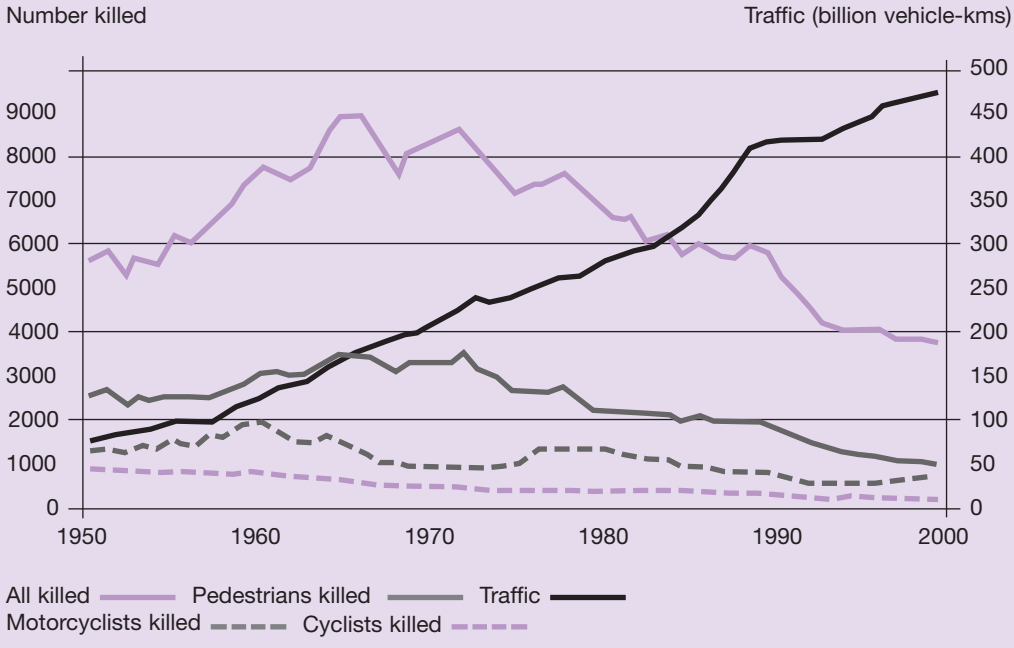
Most were strongly opposed when first put forward, but most people have shown themselves ready to accept restrictions which make good sense and are not imposed for some questionable political or bureaucratic purpose. But acquiescence cannot be taken for granted. To what extent people would be prepared to accept further restriction of their freedom is an important issue for future policy.

Conclusions

The main issues which emerge from this brief history are:

- Successive Governments' transport policies have been largely responsive and often characterised by wishful thinking. Faced by the financial, social, political and environmental constraints described, Governments have been boxed in and unable to find a stable policy stance. The consequence has been bursts of policy action followed by periods of immobility.

Figure 1.6
Safety on the roads in Great Britian



- The cyclical nature of policy and expenditure has made it difficult to plan for achievement, and to keep together the teams and the resources needed to deliver. Partly as a consequence, the time taken to complete projects has become absurdly long, making investment even more vulnerable to postponement. The 10 Year Plan is welcome as an attempt at a more stable environment for planning and delivery.
- Britain's investment in transport has lagged far behind that of our main European competitors. Road congestion is the highest in Europe.
- All post-war governments up to the mid 1990s shared the objective of building an inter-urban road network to enable traffic to flow freely between the main centres of population and to provide good access to ports and airports. So far as we can see from the available evidence, journey times on the inter-urban network began to rise from the mid 1990s.
- But now demand has caught up with capacity across more of the network and for more of the time. Governments have neither provided the resources to turn this round nor articulated a coherent strategy to manage demand particularly on the inter-urban network. The fuel duty escalator introduced in 1993 and abandoned in 2000 was a crude attempt which failed.
- It is not obvious that the present Government will find it easier than its predecessors to keep to its plans for transport investment, given the pressing demands of other public services, notably health and education.
- Few major urban roads have been built recently except for the M11-Hackney link and the completion of the M60 in south east Manchester. Institutional and financial difficulties have hemmed in urban transport policy, as have disagreements about the balance to be struck between the interests of car users, commerce, public transport and those who wish to return the streets to pedestrians. Policies towards light rapid transit, guided buses and quality bus partnerships point to a possible way forward, but there are concerns for the economic prosperity of cities if these policies become too coercive.
- There has recently been more interest in general measures to restrain traffic in cities and towns in addition to the traditional instruments of control of on-street parking and pedestrianisation. Pricing the use of roads was identified as a possible measure to deal with urban congestion by the Smeed report as long ago as 1964, and the control of privately owned non-residential off-street parking was proposed in the 1977 White Paper on Transport Policy. The Transport Act 2000 finally gave local authorities powers to put these measures into effect. Some cities, including London, are planning its implementation.
- A call for the better integration of transport and land-use planning has been commonplace since the late 1960s, with the aim of bringing together planning for the generators of transport and the provision of transport facilities, while reducing the underlying demand for travel. The Department of the Environment was created in 1970, the Department of the Environment, Transport and the Regions in 1997, and the Department of Transport, Local Government and the Regions in 2001 in part with this objective in mind; but there is no evidence yet of practical steps towards it. For the future, it will be important for Governments to give the objective of integrated planning practical meaning and indicate how it might be achieved.

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9 *Roads for Prosperity*; Cm 693 1989

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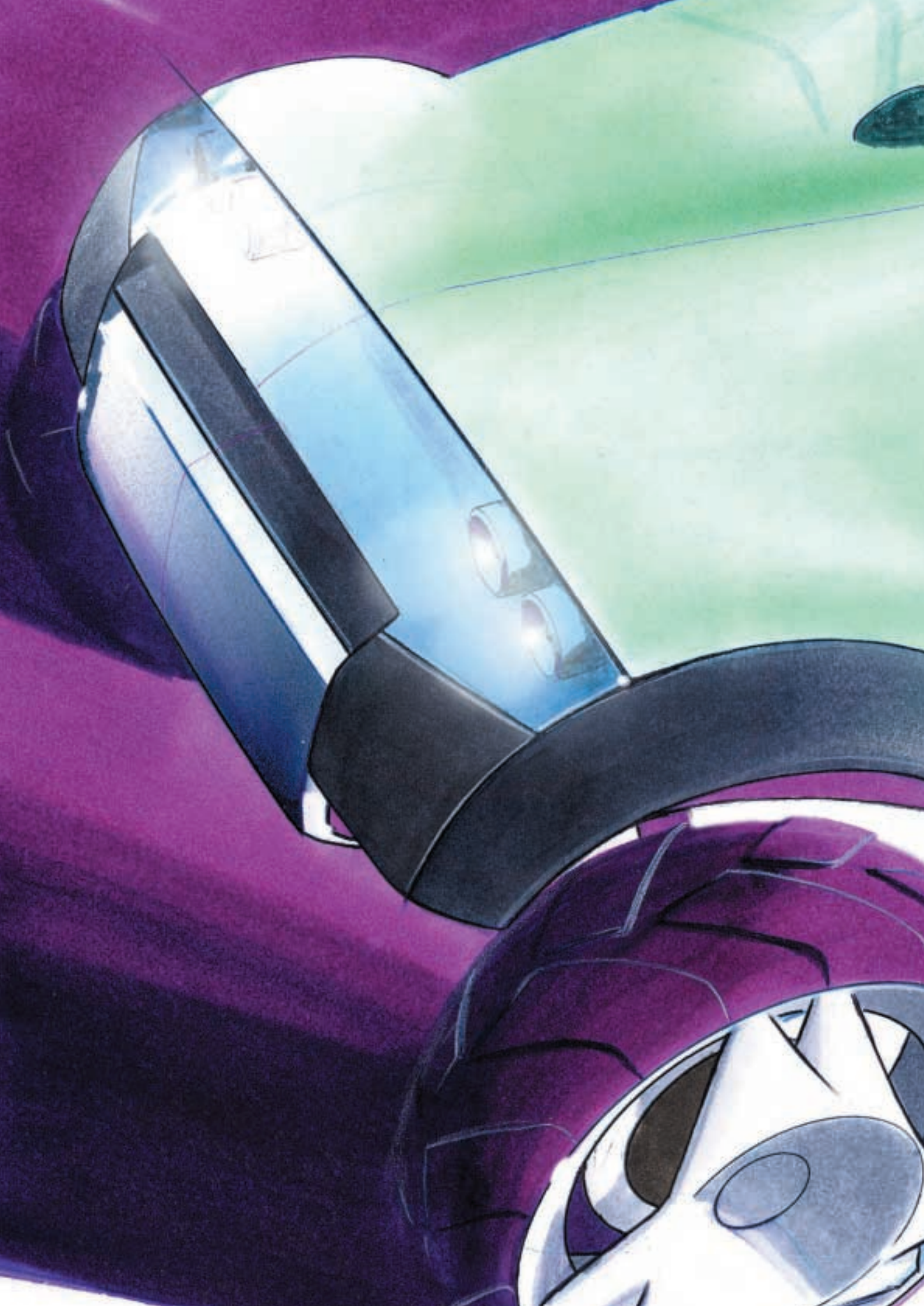
11 *A New Deal for Transport: Better for Everyone*; Cm 3950 1998

12 *European Best Practice in Delivering Integrated Transport*; Commission for Integrated Transport 2001



2 Demand and modal split

- The prime driver of car traffic growth has been ownership growth
- Latent demand for car travel will be nearly 50% higher in 2031 even assuming slower growth rates
- By 2031 bus travel will stay much the same, walking and cycling trips would be fewer but the latent demand for rail doubles
- Limiting car ownership is unlikely to be an effective or tolerable way to check traffic growth
- To rely on congestion to rein back traffic growth would be economically damaging
- If road capacity is only increased as suggested in the 10 Year Plan, congestion will increase considerably
- To maintain congestion at its current level would require unacceptable increases in motoring costs or charges to reduce demand

2 The demand for transport

The last 50 years have seen a rapid growth in car ownership and car travel: in 2000 85% of all kilometres people travelled was by car. Allowing for commercial vehicles, 81% of all road traffic (in vehicle-kms) is in cars.

How much more growth can be expected over the next 50 years? While there are reasons for expecting a lower rate of growth than over the last 50 years, substantial growth must be expected over the next 50, too, a crucial problem for Government in deciding its transport policy.

Traffic growth is the main cause of congestion and pollution. It is not the only factor. Elsewhere in this report the likely effect of changes in vehicle technology on both are examined. But to predict traffic growth – and hence the scale of future congestion, pollution, infrastructure and fiscal problems – what determines the demand for road travel must be understood.

Factors underlying the growth in car travel and in freight traffic are different. Both because the first is better understood and because private car traffic is five-sixths of road traffic, this chapter concentrates on the demand for car travel.

Determinants of car ownership and use

Figure 2.1 sketches the main factors affecting the ownership and use of cars.

Rising incomes and changing demographics are the main determinants of car use

It is useful to distinguish between factors external to transport policy and those susceptible to influence by policy. The strongest determinants are external, shown in dark purple: these are income and demographics. *Higher real incomes* go with an increased propensity to own and use cars. *Demographic change*, particularly reduction in average household size, has led to an increase in cars per head. *Technological progress* is largely outside government influence, but the rate of technical progress and its take-up by the consumer can be influenced by Government.

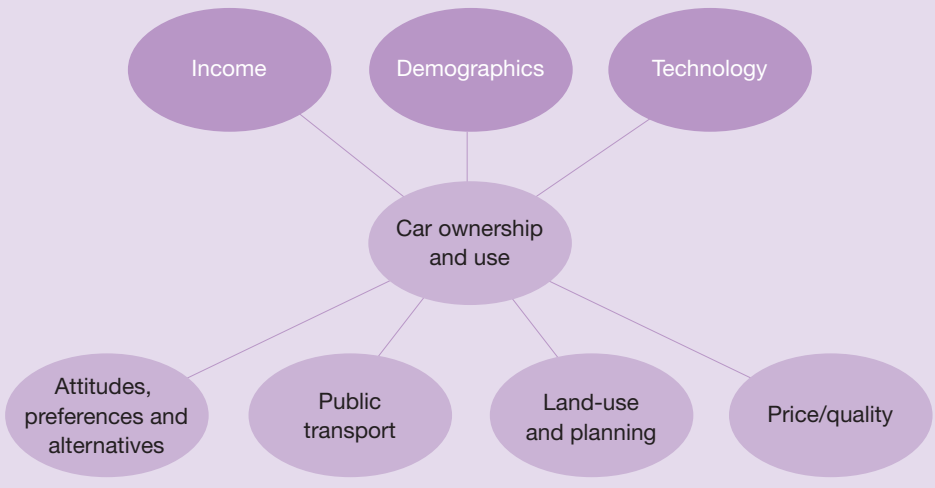
The remaining four are the main ways in which government policy can influence demand:

Attitudes, preferences and alternatives refer to policies aimed at reducing car travel. Some relate to the potential for substitution offered by e-everything, some to information provision and persuasion, some to the creation of new transport products.

Public transport refers to policies to improve the attractiveness of public transport attributes like journey time, reliability, comfort and price. Though public transport's share of the overall travel market is small, there are sub-markets where its market share and therefore its potential for replacing the car are greater. Especially important is transferring trips from the car to public transport where the road network is under most stress, as in city commuting and inter-city travel.

Land–use and planning policies are a key element over a 50 year period. Within this time frame, changes in urban form and settlement density can affect the pattern of demand for travel and the role which public transport can play.

Figure 2.1
Determinants of car ownership and use



The price and quality of road travel, compared with other modes, are important, since they influence travel choices. The real cost of travel is strongly influenced by the balance governments strike between the price of road use and the level of investment in the road system. Between them they determine the cost and quality of the road system to the user.

The growth of car ownership, car use and traffic

Over the last 50 years, car traffic has grown on average at 5.5% per annum, but slowing over the period. From 1965 to 1974, average car traffic growth exceeded GDP growth by nearly 3% per annum. By 1985 to 1994 the average excess was 1%. 1993 was the first year in which car traffic growth did not exceed GDP growth and it has been so for every subsequent year.

The rate of car traffic growth has been only slightly greater than that of car ownership itself, which has averaged 5.0% per annum over the same 50 years. It, too, has slowed down. From 1950 to 1968 it was about 8.8% per annum. Since then, it has been about 3.0% per annum, still faster than income growth.

The difference between the growth in car traffic and in car ownership reflects change in the average annual distance travelled per car, but this has played only a minor role in the rise of car traffic.

Car ownership

Car ownership growth follows an S-shaped growth curve. Like many consumer durables, car ownership grew fast in the initial phases of product take-off in the 1950s and 1960s. Since then ownership growth has slowed (even though of course ownership has risen absolutely and will continue to do so). Because the market is now mature, saturation may be expected towards 2050. The main reasons for increased ownership are:

- real income growth causing some to move into the one car household bracket and more from the one to the two car bracket
- life cycle effects causing an increasing proportion of elderly and women to hold licences and own cars, an effect which will work itself out over time
- socio-demographic effects like changes in population and household size
- location effects – urban areas have lower levels of car ownership, other things being equal. The gradual relocation of people and businesses outward from urban areas was both a consequence and cause of increased car ownership
- car prices have fallen significantly, both in terms of real prices when adjusted for inflation and improved quality.

Policies to limit car ownership are undesirable

But there are areas where strong constraints on ownership exist, and where the market may approach saturation at much lower levels of car ownership. Obvious examples are central and inner London, where a combination of lower parking availability, high insurance costs, better public transport and its land use pattern more readily support a non-car owning lifestyle. In question is whether such a combination could have similar effect elsewhere in future, particularly in areas of terraced housing in older parts of the urban residential stock. Policies like the encouragement of brown-field development in city centres or Camden's provision of no-car housing, can discourage car ownership and use among those affected; but because no one is forced to live in such areas or housing, they are voluntary in nature.

It would be possible to go further than this and adopt policies which directly constrain car ownership. Singapore residents must acquire a Certificate of Entitlement to own a car, making the total cost of owning a 1500 cc car costing £7,000 around £30,000 in 1999. So car ownership, which was 0.2 million in 1967 and once projected to reach 1 million by 1990, had still not topped 0.7 million by 1999. Or one could raise residential parking charges to very high levels with similar effect. Or one could restrict those holding driving licences by policies like raising the minimum age or by instituting annual testing for those over 65. Such policies would probably be effective in slowing traffic growth but not in a targeted way, discouraging some but not other traffic, particularly through traffic in an area. We believe such infringements of people's freedom to own a car would be considered undesirable in Britain and have not discussed them further.

Car use per car owned

Compared with car ownership growth, changes in use per car have played a minor role in car traffic growth. They are mainly caused by:

- income growth – increasing kms per car
- ownership growth may reduce kms per car, since more growth in the car 'park' is because of growth in the number of two car households than in households moving from zero to one car
- company cars – a particular UK feature is the high mileage done by company cars influenced by taxation and benefit regimes which are now changing
- the real price of motoring – influenced by tax and by market forces (crude oil prices, insurance, maintenance costs).

Car traffic per head is in line with other major European countries

However, the international data in Table 2.2 shows no obvious pattern in the relationship between car ownership and car use. While UK car ownership rate is typical of our income level (column 4), the UK has relatively high car use per car (column 3) although car traffic per head is in line with other major European countries. (column 2).

The pattern of car ownership and use

The 1998/9 National Travel Survey showed 27% of households have no access to a car. While non-car owning households are concentrated in the lower income groups, a third of households in the lowest quintile and half those in the second quintile do have a car (shown in Table 2.3).

Therefore:

- demand for transport as a whole is income elastic, that is, rises strongly with income. Higher incomes permit higher mobility. Households in the highest quintile travel (all modes taken together and car alone) three times more than those in the lowest
- the car is very important for all income groups. Car driver or passenger mileage accounts for 70% of miles for the lowest two income groups and 83% for the highest
- 60% of car driver plus passenger miles are by the top 40% in the income distribution, but 20% by the bottom 40%. Any reform of car taxation must consider the likely impact on lower income groups
- policies encouraging bus services and walking are likely to benefit people in the lower half of the income distribution more.

Table 2.2

International comparison of cars and traffic, 1999

	(1) Cars per 1000 pop	(2) Car traffic per head (1000kms)	(3) Kms per car (1000kms)	(4) Cars per $000 GDP	(5) Car kms per $000 GDP
UK	410	6.6	16	17	270
Belgium	450	6.6	15	18	270
Denmark	340	7.2	21	10	220
France	470	6.6	14	19	270
Germany	520	6.5	13	20	250
Italy	540	6.0	11	27	300
Netherlands	400	6.0	15	16	240

Source: TSGB 2001 Tables 8.1,8.3,8.4

Table 2.3

Car ownership by household income quintiles

	% without a car	% with 1 car	% with 2 cars
Lowest quintile	63	29	7
Second quintile	50	44	7
Third quintile	22	54	24
Fourth quintile	12	53	35
Highest quintile	6	44	50

Those with low income can be very dependent on cars

Within the low income quintiles the pattern of spending is skewed (Lucas et al, 2001). Not surprisingly expenditure on car travel as a proportion of household budgets is concentrated in the one-third (lowest quintile) who own cars. They commit over 20% of their income to car ownership and use; significantly higher than the average for the highest quintile at 15%. This strongly suggests that there are those with low incomes who are car-dependent and on whom the effects of any policy package discouraging car travel require particular consideration.

The balance between ownership, local use and long-distance use will also be of interest because a significant proportion of car use is contributed by a small proportion of long distance journeys (over 40 kms), made predominantly by persons in higher income categories.

Commercial vehicle traffic

While there are well-researched reasons for predicting a long run decline in the ratio of car traffic to GDP, no similar theory exists for commercial vehicle traffic. Heavy goods vehicles have shown growth rates below that of GDP except between 1987-1993. We assume this tendency will continue: heavy goods vehicle traffic growing about 0.2% less than GDP. Light goods vehicles growth has significantly exceeded GDP growth from 1987 to 1994. We assume in future that it will grow proportional to GDP growth. These forecasts imply that HGV traffic will grow at roughly the same rates as car traffic, with light commercials growing rather faster. These forecasts remain aggregates, because forecasting freight transport demand at a more disaggregated level is not straightforward and depends partly on forecasts of influences on industrial organisation outside the transport sector. Nor is the responsiveness of freight traffic to changes in price and travel time well understood. Partly for these reasons, but also because car traffic is five-sixths of the total, our argument about the future concentrates on passenger rather than on freight traffic.

Latent travel demand – the demand for travel if there were no changes either in relative costs or in the level of service (time, reliability etc.).

Actual travel demand – latent demand reduced by the effects of costs or congestion (suppressed, re-timed, or shorter journeys or, where relevant, switched to another mode).

Forecasting traffic growth

In forecasting future traffic growth the first step is to forecast car ownership. Then, that forecast can be used to estimate latent travel demand. Thus forecasts of latent demand aim to answer the question: if travel conditions remained as today, what travel demand would we expect in the future as a result of rising income, car ownership and demographic change?

In practice, travel conditions cannot remain the same. Even with investment in road capacity, increased demand is likely to overtake it and lead to worsening congestion. As well as this, we expect price changes, partly from industrial and technical factors and partly due to policy. We need to forecast the increase in congestion and to modify forecasts of latent demand so as to produce outcomes which allow for these factors. These last two steps are needed to produce an 'equilibrium', so that the level of congestion and the demand for road use are compatible.

Table 2.4

Average distance travelled (miles per person per annum) by mode and level of household income

Mode	Lowest income quintile	Second quintile	Third quintile	Fourth quintile	Highest quintile	All bands
Walk	201	178	177	151	133	168
Car/van driver	1405	1587	2967	4598	6672	3489
Car/van passenger	1290	1464	2065	2582	2651	2034
Other private	136	232	199	224	246	207
Stage bus	344	330	255	205	141	253
Underground (London)	27	151	27	41	139	47
Surface rail	182	112	185	313	816	321
Taxi/Minicab	45	43	38	44	60	46
Other public	77	142	109	158	326	161
All modes	**3707**	**4239**	**6023**	**8316**	**11184**	**6728**

2 The demand for transport

To understand the scale of the problem we begin with forecasts assuming no changes in policy, though the forecasting procedure can also estimate the likely outcome of broad brush policies. All forecasts are, of course, subject to uncertainty, and although we only present the 'most likely' values based on the input assumptions, it is implicit that these are only the midpoints of a relatively wide range of outcomes. The forecasts assume a central scenario with respect to demographic development and the growth of income. They should not be viewed as either optimistic or pessimistic. (The assumptions about inputs and the details of the forecasting procedure itself are described in a separate Technical Note published on the RAC Foundation website: www.racfoundation.org). We believe it a better approach than conducting many sensitivity tests to recommend that Government, using its models, should periodically up date the forecasts made here, say, every five years. Actual experience is as likely to show car ownership and traffic growth above as below what was forecast. Since most investment in transport infrastructure and many significant policy changes seem to take substantially more than 10 years to plan and execute, five yearly changes in forecasts should be enough to guide them.

The Governent should publish long-term traffic forecasts every five years

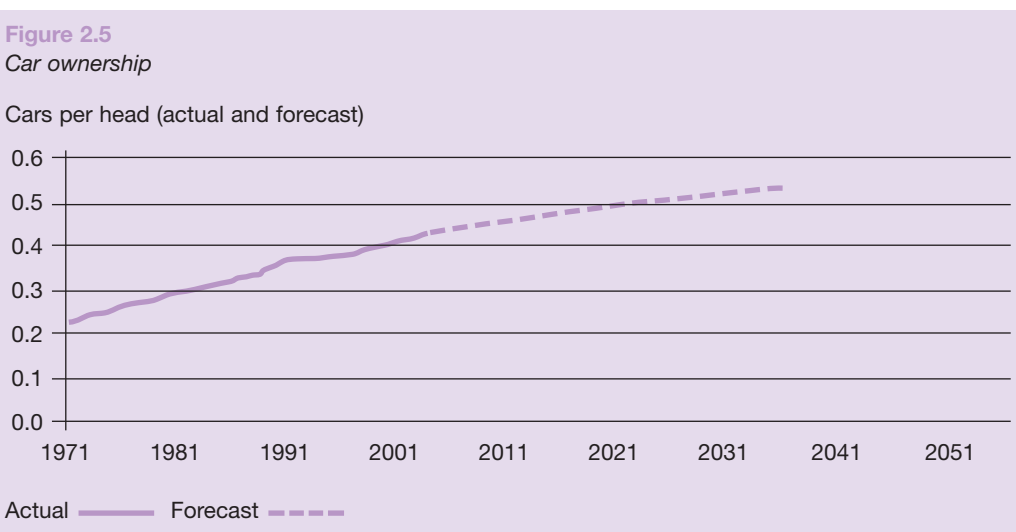
The procedures used here are grounded in the observed situation for 1991, since the best source of variation in car ownership levels by geographical area is the 1991 Census.[1] We begin by showing how the model can be used to give a reasonable account of the changes in travel between 1991 and 2001. Armed with this reassurance, we then apply the model to make forecasts up to 2031. Forecasts beyond that are more tentative, but it can be seen that relatively continuous trends are emerging, giving a reasonable indication of how the more distant future might develop.

(1) Car ownership

Substantial research on factors affecting car ownership exists in the UK. The approach here is substantially that used by the DTLR in its 'National Road Traffic Forecasts'. Using the standard planning assumptions about the future distribution of persons and households among the different areas of Great Britain, we estimate household composition, with special attention to single person households (which we do not expect to own more than one car and even if they do, will not use more than one at the same time). The long-term annual growth rate in income per head has been 2.2% over the past 50 years, as it was also over the last 10 years: it seems not unreasonable to assume that this continues into the future.

Car ownership is also affected by the purchase price of cars and, to a lesser extent, by running costs. We have assumed no change in the relative purchase price of cars beyond 2001. A substantial fall (of about 1.7% per annum) over the last 25 years, makes it a conservative assumption when predicting traffic growth. However, we have taken the view that while there may be further declines, they will be of lesser magnitude, partly because of offsetting costs associated with new safety and environmental features. We have also assumed no real changes beyond 2001 in running costs (tax, insurance, maintenance, fuel and oil). To prove our model we have fitted it to actual data between 1971 and 2001. Its closeness of fit encourages us to forecast the future. The forecasts for 2001 allow for purchase prices, which have fallen in real terms by approx 21% between 1991 and 2001, and running costs which have risen over the period by about 36%.

Figure 2.5
Car ownership



The results for 2001 agree well with the actual outcome: 0.427 cars per head, compared with the model forecast of 0.432. The 2031 figure rises to 0.556. Total cars become 35.0 million, a growth of 72% from 1991. This is close to the implied growth of 70% predicted in the DTLR's National Road Traffic Forecasts published in 1997[2].

(2) Forecasts of latent travel demand

We now use these car ownership forecasts to estimate latent travel demand by mode. Different people have different travel demands. Employed persons need to get to work, children to school, and retired persons have more opportunity for leisure travel. These various trip rates have been found extremely stable over time. Variations in trip rates by journey purpose, across all modes, depend largely on age, sex, employed status and household car availability. The type of area has little effect.

Car usage has been affected by rising incomes and falling car ownership costs

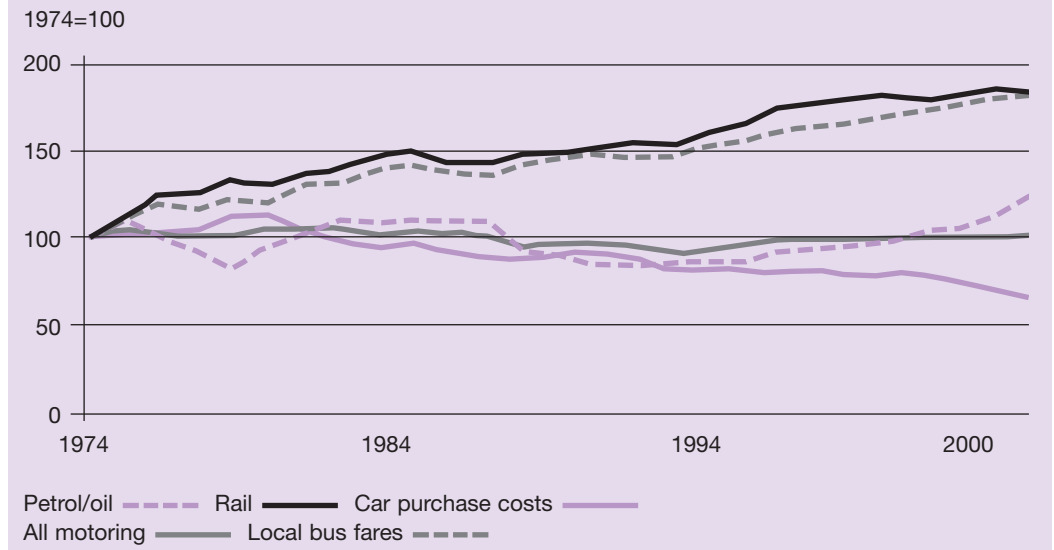
However, how journeys are made, and hence variations in mode share, depend not only on car availability, but also on area type, both because of the different extent to which destinations are concentrated and the different levels of public transport provision. Therefore, we find significant differences between conurbations, smaller urban areas, and rural communities. How much non-car modes are used will obviously be influenced by car availability, as well as the journey purpose. There are some secondary effects from employment status and sex.

Average journey distance varies appreciably by mode: rail journey lengths are the longest, walking and cycling the shortest. Area type is also important, again reflecting differences in the concentration of opportunities. There are important variations by journey purpose. Holiday and business trips are significantly longer than for other purposes. We can estimate the impact of, for example, increased car availability among women and older people, and dispersion from conurbations and city centres.

Experience suggests that these variations will broadly continue, so that, given a distribution of person types by car availability and area, compatible with the car ownership and demographic forecasts, we can apply the current trip rates, modal shares and journey length distributions to the future population.

So we reach the change in modal demand, in both journeys and kilometres, which results from demographic changes in different areas and changes in car availability. However, the amount of travel will also be influenced by income effects. To reflect them we have used research which shows the responsiveness of travel demand to income changes.

Figure 2.6
Transport prices relative to general price inflation (RPI)



We can now disaggregate overall latent growth in car traffic into its main constituents (shown in Table 2.7).

Rising population and changes in household size, composition and location of residence increase car ownership, but compensating effects on latent car use effectively cancel them out. By contrast, income effects reinforce both car ownership and car use. The table shows that changes in motoring prices have also increased car ownership. Purchase prices fell substantially, though offset by a weaker consumer response to rising running costs.

However, while these figures indicate the scale of latent demand, they do not indicate what demand will actually materialise. To estimate this, we need to extend the methodology to allow for policy interventions: both to pricing and infrastructure provision, and for external effects (principally congestion on the highway network).

(3) Allowing for congestion – network response

To estimate the impact of increased traffic on congestion, two questions must be answered:

- if no extra capacity is provided, how will speeds and journey times deteriorate as the volume of traffic increases
- what impact will additional capacity have in reducing congestion?

With our database and model, we can only answer them at an aggregated level. However, we can give a reasonable indication by working with known sensitivities from published and unpublished work. In addition, we can demonstrate that our aggregate assumptions are broadly compatible with those made by others at a more detailed level.

We measure the average speed over the whole highway network, inevitably a coarse average, taken over both quiet and busy sections of the network, unable to represent experience on any particular road. We express it as average minutes per km over all journeys made: the ratio of total time spent on the highway network (vehicle-hours) to total distance travelled (vehicle-km).

But we have examined the database the DTLR uses to make its own forecasts and have drawn some conclusions. The current average speed (2000) of all vehicle movements on all types of road is about 52 kph, or 1.14 minutes per km. For every 1% increase in traffic, this time per km will increase by approximately ⅔ of 1%, if no additional capacity is provided (The Technical Note has more detail).

Congestion reduces demand as drivers reduce the number of trips or switch time, route or mode of transport

Of course, increasing highway capacity will alter this relationship, reducing average time per km. However, an increase in capacity substantially in excess of what is envisaged in the current Road Programme plus the 10 Year Plan, corresponding broadly to continuing its level of investment for another 20 years, will very substantially reduce congestion on parts of the network with a significant saving in time and improvement in reliability. Overall it would reduce average journey-times by about 3½ seconds per km which may appear so insignificant as to be not worth considering but the total saving to all motorists would be worthwhile while savings to road-users on the links and nodes improved would be very worthwhile. Much more investment would be needed to match the growth in latent demand. In passing we note that, faced by such evidence, it has been asserted that time savings of this order are so insignificant as to be not worth considering, but 3½ seconds less per km is the average on all the network of an investment programme targeted at certain parts of it; the time saving per km on the improved sections will be much greater. Even 3½ seconds per km on a 200 km journey like London to the West Midlands is a not trivial 10 minutes on the journey.

The more important effect is greater reliability rather than shorter journey-time: for instance little change in journey time on 80% of journeys and a much larger change (say, 15 seconds per km or in the example above, about three quarters of an hour) on the other 20%.

Table 2.7
Constituents of latent car traffic growth 1991-2001

	Demographic %	Income %	Prices %	Overall %
Cars	+ 6.5	+6.8	+5.2	+19.7
Km per car	–6.0	+5.4	(ignored)[3]	–0.9
Car km	+0.1	+12.6	+5.2	+18.5

Congestion will reduce, but not eliminate, traffic growth

(4) Demand responses

The definition of latent travel demand assumes congestion does not alter the level of traffic. But it does. Longer journey times reduce demand either by trip suppression, change of mode, or change of destination. Other factors affect demand, particularly changes in the cost of travelling by different modes. (Not easy to predict, the assumptions made are set out in the Technical Note, based on the evidence). For each 1% increase in time per km (or 1% decrease in average speeds), we expect traffic to be reduced by about ½%. Some car trips lost will be diverted to other modes, others will become shorter, be switched to another time or be abandoned altogether. Thus, congestion will reduce, but not eliminate, traffic growth.

As a result of these calculations, we can estimate future car travel demand allowing for congestion and changes in travel costs.

Validating the model – the 2001 forecasts

A good way of validating the model is to calculate how well it reproduces past traffic growth.

There are no definitive figures for the reduction in average car speed between 1991 and 2000. Surveys on trunk roads indicated that speeds fell significantly between 1995 and 1998[4] although there was a small increase in speeds in peak hours in 2001 possibly due to better management of roadworks or more spreading of the demand into non-peak hours. The annual speed surveys[5], using a different methodology, show no obvious trend over the 10 year period. The change in all motoring costs over the period is small. Purchase costs fell, but running costs (fuel, oil, maintenance, tax and insurance) have increased strongly, fuel prices by 44%. The actual 10 year growth in car-km (from 1990 to 2000) was 13%, whereas the implied latent growth in car-km from 1991 to 2001 was 18%. The reduction from 18% to 13% is broadly consistent with the 'elasticities' or responsiveness, assumed in the model, given a) some increase in capacity and b) generally lower impact of growth on congestion in the early part of the period.

The actual growth in rail passenger-km to 2000 was 19%. The implied latent growth from 1991 to 2001 was 32%. However, over this period, fares increased by about 19%[6], and allowing for this brings the forecast down to 15%. The difference between it and 19% can reasonably be ascribed to service improvements.

Less relevant bus information is available. As reflected in receipts, bus passenger-km fell from 1990 to 2000 by about 2%, while latent growth from 1991 to 2001 came out at 1%, but again, real fares increased over this period, by about 20%.[7] Allowing for this brings the forecast down to -3%, close to the actual evidence.

Therefore, we conclude that the forecasting procedure developed gives a reasonable account of what actually happened between 1991 and 2001, making allowance, of course, for the approximate nature of all the calculations.

Having demonstrated that the model is in line with past experience, we can take 2001 as our base, and estimate the future growth of travel demand with some plausibility. To do so, we need for the future as has been done for the past:

- to predict car ownership, given demographic and income changes, while allowing for possible changes in motoring costs

Table 2.8

Implied latent growth from 2001 to 2031 in total km by mode

	2031 – demographic and car ownership effects %	2031 – income effects %	2031 – overall growth %
Walk	–4	–	–4
Cycle	–2	–	–2
Car-driver	+25	+17	+46
Car-passenger	+9	+17	+28
Bus	–12	+14	–0.3
Rail	+0.3	+119	+120

- to predict the impact of demographic, income and car ownership changes, on latent travel demand by mode
- to modify the latent demand forecasts to allow for congestion, highway capacity changes and other service quality changes, particularly prices.

Demand forecasts assuming no policy intervention

We can now present latent demand forecasts of what demand would be if unconstrained by shortage of road or rail capacity and unaffected by changes in relative prices between modes. We concentrate on 2031, the furthest year into the future for which we have operated the full procedure. Since forecasts for intermediate years show a generally smooth, somewhat declining, trend, it is not unreasonable to extrapolate the detailed results to 2050.

Table 2.8 shows car vehicle-km, which are equivalent to car-driver-km, are predicted to increase by 46%. (The forecast population growth is 7.4%, in line with official forecasts)

Latent traffic demand would increase by 46% by 2031

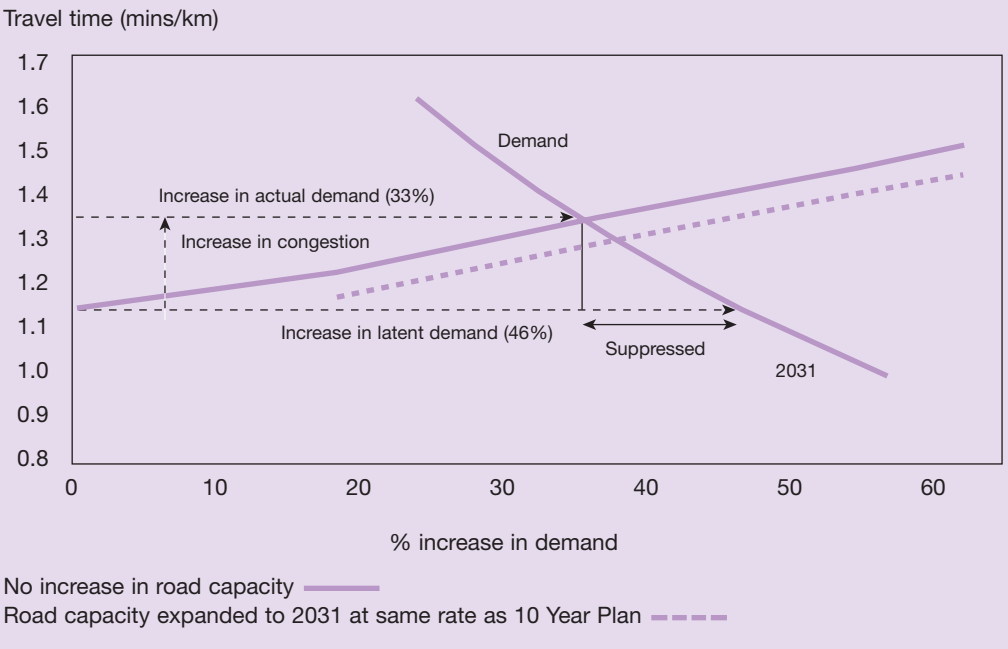
We show the contribution made to predicted growth by the two main sets of factors. Apart from the increase associated with a steadily (though slowly) rising population, the other demographic changes – which allow for different growth in households, the number of persons within them and in their locations – have relatively minor effects on the development of travel demand. Car ownership and income are the dominant determinants.

Walking and cycling are forecast to decline, despite the increase in population. Over 30 years, kms walked and cycled per person fall by 11% and 9% respectively.

Demographic and car ownership trends tend to a decline in bus patronage (in kilometres travelled), but are offset by the effect of increasing incomes leading to a more or less static level of demand. The effect of rising income leads to substantial growth in latent rail demand.

Although the rate of growth in car ownership will slacken, a continued substantial increase of 34% is forecast between 2001 and 2031, which in itself leads to a 25% increase in demand for car travel. Because this is lower than the increase in car ownership, it suggests that a demographic tendency for average car use to fall is outweighed by income-related effects, leading to an overall increase in latent demand of 46%.[8]

Figure 2.9
2031 supply demand equilibrium



Road congestion is affected by other vehicles besides cars. Over the last 10 years, the proportion of total traffic attributable to commercial vehicles has remained around 16-17%. We have no reason to assume other than that this proportion is maintained into the future, so total traffic also increases at 46%.[8]

Supply demand equilibrium

We now need to adjust the latent demand forecasts for the effects of congestion. The model developed to predict it indicates that if such traffic growth in fact occurred, average time per km would increase by 29%. However, this increased congestion will deter some growth in traffic. Described in more detail in the Technical Note, the predicted outcome is that, after allowing for this deterrence effect, there will only be 33% growth and time per km will therefore only increase by 21%.

Actual demand will only be 33% because of congestion

Figure 2.9 suggests how this will come about, by means of the equilibrium between demand and supply. Note that the lower 'supply curve' indicates additional capacity investment broadly in line with extending the 10 Year Plan proposals over a further 20 years. It indicates that much more capacity would be necessary in order to maintain current (2001) speeds and accommodate all latent demand in 2031. The shape of the demand curve also indicates how much travel times per km (and, implicitly, costs per km) would have to rise to keep demand at current levels. In fact, using the assumed fuel price elasticity and allowing for the impact of fuel prices on car ownership, in 2031 fuel prices might have to be more than five times their current level (an annual increase of 6%) to restrain traffic demand to the 2001 level.

Some of the suppressed demand will divert to rail, so that an additional 5% growth in rail traffic is predicted. If combined with latent growth in rail passenger km of 120%, it implies an overall growth in rail demand of 130%. Note once again that this assumes no increase in fares from current levels and ignores any shortages of rail capacity.

Using that methodology, Figure 2.10 shows forecast growth assuming a no further increase in capacity or 'Do Nothing' policy over the next 30 years, and, by, implication, its likely continuation beyond.

Implications

Our model implies most traffic growth will be caused by increases in car ownership, for which we have used a detailed procedure in line with 'best practice' as used by the Department of Transport. To translate the demographic and car ownership forecasts into traffic growth, we have perforce had to operate at an aggregated level, but the procedure is based on sensitivities which are reasonably supported, and produces an acceptable account of the actual development of travel demand between 1991 and 2001.

If no further capacity is provided and transport prices remain at their current level, our model predicts that after allowing for traffic being choked off by congestion, traffic will still increase by 33% between now and 2031 and journey times will rise by 21%. So, we predict that, even with a modest latent traffic growth of around 1% per annum, such a 'do-minimum' strategy would lead to a significant deterioration in travel conditions. In 10 years' time the average one hour journey today would take 64 minutes; in 30 years' time, 72 minutes.

Table 2.10
Changes in travel

	1971	2000	2031	Increase from 2000 to 2031
Population (GB) (million)	54	58	63	+9%
GDP per head (UK) (1971=100)	100	180	354	+97%
Car stock (GB) (million)	10	24	35	+46%
Cars per 1000 population	190	420	560	+33%
Vehicle-km (cars and vans) (GB) (billion)	165	380	555(1)	+46%
			504(2)	+33%
Journey time (min per km)		1.14	1.38	
Bus & coach passenger-km (billion)	60	45	44	-2%
Rail passenger-km (billion)	35	47	103(1)	+120%

(1) 'latent demand' forecast.
(2) forecast assuming no additional highway capacity.

But of course that is just an average. There is no reason why journeys made in uncongested locations or at off-peak times will take longer in 2010 than today. However delays on congested motorways will be worse, with increasing unreliability and greater impact of incidents and accidents although these latter effects should be helped by the Highways Agency plans to manage incidents better.

A 'do-minimum' road investment strategy would lead to a significant deterioration in travel conditions

Nevertheless what that still predicts is congestion spreading progressively in time and space, increasing the proportion of vehicle kms where queuing (in urban conditions) or flow breakdown (on motorways) is encountered. If on average, journey times increase by 7% every 10 years, then there will be many journeys currently undertaken at the shoulder of the peak or in moderately heavy traffic conditions, where the actual deterioration will be twice this. An allied issue is reliability. Many journeys, especially for business purposes, involve timetable constraints at one or both ends of the journey. For many users what matters is not the average journey time from origin to destination, but how much time they must allow to be punctual on an acceptably high (say 95%) proportion of occasions. A certainty is that without capacity increases the system not merely performs worse on average, but also becomes significantly less predictable.

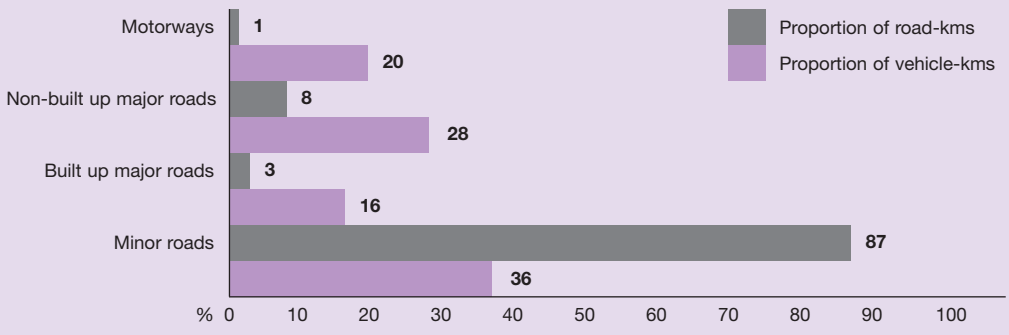
Faced with this prospect, it becomes more urgent to ask whether rationing by queuing is the best mechanism. Many would say that with only slight or moderate congestion, there is a certain democratic appeal in this. When congestion becomes severe, however, there are considerations both of environmental performance and of efficiency to consider. If all units of traffic had the same willingness to pay to save travel time, then rationing by queuing would impose absolute but not relative inefficiencies on the system. But different people's valuation of time is not the same. In practice, roads are one of the last common user resources, with high value freight and employers' business traffic (value 20-40 pence per minute) fighting it out for road space with commuting and other purpose car traffic (value 4-10 pence per minute, depending on person, purpose and journey distance characteristics). The efficiency penalty of rationing by queuing will increase significantly as traffic grows, and we shall progressively see business interests demanding a more rational system for allocating road space than the queue. Versions of this will assert that poor transport conditions are a negative factor in macroeconomic performance. There is a very extensive debate on this (see SACTRA 1999[9]) and the more apocalyptic predictions should clearly be treated with caution. But we believe that if road and public transport quality and reliability were allowed to fall significantly, then the impact on competitiveness would need to be considered. It would be risky to 'go the Bangkok route' and rely on human ingenuity and the traditional British gift for improvisation triumphing over appalling traffic conditions.

Conclusions

Our conclusions therefore are that:

- a policy stance which is close to the do-nothing base will result in significant progressive deterioration in network conditions
- this deterioration will fall most heavily on the high valued business-related traffic which is prepared to pay most to secure a high quality network
- even though there is a view that 'conditions are not too bad now', given the long lead times for policy, it is necessary to start planning now for an alternative to the inertia solution to the problem.

Figure 2.11
Traffic on different types of road, Great Britain 2000



In the face of this, then, it seems as if 'do minimum' is not a good option for society to follow. What are the alternatives? At the extreme, there are two types of policy which could prevent the deterioration in service quality. On the one hand, we could increase road capacity in 2031 to a level where average speeds are no worse than today. On the other, we can use demand management in the form of pricing to ensure that the predicted latent demand increase of 46% by 2031 does not in fact occur – in other words, to 'price it off'.

Both of these options are difficult. The additional capacity required to accommodate the demand to maintain today's speeds appears to be of the order of four to five times the scale of investment envisaged in the Government's 10 Year Plan, sustained over a period of 30 years. Alternatively, to keep demand at current levels, motoring charges and taxes in 2031 would have to be more than five times their current level (i.e. three times in relation to real incomes). This includes some allowance for the impact of fuel prices on ownership. In other words, it is roughly equivalent to maintaining the fuel duty escalator in place in perpetuity.

To conclude, we think the implications of this analysis are that even with a significant road investment programme, combined with some form of demand management, traffic growth will continue to outstrip capacity growth leading to deteriorating road network service levels. We do not think the British public, nor the political system, has yet woken up to the consequences of this, and until this happens, the essential policy choices will not be confronted.

References

1 Results from the 2001 Census are not yet available

2 DETR, NRTF 97

3 These effects are omitted from the latent demand forecasts: they are discussed below

4 *Traffic Speeds On English Trunk Roads*, DETR 1998

5 *Transport Statistics Bulletin: Vehicle Speeds in Great Britain*, DETR annual

6 1990-2000

7 1990-2000

8 Note that if, alternatively, we assumed that commercial vehicle traffic would in the future increase at twice the rate of private car traffic, the total traffic growth would rise to 54%.

9 SACTRA (1999), *Transport and the Economy*, DETR, London.

Congestion definitions

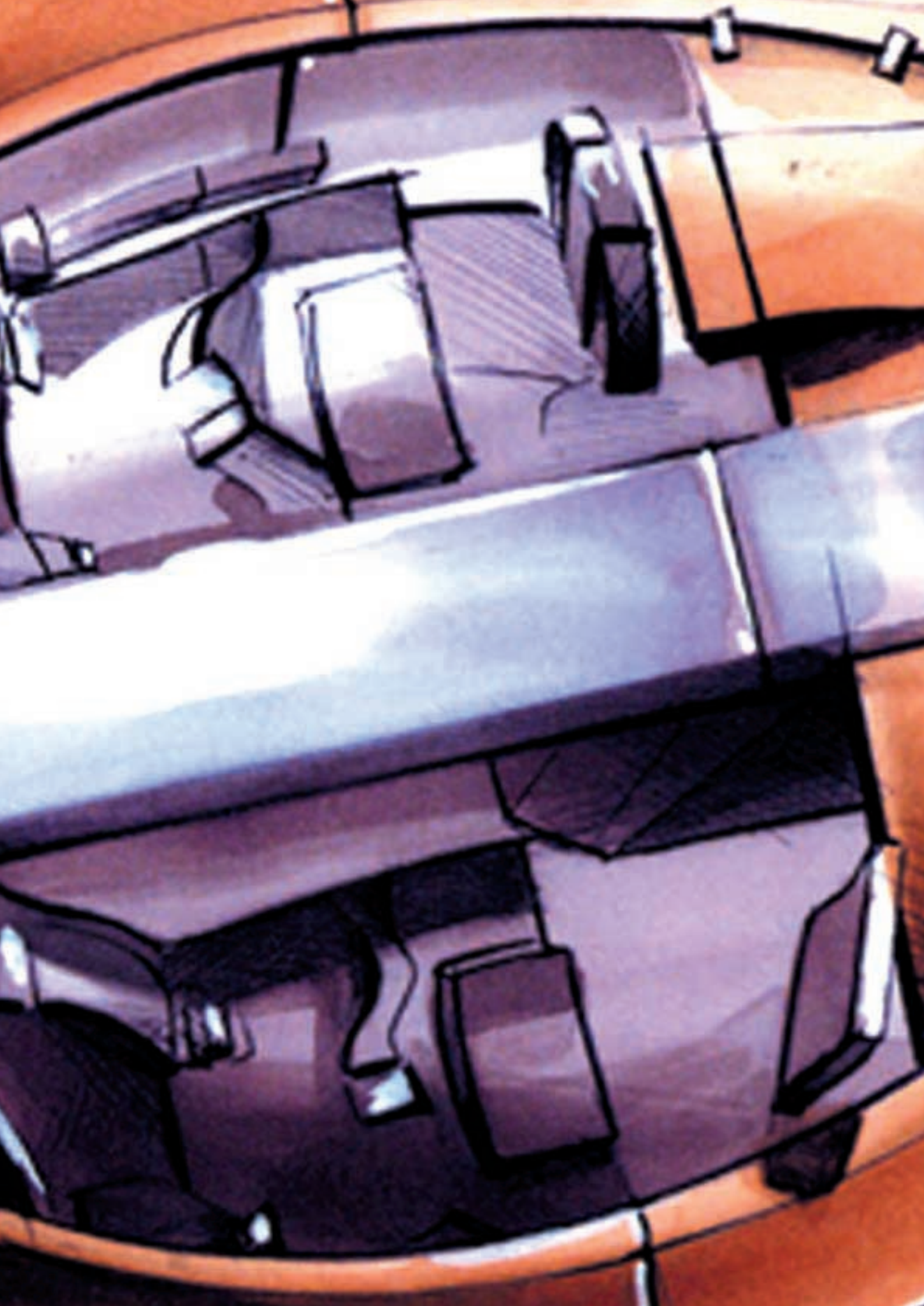
Time delay: The average delay experienced for each kilometre travelled compared with driving at speeds typical when traffic is light (measured in seconds per km). Official definition used in the 10 Year Plan where the target is to reduce it by 5%. Monitored by speed surveys using moving cars over standard journeys.

Links congested: The proportion of links congested (i.e. where the traffic is flowing at less than free flow speed as defined in 'time delay'). This is used by CfIT for comparing congestion in different countries.

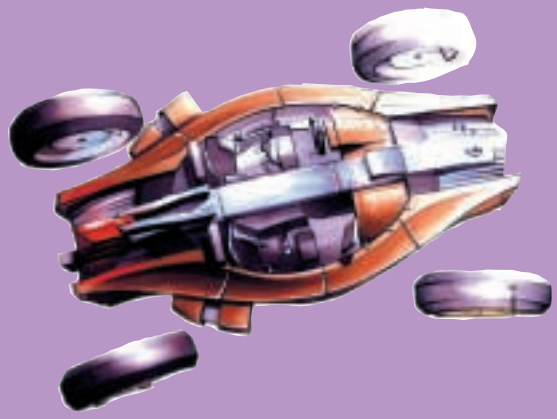
Capacity utilisation: Ratio of actual traffic flow to maximum capacity of road link. Maximum capacity is not necessarily fixed (e.g. it is lower in bad weather). Used by transport consultants: ratio of 0.6 is considered limit of free flow traffic, at 0.8 serious breakdown of flow and stop start conditions result. Easy to measure.

Urban congestion: Time spent in stop start conditions in urban areas (% of driving time or minutes per hour). Not currently used, difficult to measure except by moving car surveys.

Unreliability: Chance of serious delays. Difficult to define but important for journey planning.



3 The environment



- Road transport now accounts for half of most pollutant emissions and a fifth of all CO_2 emissions
- While transport is not the largest contributing sector, it is the only one where CO_2 emissions are forecast to rise in the next few years
- Current legislation and technology can eliminate the impacts of road transport on air quality, and remove air quality as a constraint on transport policy
- 'Zero-emission' vehicles are technically feasible but the energy must come from low carbon sources such as renewables or nuclear energy
- Transport noise in the United Kingdom is likely to get worse unless technical solutions to improve both vehicles and roads are speeded up
- The motor industry must make further efforts to ensure the recyclability of its products
- Control will still be required to reduce the impact of the car on quality of life in local areas

3 The environment

In this chapter, we explore the relationship between transport and the environment, the environmental targets that should inform transport policy and the prospects of meeting them in the next 50 years. We first consider air quality, noise and climate change, then, more briefly, the environmental sustainability of motoring as congestion rises. Although these are separate issues, they need to be seen through the unifying perspective of sustainable development, which reflects the broad time horizon of this report and highlights the essential link between environmental concerns and the social and economic objectives which must also inform transport policy.

Transport and the environment

Over the last half-century road transport has become a dominant influence on environmental quality in the developed world. Within the United Kingdom it now accounts for about half of the main pollutant emissions (but up to about 80% in London, and around 70% in other cities). Vehicles also accounted for some 20-22% of all CO_2 emissions. While transport is not the largest contributing sector, it is the only one where CO_2 emissions are forecast to rise in the next few years.

The noise climate of urban societies is also dominated by transport to the extent that environmental noise and transport noise are now often treated as one and the same, and heavily-trafficked roads are increasingly seen as dividing local rural communities and diminishing the quality of urban life. Not surprisingly therefore, traffic and its associated environmental effects are now seen as the environmental issue which will cause most concern in the next few decades.

In considering these challenges, it is necessary to have in mind available policy instruments and their limitations. Technological change offers relative certainty of impact and has recently been the dominant factor mitigating the environmental impact of motoring. Planning remains important, but is constrained by long time lags and uncertainty of effect, which can affect even short-term adaptations to traffic management systems. Persuasion often has little effect in the short term, although change in attitudes between generations should not be underestimated. For the rest, there remains a choice between traditional regulation and incentives through economic instruments. The relative benefits of those approaches in terms of equity, effectiveness and ease of operation, and the balances between them are among the underlying themes of this report.

Air quality

Where are we now?

The contribution of vehicle emissions to air pollution is generally seen as the most significant environmental impact of road transport. Department of Health estimates suggest that between 12,000 and 24,000 earlier deaths occur each year as a result of acute (short-term) episodes of air pollution. Those affected will usually already have been ill, and the period by which death is advanced – whether by days, months or years – is uncertain. There is also increasing evidence of chronic effects of elevated levels of pollutants such as fine particles. Early studies indicate that the impacts in terms of life years lost could be as much as ten times that for acute episodes.

Emissions of main pollutants from motor cars have fallen significantly and will continue to fall

While this is clearly an important health and social issue, it is one that has recently been yielding – at least in respect of transport – to technological change and policy intervention. Over the last 20 years, as a result of successive rounds of emission reduction regulations and advances in technology in Europe and North America, the level of emissions of main pollutants from motor cars, per vehicle, has fallen significantly, and is projected to continue to do so.

The relationship between emissions and air quality is complex and non-linear, but this trend offers an encouraging prospect. It is undermined, however, by the extent to which continuing increase in vehicle numbers is likely to offset the benefits deriving from per-vehicle emissions improvement. Indeed the dominant issue in air quality policy is the prospect that, on current trends, somewhere around 2020 the impact of rising vehicle numbers could begin to offset that of improved vehicle technology.

Table 3.1

Emissions from road transport as a percentage of all emissions (1996)

Pollutant	England and Wales	London
NOx	47	75
Particles	26	78
SO_2	2	23

The current policy framework

While they will pose important challenges for some time, there is now a framework in place for addressing air pollution and the role of vehicle emissions. Increasing understanding of the sources and dispersion of pollutants and their health impacts has already allowed the Government to develop a National Air Quality Strategy, whose aim is to reduce air quality pollutants to a level at which they present no significant risk to public health. The Strategy requires a mix of national and local action, to speed the introduction of cleaner technologies, manage traffic volumes, and promote less polluting transport modes. The initial targets of the Strategy, reinforced by mandatory European requirements, are set for different pollutants for dates between 2004 and 2008, and a further set have been proposed for 2010, notably particles and oxides of nitrogen.

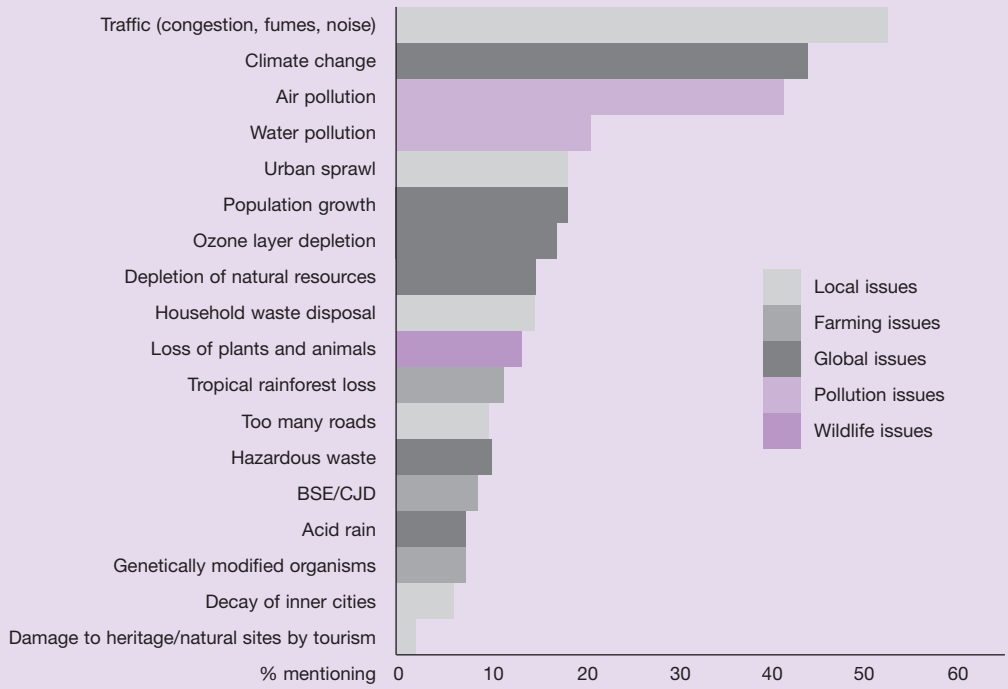
The Natural Air Quality strategy could eliminate the impacts of road transport on air quality

For transport policy, two aspects of the current Strategy are crucial. First, it recognises that improvements in air quality in recent decades mean that air pollution is now a problem of local hotspots – but some of these, such as London – are large. Second, while for some pollutants, the objective of policy – the reduction of pollutant concentrations to below the 'no health effects' threshold or some proxy for it will have been achieved by 2010 or before, a longer – as yet indeterminable – period will be required for the key transport-related pollutants. Over time, if effectively rolled forward, this Strategy can be expected to eliminate the impacts of road transport on air quality, and in turn remove air quality as a constraint on transport policy. The key question is the time-scale and the mix of policies.

What needs to be done?

Air quality is thus an area marked by relatively firm targets and framework for delivering them, and good prospects for continued progress. Some priorities for the next decades can therefore be discerned.

Figure 3.2
Future environmental concerns (2001)



Source: DEFRA Survey of Public Attitudes to the Environment in 2001. Respondents were asked what environmental trends or issues would cause most concern in 20 years time.

First, as a bedrock for confirmed progress, the targets in the Government's current strategy through to 2010 should be vigorously pursued. This requires effective local measures in about 125 Air Quality Management Areas where existing national measures appear unlikely to achieve the targets of the strategy. In most of these areas transport is the principal problem. The Government has already agreed that, exceptionally, in those areas, Local Authorities will have powers for roadside emissions testing. It has also supported the concept of Low Emission Zones, which will allow Local Authorities to identify areas from which polluting vehicles of specified kinds could be excluded. Other reasonable and cost-effective regulatory measures may be needed.

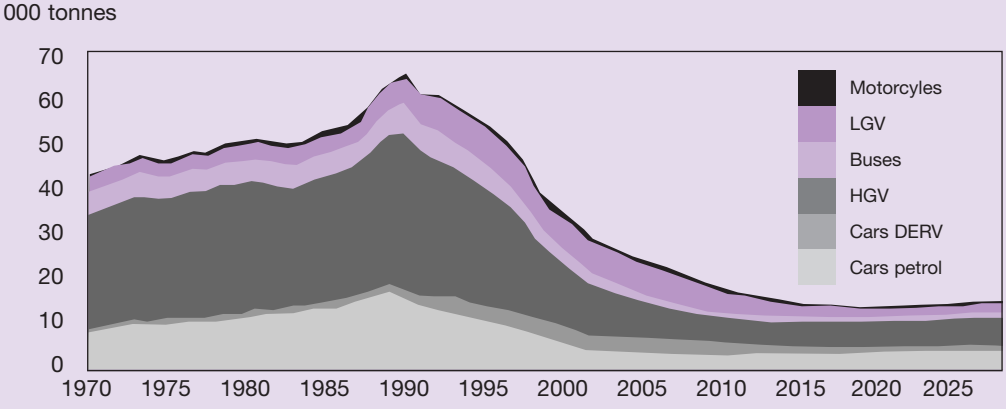
The real challenge will come, however, in the decade or so beyond the current strategy. Even with the targets of the current strategy achieved, substantial further progress will be required, in the abatement of emissions of fine particles and oxides of nitrogen, if the health impacts of road transport are to be removed. This will require continuing technological innovation. Given that progress in reducing emissions from conventionally fuelled combustion engines is likely to bottom out, there will be a need for new fuels and new power developments.

'Zero emission' vehicles will be necessary

For full resolution of the problems the use of 'zero emission' vehicles will be necessary, and in a later chapter we conclude that – probably through the use of hydrogen fuel cells – this prospect may now be in sight. But zero emission at the tail-pipe are not alone enough. On sustainability grounds it is important that the energy comes from renewable sources, nuclear or some other technology which does not simply transfer the emissions to other stages of the product cycle. The other consideration is time scale and the incidence of benefits. If the full answer is some considerable time ahead, it will be important to keep in play other options which offer real improvement over the interim period. This highlights the potential importance of 'hybrid' vehicles, utilising for instance diesel and electric batteries, both in maintaining progress in the short and medium term and paving the way, probably well within our timescale, for the full elimination of emissions.

There are however major uncertainties, which could affect the foundation and objectives of policy. Evidence on health effects must be expected to change, as it recently has on 'chronic' effects. Public opinion may conclude that elimination of the measurable health impacts is not a sufficient objective, and that goals should embrace the impact of air quality on eco-systems and the contribution which very clean air can make to the human feeling of well-being, thus raising the standards against which policies are judged. Finally, emissions from abroad may prove a more significant component of air quality than previously assumed, as has already happened in respect of ground-level ozone, and this could have implications for the contribution domestic transport policies should make to achieving targets. In spite of these inevitable uncertainties we see every prospect that within the next few decades the impact on air quality can be substantially eliminated.

Figure 3.3 a
Emissions from road transport – PM_{10}



Source: The Air Quality Strategy for England, Scotland, Wales and Northern Ireland; DETR; January 2000

Noise

Noise has not so far been a significant factor in road transport policy in the United Kingdom. This is surprising in view of the relatively greater attention afforded the issue in other Northern European countries, and the relatively high levels of concern that tend to be expressed by the public on noise issues generally.

Transport now dominates the noise climate in developed countries

The contribution of transport to the overall noise climate is however somewhat ambiguous. On the one hand continuous transport noise can be relatively less damaging to public health and well-being than explosive noise from neighbour disputes, and late-night pubs and clubs, and certain sporting events. On the other hand, it now dominates the noise climate in developed countries, and is responsible for an overall level of background noise which is widely perceived as unacceptably high.

By comparison with air quality, its health effects may appear (at least on the basis of current science) more difficult to isolate, but some links have been identified, notably with certain heart conditions. More important is the wider erosion of quality of life through effects such as increased stress and annoyance, serious sleep disturbance, and measurable effects on attention levels and performance, notably in schoolchildren.

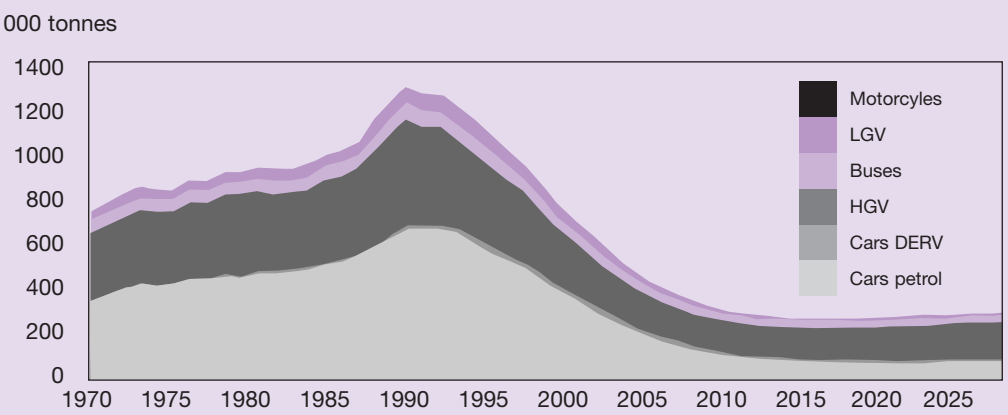
Where are we now?

While air pollution is being progressively abated, transport noise in the United Kingdom appears relatively constant or deteriorating. The prospect is that, with future increases in traffic and congestion levels, the position could further deteriorate without technological innovation to reduce emissions at source or other policy measures to abate their effects.

In particular the erosion of 'tranquil areas', in both space and time, has been one of the more notable social and environmental trends of recent decades, reflecting in part the progressive shift in many urban areas to the '24-hour day', itself not unrelated to changing transport opportunities and constraints, and to improved roads opening up previously less trafficked areas.

Nevertheless, there has been some progress. Over the past twenty years vehicle engine noise has been significantly reduced, largely because of successive stages of European Auto/Oil Programme negotiations. Less progress has however been achieved in reducing tyre and body noise. Moreover, any reduction per vehicle has been substantially eroded by the continuing increase in the volume of vehicles.

Figure 3.3 b
Emissions from road transport – NO_X



Source: The Air Quality Strategy for England, Scotland, Wales and Northern Ireland; DETR; January 2000

We lag behind on other policy measures, notably quieter road surfaces and installation of sound barriers, at least by comparison with other countries in Northern Europe, although the DTLR's 10 Year Plan has now opened up the prospect of a more positive approach with a commitment to introduction of quieter surfaces on 60% of the trunk road network over the decade. The trunk roads are however a relatively small component of the transport network. There is less evidence that the fundamental issues raised by noise on urban and rural roads are being seriously addressed.

Prospects for change

It seems unlikely that this position can continue much longer, and wider developments suggest noise may be a more significant constraint on transport policy in the next few decades.

The first is the publication in December 2001 of the Government's consultative proposals for a Noise Strategy for England. This makes no concrete policy proposals, and in effect postpones significant expenditure for five years or more. Nevertheless, taken with increasing research and staffing expenditure, it is important in signalling Government recognition that noise is a significant issue that requires a more coherent and effective strategy.

Significant changes will in any case result from developments at European level. The EU Directive on Noise Assessment & Management will require that all significant population centres of over 200,000 are mapped for noise exposure levels. This is likely substantially to increase public awareness and concern, and generate local pressures for improvement. More importantly, it provides a quantitative basis whereby noise can be taken more systematically into account in local planning decisions, making it potentially a more significant constraint in local transport planning. How this happens may be moderated only by the extent to which improvements in vehicle technology can reduce the need for other containment or reduction measures addressing road surfaces, sound barriers, or reduced use of vehicles in sensitive areas.

Zero-emission vehicles should in due course dramatically reduce engine noise

As with air quality, however, the longer term picture appears relatively encouraging. Zero-emission vehicles should in due course dramatically reduce engine noise, and other technology changes may reduce tyre and body noise. Meanwhile, technological improvements to current vehicles, and new hybrid technologies could allow earlier reductions in transport noise of particular benefit in sensitive and heavily populated urban centres.

Forcing further technological development will have the benefit of allocating the costs of transport noise abatement to the transport sector itself. But there is a wider question of the relative cost effectiveness of such reductions at source as against, for instance, insulation measures which may mitigate the impacts not only of transport noise but also of other noise sources. If the burden of the Government's consultation proposals is indeed to defer significant action for at least five years, it is important that that time is spent getting to grips with such issues so that a balanced and coherent noise policy emerges which bears upon transport and other noise sources in proportionate and cost-effective ways.

These considerations point to three general conclusions:

- noise will become a more prominent issue in transport policy in the decades ahead
- while fuel cell vehicles may ultimately remove the problem, and other technological development significantly reduce it meanwhile, there remains a strong case for speedier introduction of quieter road surfaces, noise barriers and other abatement measures to protect sensitive areas
- however the balance between technology and other abatement or management measures should not be dictated by the progress of technology. Different kinds of measure will vary in their direct and indirect effects and their social benefits and cost. This emphasises the long term importance of the strategy process on which the Government has now embarked, even though its progress in the short term is slow.

Climate change

While the problems of toxic emissions and transport noise could be things of the past by 2050, climate change is likely to remain a dominant global issue. The question is whether by then the contribution of motoring at least to CO_2 can be eliminated.

There is no longer any serious question that although man-made CO_2 emissions are still small compared with those that occur naturally, their cumulative additional effect has been driving global temperatures higher, at a steadily increasing rate, since the mid-19th century (Table 3.4).

The transport sector accounts for just over 25% of man-made CO_2 emissions

Transport energy use, and thus its contribution to man-made CO_2 emissions, is significant although not predominant. Table 3.5 shows the distribution CO_2 of emissions by sector in the UK. The picture for other advanced industrialised countries is broadly similar.

In 1999 the transport sector accounted for just over 25% of man-made CO_2 emissions, but was on a generally rising trend whereas electricity generation and industrial emissions had fallen, mainly due to a shift from coal to natural gas. At the same time, the emissions from the domestic sector seem to be peculiarly intractable.

The current position

Through the Kyoto Protocol the United Kingdom and the European Union have accepted challenging targets for the reduction of CO_2 and other greenhouse gases. For the UK this involves a legally binding commitment to reduce CO_2 emissions to 12% below 1990 levels by 2008 – 2012, and a domestic goal of a 20% reduction in CO_2 emissions below 1990 levels by 2010.

No realistic implementation of the Kyoto Protocol targets is likely without some significant reduction in CO_2 from road transport, notably private motoring. Fortunately there is evidence that, even with conventional IC technologies, there is scope to halve the carbon intensity of car travel. UK fuel consumption per passenger mile has remained virtually unchanged for the past 30 years. Current VCA data reveals that some new petrol and diesel saloon cars are approaching 100g/km of CO_2, but the fleet average is still twice that figure, and even for specific makes of car, some high-performance models have a CO_2 rating almost double that of the most economical.

The principal instrument for delivering the necessary reductions is therefore the EU Strategy on CO_2 from cars which is estimated to yield carbon savings over the relevant period of 4 MEC below the original projection. Taken with the 1 – 2.5 MEC already achieved by the fuel duty escalator up to 1999, and other available measures, it seems clear that motoring's contribution to the Kyoto Targets should be readily achievable.

Table 3.4

Actual and predicted global warming with no CO_2 control

Year	1860	1910	1960	2010	2060	2100
Temperature increase (degC)	0	0.1	0.3	1.4	2.9	4.3

Source: UK Meteorological Office, Hadley Centre Model (DETR No 1998)

Table 3.5

UK carbon dioxide emissions by source, 1970 to 1999 (million tonnes of carbon)

	1970	1980	1990	1997	1998	1999
Power stations	57	58	54	40	40	39
Industrial combustion	66	43	38	38	38	40
Domestic	26	23	22	23	24	23
Transport	22	26	32	36	36	36
Other sectors	11	14	5	3	4	4
Total	**182**	**164**	**151**	**140**	**142**	**142**

Source: UK Energy in Brief (DTI, July 2000)

Prospects for the longer term

Beyond 2010 the position becomes more difficult. For emission reductions after 2010 commensurate with the potential severity of the problems – such as RCEP's recommendation for a 60% reduction target – foreseeable improvements within existing technologies seem less likely to offer a sufficient remedy. Whereas technological developments have allowed air quality to be improved in the face of rising vehicle numbers and miles, that would be unlikely for climate change. The implication is that the way forward within a relatively short period must be either a step change in technologies, which radically improves CO_2 emissions to an extent that existing technologies do not allow; or other policy instruments – limiting the number and use of vehicles – would have to be brought into play.

In fact, environmentalists and industry now largely share a long-term view of the role low carbon automotive fuels – specifically, fuel cells powered by hydrogen derived from renewable energy – could play. However there is a concern about the environmental impact of transitional hydrogen technologies. A lifecycle assessment of the environmental impact of hydrogen derived from fossil fuels suggests less clear-cut reductions in greenhouse gas emissions improvements, which may be matched by lower cost options such as diesel-electric hybrid technologies which could be available more quickly.

Such technologies have the potential to deliver some of the benefits of both battery electric and internal combustion engine (ICE) technology, while mitigating some of the more serious limitations of both. Indeed many now argue the positive merits of the 'hybrid pathway', even promoting the view that they may be so successful that they will keep fuel cell vehicles out of the market for a long time to come. Thus, paradoxically, they can be seen as a stepping-stone to fuel cell vehicles, or a diversion, or possibly even a dangerous competitor to fuel cell developments.

There is thus a prospect that either hydrogen fuel cells or hybrid technologies will prove the step change in CO_2 emissions required to achieve the sorts of targets to which RCEP has pointed. For environmental policy however it is important that the choice take account of the full lifecycle costs and give full weight to the value of short and medium term benefits as against the longer term goal.

Motoring's contributions to climate change targets may be achievable through low emission vehicles

If one or both of these options becomes available – and the speed and likelihood of this is explored in the next chapter – motoring's contributions to climate change targets may be achievable without other intervention. However, the possibility that technology may not deliver, or at least deliver quickly, suggests a need to have open other options – which, by regulation or economic instruments – could constrain the demand for vehicle use – if there is to be confidence that the impact of motoring on climate change can be removed.

Sustainable development and the car

The 50 year time horizon of this report makes it necessary to look not just at the separate environmental impacts of the car but also at its long term sustainability. The prospect of bringing air pollution, noise and climate effects substantially under control, is important but not sufficient. The wider geographical and timeframes, and the importance of a holistic approach which integrates social, economic and environmental considerations, make it necessary to look at prospective levels of car ownership and use in terms of resource use and energy consumption and impact on the viability of local communities.

Resource and energy use

The rate at which non-renewable resources have been depleted over recent decades has speeded greatly, and were this rate of increase to continue, finite limits would be in prospect before long. In 1999 DTI statistics show that the transport sector consumed 53 million tonnes of oil out of a total national consumption of 65 million tonnes – 81% of a resource that has other valuable uses and could be exhausted as early as the second half of this century. Were patterns of personal mobility now characteristic of the developed world to be replicated generally throughout the developing world, the implications would be unsustainable. Even if the United Kingdom's own demands for energy and mobility, and its CO_2 emissions from vehicles, were to stabilise and reduce, it would almost certainly be necessary for the developed world to accept some greater degree of restraint: if the developing world is to accept sustainable development, the developed world will be expected to move towards more sustainable consumer patterns. The motor industry is unlikely to be immune from this process.

The motor industry was at first slow to respond to pressures for increased resource efficiency. The environmental labelling of vehicles has also lagged some way behind such processes in some comparable sectors. More recently, however, significant strides have begun, including enhanced efforts at vehicle labelling and acceptance of recycling, through the End of Life Vehicles Directive. The SMMT sustainability strategy consolidates this important shift of attitude.

The environmental impacts of congestion

Global concerns are replicated at local level. Surveys of local environmental problems – what the Prime Minister has called 'the environment on your doorstep' – suggest that people see vehicle numbers as a problem quite separate from the sum of noise, fumes and air pollution. It is clear that some characteristic physical and social settings have found it difficult if not impossible to adapt to contemporary vehicle numbers, let alone those now in prospect:

- the impact of congestion on quality of life in urban and city areas has only in limited areas so far yielded to policy responses
- the problems of the integrated, high-rise estates of the post-war years have been increasingly exacerbated by the fact that they were not designed to accommodate large numbers of vehicles
- more recently the increasing volume of high speed traffic has impacted detrimentally on rural villages and the countryside.

As vehicle numbers increase, such environmental quality problems must be expected to grow. The exclusion of vehicles from urban centres through pedestrianisation, speed and traffic management measures in rural environments, and similar measures, suggest that as vehicle numbers increase, higher levels of regulation of vehicle use may be unavoidable if the quality of local environments is not to deteriorate further.

Congestion is also a major environmental and social problem

What such illustrations emphasise is that congestion – although generally seen as an economic phenomenon measured in terms of the costs of delay – is also a major environmental and social problem, and one for which we have no adequate system of governance. Persuasion, fiscal measures and other economic instruments may be applied to discourage some percentage of trips. But, short of general or selective vehicle bans, there is nothing the affected local community can do if enough individuals still find the increased travel time and cost something they personally want to accept. 'Home Zones', which might appear to impose very severe restrictions on vehicular access to reflect the interests of the local community, could come to be seen as setting an important precedent.

The overall point then is clear. Technological change may substantially remove the need for tighter regulation of car ownership and use on grounds of air quality, noise and climate change. But that is unlikely to be the end of the story. Both the global level of energy and resource depletion, and the quality of life of local areas may force us to address congestion and vehicle use more radically though direct regulation or pricing and economic incentives.

Conclusions

We are not facing an 'environmental crisis' in the UK – indeed a good many things are and will get better. But we are certainly facing an international environmental crisis, whose impact on the UK is bound steadily to increase.

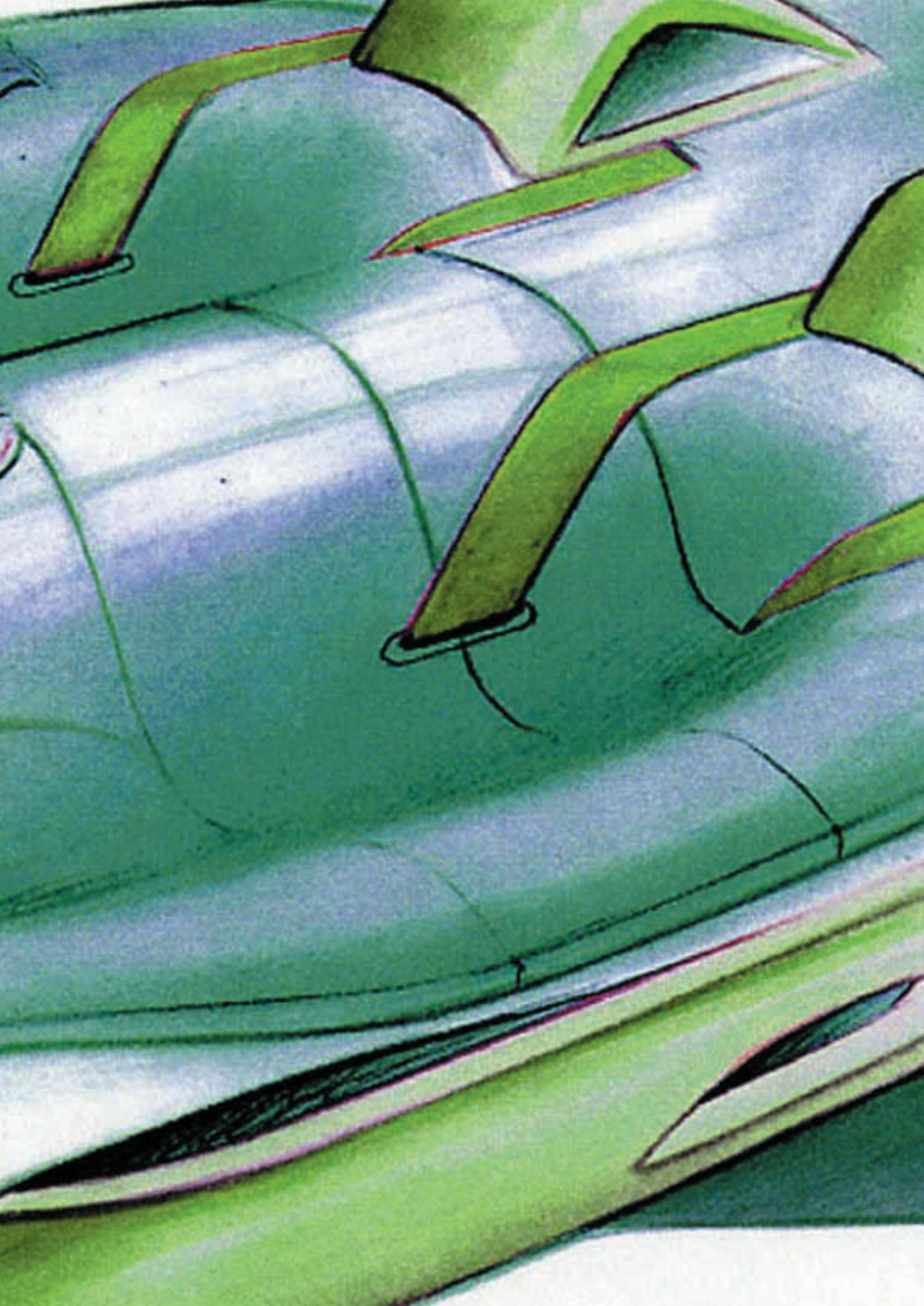
Within the UK, we are however now approaching a turning-point in terms of the environmental sustainability of car use. The growth of car ownership and use has so far been almost entirely unconstrained by environmental factors. Each round of new emission reduction regulations has added £100 or so to the price of a new car, a relatively negligible figure, while at the same time fuelling new production. The essential question is therefore whether, given the critical difficulties to which unconstrained growth is now bringing us, demand can be left to develop unrestrained by some general framework of management.

Against this background, some conclusions emerge, and some are grounds for optimism:

- The impact of the car on Air Quality has been diminishing and should continue to do so. Nevertheless to achieve current targets will require new regulatory measures in residual 'hot-spots' – not least London – combined with national measures to speed the roll out of cleaner fuels and technologies. Some decade or two after 2010 there is the hope that hydrogen fuel cells and new hybrid technologies should largely remove the problem. But there are important choices of pathway to be made in the next few years, and technological fixes will not remove the need for significant contributions from planning, demand management and influence on driver behaviour.
- By contrast, noise is likely to prove an increasing constraint on transport policies, as a result of important shifts in UK Government policy and EU requirements. A better strategic policy framework is needed now if necessary environmental goals are to be secured in a cost-effective manner in the years – perhaps decades – before major shifts in technology substantially eliminate the problem.
- The problem of Climate Change will be with us for the whole of the next 50 years. As private transport is the only significant sector where CO_2 emissions are still forecast to increase, the sector must play its part in achieving the Kyoto targets by effective implementation of the EU CO_2 from Cars Strategy, and by further promoting the move to smaller, more fuel efficient vehicles. Beyond 2012 there are encouraging grounds for believing that the demanding requirement for a 60% or more reduction might be met by some combination of fuel-celled or hybrid technologies. But the importance of the issue is such that it would be incautious not to have available demand restraint measures which are likely to be necessary in any event to tackle congestion.
- The paradox of successful pollution control measures in the vehicle sector is however that they have served only to exacerbate the central issue of vehicle numbers and congestion, which is an environmental as well as economic issue. At a national level these can be tackled by continuing pressure for resource efficiency in the vehicle industry, effective recycling through the End of Life Vehicles Directive, and developments sketched in the SMMT's Sustainable Development Strategy, if vigorously pursued, point to a sustainable future for motoring.
- But at the local level many valued physical and natural environments cannot sustain the pressures of current and expected future vehicle numbers. Even with acceptable national measures of restraint, local regulatory measures may be unavoidable if the quality of life is not be further eroded in urban centres, integrated estates, rural villages and sensitive natural environments.

Recommendations

- Given that an appropriate policy framework now exists for balancing air quality and transport considerations, we endorse the Government's current air quality targets, and recommend that these continue to be regularly tightened and updated in the light of changing scientific evidence, so that motorists and the public at large can have the confidence that within a foreseeable period the significant health effects of air pollution from vehicles can be eliminated.
- In the interests of cost-effectiveness, the Strategy targets local management areas. We note that additional local regulatory measures principally affecting vehicle use, may be needed if local targets are to be achieved, but endorse this so long as it represents a more cost effective approach than more general national measures.
- We recommend that measurable targets for noise abatement from transport should be developed, and welcome the Government's commitment to develop a strategic framework which addresses all noise sources in a balanced way.
- We recommend the Government's commitment to the use of quieter road surfaces in the 10 Year Plan should be extended to significant local roads and its implementation speeded up.
- Given unavoidable transport growth and necessary investment in transport infrastructure, we strongly recommend that development of a Noise Strategy should not be delayed but should be expedited to render traffic growth more acceptable.
- Faced with the challenge of climate change, we welcome the Government's commitment to achieving a radical shift to low-carbon transport, and the setting up of its 'Powering Future Vehicles Strategy' with this objective. As part of this initiative, the Government must develop a framework for assessing the relative contribution of hydrogen fuel cells, hybrid vehicles, and other technologies for radically reducing the environmental impact of road transport. This framework should give full weight to the potential advantages of hybrid technologies in bringing significant further pollution abatement on stream relatively quickly. While there are difficult choices of pathway towards zero emission vehicles, any framework should avoid picking winners at too early a stage.
- We note that the vehicle manufacturing and oil industries have been able to introduce important environmental and safety improvements at little or no cost to the motorist. We believe that should continue.



4 Land use and quality of life

- The relationship between land-use and transport is interactive. Travel responds to changes in land-use and the patterns of land-use reflect changes in transport
- People have responded to better, faster and cheaper travel by travelling further for commuting, shopping and leisure
- This has led to dispersion of activities
- Planning can do little in the short or medium-term to alter development at the national level because its possible impacts take much time to develop
- Locally, land-use should be better integrated with transport planning to reduce car and increase public transport use, consistent with a vigorous local economy and personal mobility

4 Land use and quality of life

Overview

The relationship between land-use and transport planning has always been problematic. In recent years the growing emphasis on the need to practise sustainable development has emphasised the linkage. As expressed with precision and commitment by David Banister –

As more people acquire a car, their travel patterns radically change

> The integration of land use and transport planning is central to sustainable development. Planning does matter, and it is equally as important in determining travel patterns as is direct action in the transport sector. Overall, the major impact in the recent past (and in future) is the growth in car ownership. As more people acquire a car, their travel patterns radically change as the frequency of trip changes, the mode changes, and the total distance travelled changes. Interventions from planning can help reduce the need to own a car, can promote alternative modes of transport, and can reduce average trip lengths. In conjunction with actions in the transport sector (for example on pricing), the most effective overall strategy can be adopted.[1]

'Interventions from planning' in this context means the idea that land-use planning policies and strategies can direct locational choices in development so as to reduce the need to travel.

This is not the sole aspiration for the land-use transport relationship in planning. A second major task is to help to manage the effects of the intrusion of the car and other forms of transport – a large facet of the quality of life issues. This aspiration has a long and distinguished history: an important early landmark was the original Radburn layout in New Jersey designed by Stein and Wright in the late 1920s[2], a highly successful attempt to prevent the car from dominating the movement of people in the areas around their homes. Modern urban design seeks to achieve similar or more fine-grained effects in traffic separation and traffic calming and returning the streets to the people.

Underlying assumptions and issues

As Banister explains it, there are two key ideas in the analysis of the land-use transport relationship.

The first is that transport is only a derived demand - '…One that has no inherent value in itself. People (or goods) only travel (are distributed) because of the benefits (added value) that they achieve at their destination'[3]. This notion of transport as a derived demand is a crucial concept, because it provides the basis for an analysis based on rational choices in which people act to reduce the two 'costs' of travel – time and money.

There is a close link between land use activities and trip generation

The second is that '… there is a close link between land use activities and trip generation.'[4] This is similarly a crucial concept because it provides the premise for promoting land uses through locational policy that will achieve the objectives of constraining car ownership and use.

These are obviously linked ideas – that demand for transport is essentially rational behaviour; which can be observed and interpreted technically (through models) in a scientific way; and which through a continuing rational process can be projected into policy decisions about land-use decisions in ways which will elicit a continuing rational response from the public.

The focus in this chapter is on the downstream issues – the application of policy to achieve desired outcomes. There are three sets of key questions:

- to what extent do we see through the locational choices that people are making that need or demand for travel is (still) capable of effective explanation as 'derived demand'; and to the extent that it is not, if any, then what other factors might be at work?
- what models of locational policy are available to test the policy propositions; and what is the evidence of their effectiveness in discouraging car ownership, promoting alternative modes of transport and reducing average trip lengths?
- if there is significant uncertainty arising from these two questions, that is, about whether we currently have sufficient confidence in our current ability to both explain and prescribe – then what is to be done?

Locational choices

Up to, say, the late 19th Century limited, slow and relatively expensive public transport was the only non-walking option for the vast majority of the population. Households tended to have one primary wage earner, working very long hours. So proximity of home to work had a premium that could be observed and expressed in monetary and time terms.

Even before the widespread availability of the car in this country, however, there is evidence of people paying relatively more (in terms of both time and money) for transport to achieve other benefits – either quantifiable, for example in terms of cheaper housing; or non-quantifiable, in terms of a better (e.g. smoke-free) environment or a more congenial social milieu. Electric transit was clearly a powerful stimulus for this – notably the Metro-Land campaign[5] – but this was not just a London or south east phenomenon – see for example Southport's relationship to Liverpool and Manchester in the early part of the last century.

Over the last few decades there have been significant changes in how we choose where we live and where we work driven by powerful economic and social forces. First, households with multiple adults have progressively developed more than one income generator. Second, changes in employment or occupation now take place more frequently.

The net result is that even if proximity to work is valued highly it may be very difficult to optimise. But in fact research shows that in the south east at least proximity is not the most highly valued factor: locational quality is twice as important as proximity to work, and quality of housing and schools is at least as important as an easy journey to work.[6] In terms of purely economic considerations, house prices that have risen steadily in real terms are a more powerful economic consideration than the cost of travel.

The increasing capacity of the information society coupled with a growing desire to shift the so-called 'work-life' balance might mean that the trend is to reduce the dependence on daily commuting or work-based journeys through home working.

Increasingly we are making choices about location and travel that are less obviously based on minimising the time- and money-costs of trips

Increasingly we are making choices about location and travel that are less obviously based on minimising the time- and money-costs of trips. As a society we display values constructed around broader concepts of 'accessibility'. The evidence for this is in the growth of retail and leisure journeys, where choice, convenience and (even) the pleasure principle are powerful factors. Our current values are complex and subjective: we make key locational choices about such as where to live based (for example inter alia) on the physical environment; access to highly valued services such as good schools, and probably increasingly good health care. They may be expressed as negatives, for example, freedom from fear of crime. Some of these concerns about physical and social environment may be so significant that they amount to putting a positive value on travel in terms of 'distance from' rather than 'proximity to'.

These are not just the choices of individuals – they are also the choices of firms, particularly in the service economy, for whom reducing the costs of production and delivery may be lesser factors than other economic factors (like location in the Euro-zone) or factors of perceived competitive advantage (like the ability to attract and retain key staff through working with the positive factors).

We need to understand and accept that the value placed on freedom to travel, especially the freedom of the car, is now deeply rooted. Once that freedom is acquired through car ownership, only the direct costs of operating are brought into the equation, and they may be a relatively small consideration.

This is not necessarily an argument that relates only to passenger traffic. The readiness to pay more for particular quality or qualities in goods, or to support non-economic goals such as organic products or fair-trade goods, may also have a material effect on demand for transport.

So important premises for future policy decisions must be that general economic prosperity has made the cost and duration of travel less of an issue, and not necessarily the decisive issue in demand for travel; that qualitative as well or as much as quantifiable factors are now clearly in evidence, and are driving locational preferences; and that even 'purely' economic travel choices are more complex.

If this is so, then working with the notion of travel as 'derived demand' becomes very problematic. We are indeed dealing with a variety of demands for travel, for many of which the derivation is particular to the individual and obscure to the analyst; and which might be difficult to classify and categorise into any hierarchy of need.

Ideologies and models in locational policy

British practice: from garden cities and transit cities to transport cities

Despite the clarity of the theoretical need for linking land use with transport as seen by Banister, there is a perception that the reality of practice in Britain has been otherwise. Haywood explains the origins of the dominant ideology thus –

> Historically, although models of urban planning were developed which sought to integrate metropolitan land development with transport networks ... they were not central to British planning ideology. The roots of British planning ideology lie in 19th-century concerns about poor housing and public amenity in the industrial cities and the development of the garden city as an alternative way of doing things.[7]

This account would be common ground for most. Haywood however sees the lack of centrality of transport thinking in spatial planning as more than just indifference or uncertainty as to what to do –

> Despite the antipathy of planning ideology towards transit it had exerted a profound influence on urban form in London, which had paradigm status as a planning problem. Two very different models for London's future were counterposed in the evidence collected by the Barlow Commission: railway managers saw a continuing need for population growth associated with development of commuter railways, the 'transit' city model; but town planners continued to advocate the 'garden city' model, whereby dispersal of population and jobs to self-contained new towns would lead to reduced demand for commuter rail services. It was the latter view which prevailed in the seminal report of the Royal Commission.[8]

The garden city concept is based on the idea of maximising self-sufficiency and thereby reducing transport need

But the garden city concept is not in fact antipathetic to transport or transit. Central to the concept is the idea of maximising self-sufficiency and thereby reducing transport need. (There is also the derived idea of the garden suburb, which pursues the same social and environmental objectives while recognising the metropolitan pull on employment.) This self-sufficiency has a strong resonance in contemporary thinking on sustainable development, and the need for settlements to acquire or retain the critical mass that will (in theory) deliver it. Thus reinterpreted, the garden city ideal is still a powerful ideology.

The promoters of the garden city approach always had a highly-qualified view of self sufficiency, in that they never envisaged free-standing garden cities but a continuously (up to a point, at least) evolving network of garden cities constituting the 'social city', which would indeed require a transit system to link it. Howard described this as –

> A carefully-planned cluster of towns, so designed that each dweller in a town of comparatively small population is afforded, by a well-devised system of railways, waterways and roads, the enjoyment of easy, rapid, and cheap communication with a large aggregate of the population, so that the advantages which a large city presents in the higher forms of corporate life may be within the reach of all, and yet each citizen of what is destined to be the most beautiful city in the world may dwell in a region of pure air and be within a very few minutes' walk of the country.[9]

Two important ideas emerge from this, of entirely contemporary relevance. First, there is a recognition of 'social' issues as a necessary major factor in transport demand. Second, the notion now termed 'balanced polycentric development', which has become arguably the dominant ideology at the regional and sub-regional planning levels. The latter has powerful backing through the influence of the European Spatial Development Perspective[10], in which this is a key objective in achieving the ESDP's central aim of 'balanced and sustained development'.

Even by the time of the Barlow Commission report in 1940, the south east of England in particular was starting to emerge as a form of transit city. This was due in large part to the electrification and extension programmes of the Southern Railway and London Transport.

This south eastern transit city in its post war continuation has inexorably absorbed the garden cities, the post-war new towns which were their descendants, and such of the poly-nucleated system that Abercrombie proposed for them as was built; and much more. The green belt that transport chiefs had feared would be an obstacle has never proved to be so[11]: instead it has added value through discontinuity – another demonstration of positive value ascribed to travel.

The transit city may have been initiated by railway development, but at an early stage the development of the road network and the spread of the private car became key factors in its development, and its replication in other parts of Britain much less well served by rail. Transit city has become perhaps transport city. It is not promoted as an ideology: but it is the dominant form in the macro-region of southern England and significant regions in the rest of Britain.

Examples from abroad: The Netherlands

In post-war years regional planning in Britain – England and Wales more so than Scotland – has been weak, attributed to our focus on 'land-use' rather than 'spatial' planning.[12] If our locational strategy has emerged by default, what has been the practice and the achievement in the country credited with the most sophisticated approach to regional spatial planning, The Netherlands?

The Dutch ABC location policy attempts to reduce the need to travel and encourage modal shift to public transport

The 1991 Dutch 'ABC location policy' can be seen as an attempt to bring transport city macro-regions under control through the imposition of a suite of strict locational policies reducing need to travel and trip length, and encouraging modal shift to public transport.

In the Dutch approach, housing is subject to a sequential test, and sites outside existing urban areas must have good public transport accessibility. Employment and social uses are categorised according to their trip-generating characteristics – A-profile (many visitors or workers) are close to city centres and major public transport nodes, B-locations (requiring general accessibility) are close to railway stations and the motorway network, and C-locations (fewer visitors or workers but higher vehicular access needs) next to the motorway network.

This categorisation is packaged with other measures, such as the improvement of public transport facilities and restrictions on parking. Implementation of this strategy has required joint planning by central, provincial (regional) and municipal (local) government. Much admired internationally, it was cited as an exemplar of good practice by the then DoE and DoT when Planning Policy Guidance Note 13 was produced in 1994.

But what such a policy cannot do is deliver instant results. For the period 1991-96 the greatest growth in employment was at C-locations – 37%, compared with 16% at B-locations and just 1% at A-profiles. In fact, business and employment appears over that period to have grown faster outside the ABC location network.[13]

This should not be surprising, nor taken as proof of failure. At national or regional level we are dealing with social and economic systems of extraordinary complexity, whose resilience is underpinned by the (infinite?) flexibility of private transport for goods and passengers. Over the short or medium term it may well be that individuals and businesses accept higher costs and time penalties to avoid the expense or difficulty of other change; and that adjustment to the new framework takes place only over the long term.

Nor is it the case that locational policy at a strategic level is impossible to deliver because it faces issues of wicked complexity and inter-relatedness. The issue of strategic infrastructure, particularly port and airport development, is central and crucial. Decisions on the location and distribution of such infrastructure have direct and foreseeable (if not precisely predictable) long-run implications for employment growth; passenger and freight transport demand; and housing. There is every justification for seeking to make such decisions key to the integration of land-use and transport planning, and then seeking to work with and influence the downstream implications of these decisions.[14]

An urban renaissance alternative?

The question remains whether there is a new direction to be taken through the 'urban renaissance', and its hope that more people will be encouraged to choose urban rather than suburban homes. The higher densities of city centres allow people to satisfy their social and economic needs over short distances and support frequent and efficient transit networks.

The urban renaissance is vital: but it is a complementary rather than an alternative strategy. The urban settlement pattern of Britain is already defined as a controlled but still extensive form, from which there can be no retreat. The suburban and exurban components of transport city are here to stay. The vast majority of the population must continue to live in these suburban and exurban areas. To the extent that urban renaissance and regeneration will encourage a wider range of socio-economic classes to want to live in city centres, these are likely to be people who keep second homes in the country.

There is no reason to assume that households with children will be less likely to wish to gain the social and environmental benefits that are perceived to come with suburban living. Nor are they likely to forego the benefits of home ownership that are central to the British domestic economy, but which in terms of desirable areas to live are affordable initially only in suburbs. Households will continue to 'move out'. In the process they will develop more complex economic and social demands for travel, and will continue to seek to meet them through car ownership and use.

The urban renaissance is crucially important to the health of Britain's cities and the contribution that they make to economic and social life. But its effect on settlement and travel patterns is likely to be felt at the margins.

What is to be done?

The future we face

As this report demonstrates, there are reasonable grounds for assuming that environmental issues related to problems of noise and emissions will over fifty years yield to technological solutions, but that the issues of congestion and intrusion will remain.

The possible social and economic applications of private motoring presumably will continue to grow, so the underlying demand for car ownership will not diminish. Locational policies are unlikely by themselves to have any very significant effect on that demand.

Diversification of social and economic demand for car use, related to growing options in both arenas over ever wider spatial ranges, may mean that we shall have only limited success in using locational policy to contain growing trip lengths.

Nevertheless we should wish to pursue the same sort of rationality as shown in the Dutch ABC policy. Locational policy linked with strategic decisions on infrastructure as an integrated activity of spatial planning will make it possible to develop in ways which can reduce car dependency.

However, given increasing congestion, its deterrence through parking and other controls and by motoring taxation or congestion charges, and as well as the opportunities represented by increased spatial dispersal and remote working, we shall see increasing selectivity about when and how to use private cars, based on each individual's or family's needs and demands. Spatial planning should take into account the consequences of all these factors on the location of activities.

A primary objective of spatial planning should be to reduce actual dependency on cars

A primary objective of spatial planning should be to maximise that flexibility and ensure that there is minimal actual dependency on cars, and maximal public transport alternatives. Achieving that objective will require a very strong regional and sub-regional focus to give proper recognition to the distances and areas over which people are making choices about travel. At a more local level, a matching objective should be to use urban design to support public transport and to reduce the intrusion of the car.

Policy levers

Achieving these objectives will require a broader, and more imaginative, range of policy instruments than we have used so far.

United Kingdom spatial policy. We need a spatial planning framework for the United Kingdom as a whole that deals with key infrastructure in the context of housing and employment goals. This has to be on a UK-basis because there are major implications for distribution of resources among the devolved nations and English regions. It has to be an integrated spatial strategy, as the current proposals for statements on infrastructure in the English Green Paper[15] are not, because the relationship between various modes of transport, communications and energy networks are crucial. It has to relate infrastructure to housing and employment goals because infrastructure decisions are key spatial drivers in stimulating economic development choices which effect a pull on employment and therefore (from the regional level downwards) on housing.[16]

Working within an evolving European framework and its principles of balanced polycentric development, this United Kingdom Spatial Planning Framework would create the groundwork for locational policy in regional spatial strategies, and thus help to manage the pull of London as a world-city and its impacts on the rest of the country.

European spatial policy. We must recognise that the major decisions that we need to take about key infrastructure underpinning locational policy have a European context. This is a major factor for both airport and port development. In particular it will be very difficult to develop a credible and deliverable policy on developing regional airports and reducing dependence on mega-hubs such as Heathrow without the context of a strong European policy supporting this. This calls for a commitment to develop the work begun in the European Spatial Development Perspective.

The social city. A stronger European and United Kingdom framework should manage but not curtail London's growth as a world- and Euro-city. London and the south east are very likely to continue to attract inward net migration on a very significant scale – currently 100,000 per annum[17] – and to see high levels of household formation. The demand for new housing in the south east will continue to be high, and this must involve a significant amount of greenfield land.

Given:

- the need for significant housing development over the next fifty years
- the need to optimise the relationship between housing provision and the transport infrastructure network
- the advantages of new towns in managing the provision of infrastructure, transit facilities and the relationship of people and cars
- the regional framework of transport city that we already have

We should start planning a new generation of new towns

we should start planning a new generation of new towns as part of the solution to this problem. We should accept the social city as a template, and seek to realise its full potential.

Territorial Impact Assessment. Territorial Impact Assessment (or Analysis) – TIA – is an approach developed in mainland Europe, notably Austria and Germany, to consider holistically the full spatial impacts of a proposed development or strategy, and how either the project or the spatial plan applying to the project, or both, should be developed to achieve optimum results.[18] It is a practical methodology for thinking through the issues that are linked in the idea of sustainable development, using both qualitative and quantitative assessments. It thus seeks to make a broader assessment than either a cost-benefit analysis or an environmental impact assessment, although both may be part of it.

TIA needs to be encouraged if not prescribed as a means to more constructive debate around how proposals for transport infrastructure and housing or employment development will relate within a spatial plan, at either regional or local level. Within the more flexible structures proposed within the English and Welsh Green Papers there should be the scope for a more flexible response in plan-making to the issues that are inevitably thrown up as projects develop from concept to firm proposal.

Time policies. Urban policy needs to be developed to reinforce the trend for private car users to respond to congestion and measures to restrain traffic by exercising more choice about when they make trips, and which trips they make.

Time policies[19] are a feature of urban policy in Italy, Germany, France and Spain. They seek to address such issues as queues and waiting, optimising work-life time allocations, maximising mobility, and achieving the 24 hour economy (where that is wanted). They can be expressed as 'territorial time plans' or as specific projects aimed, inter alia, at managing mobility. We need to research how time policies could be an effective component of integrated spatial strategies at local and possibly regional level.

We must continue to address the impact of the car on residential areas

Urban design: Home Zones and Placecheck. We must continue to address the impact of the car on residential areas.

In particular, we should reinforce the success of Home Zones – streets redesigned to give the living environment precedence over vehicle movements – as a means of promoting road safety, developing community capacity, improving the physical environment and reducing the dominance of the car.[20] Home Zones should have long-term funding and explicit policy support from central government.

Home Zones represent a specific technique. There is a more general need for communities to be able to analyse their environments, and transport impacts or failures are a significant part of that. Pilot projects by the Urban Design Alliance[21] have shown the value of the Placecheck programme as a community-based activity to articulate concerns and aspirations. Placecheck '…is a method of assessing the qualities of a place, showing what improvements are needed, and focusing people on working together to achieve them.'[22] Key topics within the methodology are quality of public realm and streets, 'connectedness' and use of transport.

The Green Papers propose Statements of Community Involvement as mechanisms for guaranteeing community participation: these need to encourage bottom-up input into planning, as well as responses to top-down proposals. Placecheck should be made integral to that, so the very local impacts of transport and the car will not be missed.

Recommendations

- We need a United Kingdom Spatial Planning Framework as the basis of locational policy and investment decisions for infrastructure, employment and housing
- We need to develop European spatial policy through a new version of the European Spatial Development Perspective to promote credible regional development policies that will mitigate the growing north-south imbalance in Britain
- We need to take a strategic view of housing pressures in the south east, and to consider a new 'social city' programme of new towns as part of a strategy to manage that demand in ways most transport-efficient
- We need to introduce Territorial Impact Assessment to improve the process of relating transport and infrastructure proposals to spatial strategies and vice versa
- We should research the possibilities of time policies as a means to optimise how regions and cities face transport capacity and transport constraint
- We should make Home Zones and Placecheck central features of our local planning efforts to ensure a comprehensive, people-centred response to the intrusion of the car.

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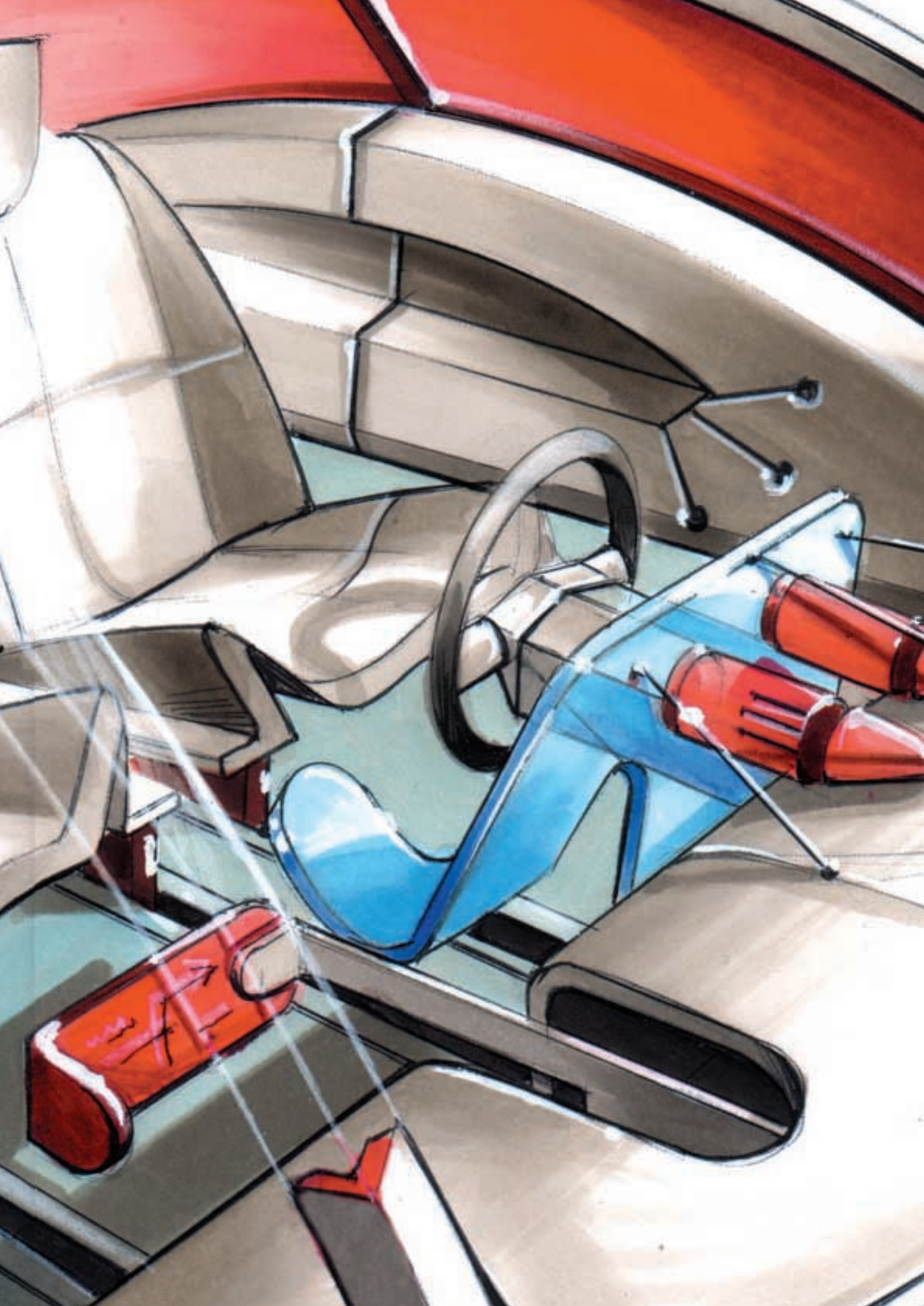
Motoring towards 2050
Part 2: Could things be different?



5 Vehicle technology

- Passenger vehicles will have a ‘one-box’ body large enough to seat four occupants in ‘mobile living room’ comfort with multi-media interface technology
- By 2050 the body of the car will be a high-strength cage covered by a minimum weight ‘skin’
- The hybrid car (diesel/electric, petrol/electric) will be an important step towards the zero emissions car
- Most authorities agree that by 2050 the fuel cell, using compressed hydrogen gas, will become the main form of propulsion
- The 2050 car will be quiet, safe, green and easy to drive
- In real terms the 2050 car will cost about the same as the 2000 car
- The 2050 car will be secure, with biometric recognition features and will be able to operate in some circumstances under ‘autopilot’

5 Vehicle technology

There is typically a degree of inherent tension between the desire of most people to travel and to consume more and to do so with higher degrees of comfort, convenience and service, and the need to contain the polluting effects of passenger and goods vehicles from emissions, noise, congestion and depletion of scarce resources. However it is also the case that motorists are increasingly conscious of their effects on the environment, and prefer not to be the cause of pollution. There is a positive synergy between motorists' interest in better fuel efficiency, reduced CO_2 emissions, and climate change issues.

Broad strategies

Although the transport sector is only a partial contributor to global warming – and the road transport sector is in turn only part of that – it is clearly important that its CO_2 emissions should be reduced. Broadly speaking, there are three ways (not mutually exclusive) in which this might be achieved:

- the first way is to encourage people to travel by public transport instead of by car. As discussed elsewhere, however much is invested in public transport in the future its effect on car use will be marginal
- the second way is to discourage people from travelling by making it more expensive (congestion charging) or more difficult (car restricting)
- the third way is to exploit technology to the utmost in order to reduce the CO_2 emissions from vehicles.

The basic assumption of this chapter is that this will be the route via which the sector's CO_2 emissions will mainly be reduced. Demonstrably high rates of technical progress have already been achieved. For example, European car manufacturers have undertaken to reduce their fleet-average CO_2 emissions from well over 200 grams/km in the mid-1990s to 140 grams/km by 2008. There is further discussion of 90 grams/km as a future step. The rate of technical progress is actually accelerating as the industry invests in computer-based techniques for design and development. Ten years ago, it took a European car manufacturer an average of 4 years to develop a major new model from scratch. Now it takes around 30 months. This implies that investment in technology could produce an ever-faster payoff in terms of CO_2 reduction, while investment in public transport infrastructure projects has become notoriously slow in both the planning and construction phases.

However, the argument does not revolve entirely around CO_2 emissions and pollution. This chapter also assumes that given free choice, the public will continue to favour the comfort and convenience of passenger car travel except where public transport offers clear advantages.

The task of the 2050 car

The main task of the car in 2050 will be the same as today – to take its occupants directly from A to B

The main task of the car in 2050 will be the same as today – to take its occupants directly from A to B as safely and comfortably as possible, with reasonable speed, minimum fuel consumption and minimum effect on the environment. In 2050 as today, the cost of the vehicle will have to be affordable. All the technical developments forecast in this chapter are likely, over such a timescale, to be achievable at a price per vehicle which will mean that in real terms, the '2050 car' will cost about the same as the 2000 car.

A secondary purpose – as today – will be enjoyment: of driving for the sake of driving, for the physical and emotional reactions it creates. For the purpose of this chapter, it is assumed that by 2050, cars which specifically serve this purpose will form a small and separate class whose technology is likely to be radically different – and almost certainly more 'old fashioned' – than that of cars performing their primary purpose. This technology will be referred to only in passing.

The greatest risk of technical prediction is this area is to extrapolate too far. The essential resemblance between a car of 1950 and one of 2000 is clear when they are closely examined. For a number of reasons it is likely that the 2050 car will differ more markedly from its 2000 counterpart, but to outside view it will look like (and will be) the outcome of evolution rather than revolution.

The unrelenting customer demand for innovation in quality, functionality, features and value will be mirrored by an almost frenzied commercial environment as giant global producers strive to remain competitive through an accelerating flow of distinct products using emerging technologies for vehicle design, production and performance. There will be more variety and choice, not less. Quality, luxury, performance, utility and style will be available to an enhanced degree in small as well as large cars. Congestion and parking limitations will encourage buyers into vehicles of smaller external size without the previous sacrifices. Within the time frame of this report, the car, the truck, the bus and the taxi will continue to form the basis of individual motorised mobility as they do today.

This analysis concentrates on six main areas of passenger car technology:

- body (basic design, materials, manufacture and safety)
- powertrain (engine and transmission)
- chassis (suspension, wheels and tyres, steering and braking)
- comfort (seating, heating, ventilation, air conditioning, noise levels, auxiliary power systems)
- driver systems (the man-machine interface)
- traffic systems (the machine-environment interface, otherwise 'telematics')
- environmental impact.

Body technology

The 1990s saw the first moves towards integration of several previously distinct types of car. By 2000, several examples had emerged of cars which combined particular aspects of the saloon car, the estate car, the 'people mover' Multi-Purpose Vehicle (MPV) and even the all-terrain Sports Utility Vehicle (SUV). However cautiously approached by the high volume manufacturers, the idea of the 'one-box' vehicle, with relatively high build by the standards of (say) the 1970s, offering maximum interior space for a given area of road occupied, with advantage taken of that space to create versatile interior layouts suitable for a number of purposes, has become well established. It has proved readily possible to adapt such vehicles to provide some measure of 'all surface' ability, with four-wheel drive (4WD), increased ground clearance and enhanced underside protection, and it is likely that a requirement for such adaptations will continue to exist to serve leisure activities of various kinds.

The car will be a 'mobile living room' for family and leisure use

It seems likely that by 2050 the 'mainstream' passenger vehicle will have a 'one-box' body large enough to seat four occupants in comfort, with reasonable luggage space. The interior will allow quick and easy conversion for a number of purposes, and especially for the stowing of various loads, and the creation of comfortable environments when the vehicle is stationary. There is already a strong design trend towards making the car a 'mobile living room' for family and leisure use, and this will be encouraged by technical developments including an increase in available on-board auxiliary power, and the emergence of the 'multimedia interface' allowing the vehicle to access a wide range of broadcast information for entertainment and other purposes, although there is concern at the possible distracting effects on the driver. Versatility of interior layout is likely to be enhanced by developments in powertrain technology which will enable powertrain components to be distributed around the body instead of concentrated in a large package, as in most current front-driven cars.

Despite these developments, it is unlikely that the average car will get any bigger. While a range of vehicle sizes will continue to exist, there seems good reason to suppose that in Europe and Japan at least, the dimensions of the 'median' car will be broadly as today – in other words, the C-segment dimensions of 400-420 centimetres overall length, and 170 centimetres overall width. The average height will increase, perhaps to 170 centimetres. The adoption of a relatively generous 'square' body cross-section will bring further engineering advantages in terms of making the structure stiff yet not unduly heavy. Aerodynamic drag will be contained through attention to detail but is unlikely to fall below 0.25 in practical vehicles. There may also be a trend towards some smaller city cars to ease pressure on parking.

Vehicle weight will be contained and perhaps somewhat reduced, although the success in reducing weight has always been counteracted by the weight of additional equipment for comfort and functionality. Thus the median 2050 vehicle is likely still to have a kerb weight of around 1,000kg, although structure and powertrain weight will account for a smaller proportion of this than in today's cars.

Structurally, cars are likely to evolve further in the next fifty years than they have in the last fifty (during which unitary sheet-steel construction has remained the norm). We are already beginning to see a separation of essential structural strength and stiffness, represented by a carefully designed frame and a limited number of fixed panels, from those parts of the body - especially the closures (doors, bonnet, rear hatch or boot lid) – whose main function is to protect against the elements. By 2050 this trend will have evolved into a high-strength 'cage' (plus a number of highly effective energy-absorbing members for impact protection) covered by a minimum-weight 'skin'. The cage may be of high-strength steel – the current material of choice – or aluminium; the skin will certainly be of a lighter and more corrosion resistant material than steel, either aluminium or advanced plastic. It is assumed that by 2050, the questions of high cost (for aluminium) and recycling (for plastic) will have been resolved, leaving the choice open to the body designer.

Today's platform – the basis for all modern body design and manufacture, each platform serving a family of related car models – will evolve into the basic cage. As today's motor industry reduces the number of platforms for the sake of economy of scale, a trend has already emerged towards each platform becoming 'flexible', with variation possible in wheelbase for example. This trend is likely to continue, until the surviving car manufacturers work with a maximum of three or four 'platform-cages' with significant variations. These units will be produced in largely automated factories. The lightweight external covering sections, together with most internal features, will be delivered as ready-to-fit modules. For external finishing, paint may give way to applied foil.

By 2050, the fuel cell will have become the power source for car propulsion

Powertrain (engine and transmission)

Most motor industry authorities now agree that by 2050, the fuel cell will have become the power source for car propulsion. Forecasts have put the crossover point at which the (rising) production of fuel cell power units will equal the (falling) number of internal combustion (IC) engines within a 'window' period around 2030.

By this time, IC engines will themselves offer effectively zero noxious emissions, but new generation diesels will continue to gain favour during the interim period due to their greater economy, lower CO_2 emissions and declining levels of pollution. There is a growing consensus that there will be increasing use of hybrid – IC and electric – vehicles, including diesel hybrids. Hybrid technology, together with lighter weight and other efficiency improvements, looks to be capable of achieving up to 50% fuel and emission saving compared with current vehicles, possibly better. Whilst the hybrids currently on the market are more complicated and heavier than conventional ICEs, basically having two engines, 'series' hybrids with an ICE generating the electricity, and an electric drive train, potentially with two or more wheel-mounted motors, would eliminate the conventional gearbox, clutch and transmission system. This means substantial reductions in weight, moving mechanical parts, maintenance and upkeep.

Hybrid vehicles will have the effect of bringing forward key vehicle technologies also relevant for and thus help the development of fuel cell vehicles. At the same time, advanced hybrids will also deliver a carbon well to wheel footprint which a fuel cell vehicle will not outclass, until renewable hydrogen is available.

An alternative argument exists – and has been most forcefully advanced by BMW – that the optimum future power unit will be an internal combustion engine operating on hydrogen and therefore emitting only water (as steam). This would certainly be a less disruptive strategy but account still needs to be taken of the inherently lower efficiency of the IC process compared with the (non-combustion) fuel cell – and of the inevitability of NOx formation within any internal combustion chamber, leading to the need for exhaust aftertreatment with its added burden on fuel efficiency.

The broad consensus within the industry already favours the hybrid and fuel cell approach. A small number of IC engines may remain in production as late as 2050 to power 'enthusiast' cars for pure driving enjoyment. While the IC/fuel cell changeover is taking place, the hybrid IC/electric car will be built in considerable numbers to fulfil a transitional role. Itself offering lower fuel consumption and exhaust emissions, the hybrid will also accustom significant numbers of drivers to the concepts of energy management and electric traction. By 2050, however, the hybrid powertrain will have been supplanted by the fuel cell, although there is a body of opinion which believes that many manufacturers will retain the hybrid well beyond that date.

Small but significant numbers of fuel cell vehicles (FCVs) are already operating in experimental fleets. Fuel cell costs continue to fall, and specific outputs to rise. By 2050, therefore, virtually all new cars except for 'fun' cars and some special-purpose vehicles will use a power source which produces essentially zero noxious emissions – and zero 'greenhouse' CO_2, if fuelled by renewably generated hydrogen – with no by-product other than water. The fuel cell also has the further advantage of inherently higher efficiency than an IC engine, because it does not suffer from the severe limitations of an engine which depends on a compression-expansion cycle (the Carnot cycle). On the basis of testing already carried out, Toyota has predicted a 'well to wheel' efficiency of over 50% for an FCV, compared with 14% for a gasoline IC engine, and 21% for a pure electric vehicle with battery recharge from the mains.

Fuel cells will certainly be able to produce the necessary power output. Even today, pilot-production cell stacks achieve up to 90kW, much the same output as is found in the more powerful of current C-segment cars. Consequently, the performance of the 2050 car is likely to match present levels, although initial and slow-speed acceleration will be improved because of the superior torque output of the electric motors through which the drive will be transmitted.

Cars powered by fuel cells will of necessity use electric traction. Indeed, a fuel cell 'engine', equivalent to today's internal combustion engine, will include an electric motor as well as the other auxiliary systems, such as an air compressor/expander, needed for the proper operation of the power-generating fuel cell stack.

There are three current engineering debates relating to the fuel cell. The first concerns the choice of fuel, either hydrogen or a 'reformed' liquid fuel. The second relates to the configuration of the fuel cell system, as a 'hybrid' system with energy storage, or with a directly reacting 'throttleable' fuel cell stack. The third concerns the choice of basic fuel cell technology, basically between the proton exchange membrane (PEM) and solid oxide (SOX) types.

Fuel cells are likely to be fuelled by hydrogen under pressure

By 2050 the first of these debates will certainly have been resolved. The use of liquid hydrocarbon fuels – methanol or modified gasoline – not only calls for complex fuel reforming units but implies wastage of the energy value of the fuel's carbon content, and generation of CO_2. The appeal of liquid fuels is that they are readily available and can be distributed (especially gasoline) through existing infrastructures; also that they offer long range between refuelling. Toyota recently mooted the idea of a specially synthesised hydrocarbon fuel – LHC (liquid hydrocarbon) which could be derived from a number of sources including coal. However, the appeal of pure hydrogen fuelling, including the simplification of the vehicle fuel cell power unit through deletion of the reformer, suggests that by 2050 a hydrogen distribution infrastructure will be in place. Present indications are that the gas will be carried in the vehicle in high-pressure cylinders, in sufficient quantity for adequate range. There remains the chance of a breakthrough in the area of special hydrogen-absorbing materials.

In the short term, plentiful supplies of hydrogen are available through the processing of natural gas, while in the longer term an infinite supply is available through electrolysis of water – assuming a sufficient supply of electric power. From the environmental point of view, hydrogen fuelling has the immense benefit of removing carbon altogether from the passenger car picture, so that eventually the only CO_2 emissions will be those (if any) which arise during hydrogen production. Eventually, with the exhaustion of natural gas stocks, that production will itself have to depend on renewable energy sources and thus become indefinitely sustainable.

The development of large-scale hydrogen production will certainly be encouraged by the eventual rising cost of 'fossil' hydrocarbon fuels. In absolute (constant energy-content) terms, hydrogen will always be more expensive to produce than today's fossil fuels, but it will claw back much of the difference through the far higher efficiency of tomorrow's cars, enabling the fuel cost per journey to be maintained close to present levels.

It is possible that by 2050, neither of the other two debates will have been resolved, and that vehicles will be offered with a choice of system configurations and fuel cell types, since each has a particular combination of advantages and drawbacks.

The ability of the fuel cell to run cleanly and virtually silently at all times will mean that substantial power is always available, even when the car is parked.

Transmission

The electric power output of series hybrid and fuel cell technology promises simpler transmission, since electric motors can deliver high torque from zero speed, and no clutch is needed. Existing FCVs all use fixed-ratio reduction drives with no gearchanging, and achieve good acceleration performance. However, it is possible that in the search for the highest possible efficiency, the FCVs of 2050 will use some form of variable gearing, perhaps a simple continuously variable transmission (CVT). Like existing electric cars, FCVs will offer easy 'two pedal' control.

Chassis (suspension, wheels and tyres, steering and braking)

The 2050 car will undoubtedly still run on four pneumatic tyres. The universal fitting of tyre pressure monitoring and warning systems and 'run flat' operation at a limited speed will be the norm.

Apart from offering lower rolling resistance and less noise, 2050 tyres will also embody sensors capable of directly measuring the loads and forces passing through each wheel.

The 2050 car will have a suspension system evolved from, today's best systems. Suspension linkage design will continue to improve with the assistance of computer-aided design (CAD). In most cars, springs will still be mechanical, and damping hydraulic. By 2050, improved ride comfort and noise will have been achieved through more sophisticated suspension mounting and the general adoption of variable-rate damping. Automatic body attitude levelling, working on the rear suspension, will have become the norm to allow increased load capacity, better aerodynamics and unaffected headlamp aim.

The 2050 car will use electronics to control braking and suspension

The 2050 car will have electric power steering (EPS) as standard, together with 'steer by wire' (SBW) with electrical rather than mechanical signalling from the driver's input to the steering motor. Apart from being more efficient than its hydraulic equivalent, with a useful saving in energy consumption, EPS will contribute to the gradual elimination of hydraulic systems from most cars (except from the self-contained suspension dampers), overcoming an acknowledged source of unreliability. SBW will enable designers to 'tune' steering characteristics to suit particular cars, and it will be possible to limit driver steering inputs which would otherwise result in loss of control.

In parallel with SBW, the 2050 car will also use brake-by-wire (BBW) in which signals from the driver's input will be taken electrically to a central control unit which will then apply each brake electrically as required. This will allow braking effort to be applied to the wheels in proportion to the load acting on each, permitting safe braking while cornering. The 2050 car will be capable of stopping more quickly than today's cars. Continental has already demonstrated technology which reduces the minimum stopping distance of a car from 100km/hour from 36 to 30 metres, and such technologies will certainly be commonplace by 2050.

In most cases, the 2050 car will use regenerative braking for moderate deceleration, reclaiming kinetic energy electrically and storing it for re-use. This will improve overall energy consumption and reduce the load on the mechanical brakes, which will be used only for hard and emergency braking.

Comfort and safety (seating, heating, ventilation, air conditioning, noise levels, auxiliary power systems, safety systems)

By 2050, the ergonomics of car seats will have improved. Seats (and driving controls) will continue to offer multiple adjustments, but power operation of these adjustments (except for seat height) will remain a minority feature because of cost and weight considerations.

The maintenance of a comfortable environment will become vital. Air conditioning will be standard in the 2050 car, and will make use both of advanced sensors and new technologies of 'energy management' to maintain suitable conditions with minimum energy consumption. Since the fuel cell can continue operation with little noise and zero environmental effect when the car is stationary, it will be possible to maintain air conditioning for as long as fuel supply permits.

The 2050 car will be extremely quiet. The main noise generator will be the tyres. Cabin interior noise will be further reduced through the refinement of current sound-deadening and insulation technologies.

A notable feature of the 2050 car will be its ability to provide large amounts of auxiliary power for various purposes, both on the move and when stationary. Even in the immediate future, engineers anticipate up to 5kW of auxiliary electrical power – against a maximum of around 1.5kW currently – being generated in 36-volt (replacing 12-volt) systems. This power will partly be needed to facilitate technologies such as BBW and SBW, but it will also serve 'comfort and convenience' features within and around the car. With the adoption of the fuel cell, the only limit on 'auxiliary' power will be the output of the cell stack itself. The need to distribute electric power in greater quantity will lead to the complete separation of power distribution and low-current electrical control circuits, a process which has already begun and which will be complete long before 2050.

The 2050 car will have electronic sensors to reduce accidents using automatic braking and steering

Passive safety systems are already divided into three main areas: structural crashworthiness and absorption of impact energy, the restraint of vehicle occupants to prevent them coming into contact with the vehicle interior during an impact, and the use of external sensors to anticipate and mitigate the effects of an impact. The basic technology of the first area is well established, although scope remains for further advances over the next decades for improved materials and better designs using advanced development tools such as computer modelling and virtual display and testing protocols. The introduction of entry level 'advanced' restraint systems will increase over the coming years, and these will slowly make way for better and more sophisticated systems. These highly engineered systems will incorporate a range of sensors able to identify the physical characteristics of each separate occupant and 'trim' the operation of restraint systems to suit. Ultimately these systems will link with external sensors to predict the impact severity and provide a further level of fine tuning to reduce injuries further. The final area is largely notional in 2000 but will be fully effective in 2050. It is already being suggested that advanced sensors could create a 'cocoon' around the car, a volume within which any object whose relative movement threatens impact would be detected before the impact occurred. This would enable the passive restraint systems to be configured, and even partly activated, in anticipation of the impact, to provide enhanced protection. In a car equipped with BBW and SBW, such a detection system could even intervene to reduce, or if possible to avoid the impact by automatic braking and steering action. The 2050 car will be equipped with such provision as standard.

Driver systems (the man-machine interface, vehicle security

By 2050, the major controls for the driver will have been simplified and the minor controls reduced in number.

The simplest major control would be a 'joystick' with which sideways movement would steer the car, forward movement would accelerate it and rearward movement would control braking. With the advent of the 'by wire' technology, such an arrangement becomes possible and has indeed been demonstrated. Similar functions have been devised in vehicles adapted for driving by the disabled.

A joystick control of this kind would bring substantial benefits. If fitted centrally, it could be used by either front seat occupant; there would be no differentiation between left-hand and right-hand drive cars; both front seat occupants would be protected by similar full-size airbags, and the threat of steering wheel related or driver leg injury through pedal movement and deformation in a frontal impact would be eliminated. However, generations of drivers have been trained in exercising control through a steering wheel and pedals, and although joystick experiments continue, it is more likely that the 2050 car could retain these features. If necessary, the range of steering wheel movement be reduced to less than a turn between locks, and the pedals will be connected only to electrical movement sensors (and will thus need to be provided with 'artificial feel').

Minor controls in the 2050 car will be minimised through automation

Minor controls in the 2050 car will be minimised through automation. In the last two or three years there has been a rapid move towards the automatic switching of headlamps according to ambient light level, and of rain detection leading to the automatic operation of windscreen wipers. Where minor controls are still needed, as for example, in selecting audio channels, they may be voice-activated. Overrides to automated systems will be provided, either via a touch-screen or a plug-in minicomputer.

The driver will be presented with minimum information necessary to operate the vehicle in safety. Instead of needing to scan a series of reading instruments, the driver will be warned of any anomaly which occurs, leaving only speed as a legally required display, and fuel contents (or range remaining) as a second figure.

A primary information system for the 2050 driver will be a location and navigation display, using positioning information from the Global Positioning System (GPS), GALILEO, or their successor services. It is clear that the 2050 car will be aware of its geographic position at all times, and able to transmit that position in the event of an emergency or for other purposes.

Aids to safe driving in the 2050 car will include advanced headlamp systems capable of changing their beam pattern according to vehicle speed, steering movement and even the local environment – city, suburb or open country – using information from the GPS positioning system. Despite the interest created by some prototypes, it is far less likely that the car will embody systems enabling the driver to 'see through' fog or spray.

On the vehicle security front, access to the 2050 car will be 'keyless', using automatic biometric recognition. The car will be able to memorise details of as many authorised users as desired, and will set up its driving, comfort and entertainment systems according to their individually memorised requirements.

Servicing of the 2050 car is likely to be minimal, and 'on condition' rather than at regular intervals, with service points able to interrogate 'their' cars and check on their condition via communications links.

Traffic systems (the machine-environment interface, otherwise 'telematics')

Apart from the move to fuel cell power, the most significant innovation in the 2050 car by comparison with its 2000 equivalent will be the provision of a wide range of systems which enable the vehicle to communicate with its environment and other vehicles in its immediate vicinity, and both send and receive location-specific information (e.g. signals about conditions ahead, particularly congestion). This communications ability has already become generically known as 'telematics' but it embraces two distinct functions. One is to help smooth and direct traffic flows and to improve safety. The other is to enable vehicle occupants to access a wide range of information sources for the purposes of work or entertainment, via what is becoming known as the 'multimedia interface'.

The 2050 car will be able automatically to locate itself, using GPS

The ability of the 2050 car automatically to locate itself, using GPS will form the cornerstone both of the navigation function and of the car's participation in traffic-smoothing telematics. Navigation may be conducted using either an on-board system (with map-memory and computer in the car) or via an external link with a central facility holding detailed geography and a fully updated traffic situation, sending information to be displayed in the car as necessary. Drivers will notify the in-vehicle systems of their intended destinations; the systems will receive updated traffic information to warn if the planned route is becoming congested and suggest alternatives and the likely impact on journey times.

Apart from its value to individual drivers, GPS based location and guidance will be of immense value to fleet and business operators, allowing vehicle operations to be planned and conducted more efficiently.

The aspect of telematics in most immediate prospect is that of automatic safety following distance and lane keeping. A few production systems already offer the first facility (Autonomous Intelligent Cruise Control), and the second has been often demonstrated, though always in motorway driving conditions and with a minimum safe speed. Ultimately, the two systems will – despite current legally based misgivings – function essentially as an 'autopilot', at first on motorways and ultimately, with improved sensors and control software, on a wide variety of roads. Such abilities, combined with rapid forewarning of any emergency situation ahead, should supersede the attraction of the 'see through fog' systems previously referred to. Flexibility of vehicle control will become easier once BBW and SBW have been widely adopted, allowing the principle to be extended to stop-start driving in city traffic. By 2050 such systems will have been widely adopted, leading to the prospect of automatic 'convoy driving' on motorways, perhaps on separate carriageways dedicated to this purpose. A half-way house is already being recognised in which the driver is vigorously alerted to excessive lateral movements or intended manoeuvres that would risk crossing the tracks of other vehicles.

At a more advanced level, which should be well established by 2050, the car will be able to communicate with short-range roadside beacons which will be aware of both local and medium-distance traffic conditions. The in-vehicle equipment will match this information to its knowledge of the car's intended route, and advise (or even directly control) the correct speed at which to proceed in order to avoid conflicts – in essence, for example, to ensure every traffic light turns green as it is approached, without needing to stop. This will reduce energy consumption without affecting average journey times – in fact they will almost certainly be improved.

The multimedia interface will also offer driver assistance in the form of advice concerning parking spaces, service stations, hotels and public buildings and access to reservations and payment services. Many service providers are eager to see cars turning into 'mobile internet terminals'. The car buyer of 2050 may still see built-in internet/ethernet access and information handling ability as an option rather than an essential, even if it means the ability to keep young passengers quiet with the help of interactive video channels. An alternative solution is that the driver or passenger takes to the vehicle a Personal Digital Assistant (PDA) which is placed in a special housing so that all personal and trip-related details are immediately available to the vehicle's systems.

Environmental impact

Since 1990 there has been a distinct trend for properly maintained cars to last longer. However, an over-long life for the average car will delay the achievement of even better standards – lower exhaust emissions and noise, better safety, superior comfort – by succeeding models. It is already the case that air quality could be quickly improved by removing from the roads the 10% of gross polluters, and in future it may be that the momentum of rising standards can only be maintained by a more coherent strategy for encouraging the scrapping of older cars.

The passenger car sector will move towards 'sustainability' in its use of materials

Scrapping will naturally imply recycling to the greatest possible extent. Cars of the latest generation are designed not only to achieve at least 90% recycling, but also to reduce the cost of the process through ease of disassembly and the identification of materials, especially plastics. These trends will inevitably continue, with a trend towards 100% recycling other than for residual fluids and accumulated debris. To this extent, the passenger car sector will move towards 'sustainability' in its use of materials.

2050: the overall transport context

Cars of the kind outlined in this chapter are likely to fulfil a very similar role to their present counterparts. They will do so with far less expenditure of energy, far less effect on the environment, and in far greater safety. The extent to which they are allowed to travel anywhere on the road system at any time will depend on policies adopted in relation to traffic congestion in general and to city centre access in particular.

It should also be clear that the same advances in power train technology which have been described in relation to passenger cars also have a huge impact on trucks, buses and taxis in relation to emissions, CO_2, noise and sustainability. Indeed, it is in the context of commercial vehicles that the fuel cell may convert sooner and faster. Depot based fleets can have access to centralised hydrogen storage and the short term weight penalty may not be so critical for certain types of operation. We feel confident that the commercial vehicle industry will maintain the pace of technological change it has demonstrated in the last few years.

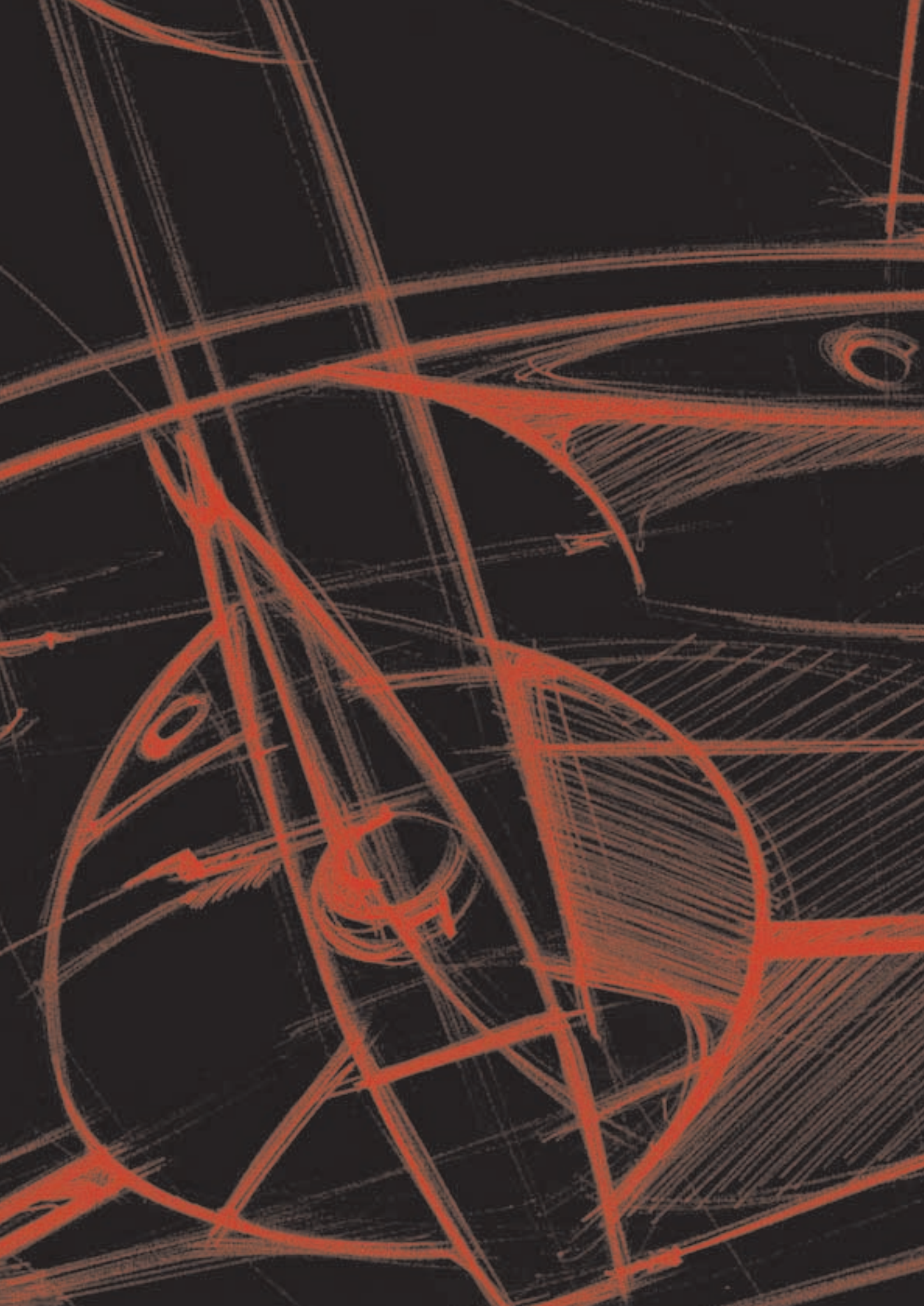
In summary

The 2050 car will look relatively familiar from outside. The average European car of 2050 will be much the same size as today's C-segment model, and will weigh about the same. It will however embody many features which make it more versatile.

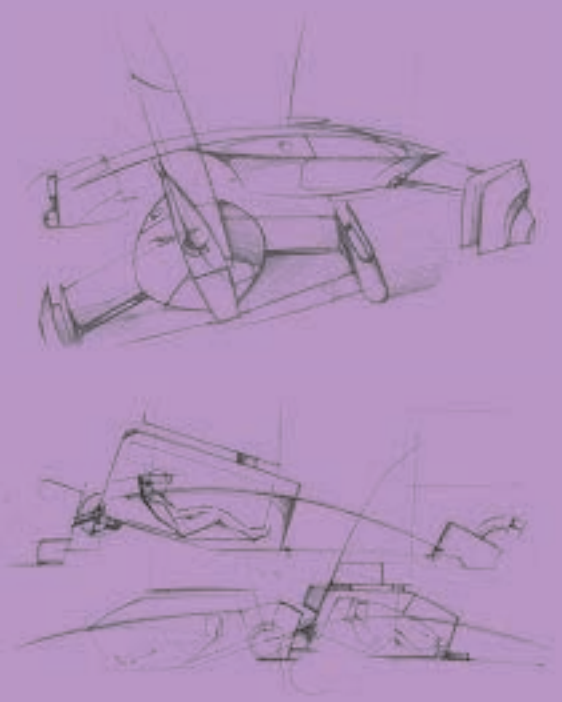
The 2050 car will have a fuel cell powertrain, almost certainly (barring a genuine breakthrough in storage technology) using compressed hydrogen gas as its fuel. Thus its on-road emissions will be zero, except for a small amount of water vapour. Its energy consumption will be substantially less than half that of current cars, and it will be exceptionally quiet, which will highlight the need to extend the adoption of 'quiet' road surfaces to urban areas.

The 2050 car will be extremely easy and safe to drive. Its braking and steering operation will be electric. In some circumstances, cars will be driven 'on autopilot'.

Journeys in the 2050 car will be made significantly easier and safer through the widespread use of telematics to aid navigation, smooth traffic flow and provide the driver with other information, and passengers with entertainment or a working environment.



6 Freight



- Trucks will remain the dominant means of moving goods because of their flexibility and cost effectiveness
- Rail freight will benefit from the railways investment programme but will compete with passenger movements for investment and track access
- Improvements in freight efficiency over the past 30 years are now coming to an end so more trucks will be required in the future but telematics can make them more effective
- Improvements in vehicle technology will make trucks quieter, safer and more fuel efficient
- Restricting or encouraging trucks to night time use of the motorways could help congestion

6 Freight

Freight patterns

Freight transport is a major underpinning of today's society – it brings raw materials to factories and finished goods to shops and homes. It is therefore a derived demand. Freight mobility must be maintained and enhanced if society is to grow and prosper. In Britain, the vast majority of freight (81%) is moved by road, with a typical distance being just under 100 km; rail journeys are about twice as long. The tonnage moved by road in 2000 is similar to that in the 1960s but the average distance moved has more than doubled over that period and therefore tonne kilometres have also doubled. This reflects the way supply chains have become more sophisticated with companies optimising their factory locations, introducing regional warehouses and the different style of shopping. Other modes of freight transport primarily serve simpler supply chains, such as pipelines moving petroleum products or rail moving coal from mine to power station (48% of rail freight tonnes). The nature of freight has also changed with more food and manufactured goods being imported, largely by road, concentrated through a relatively small number of ports.

Figure 6.1
Freight movements in Great Britain[1]

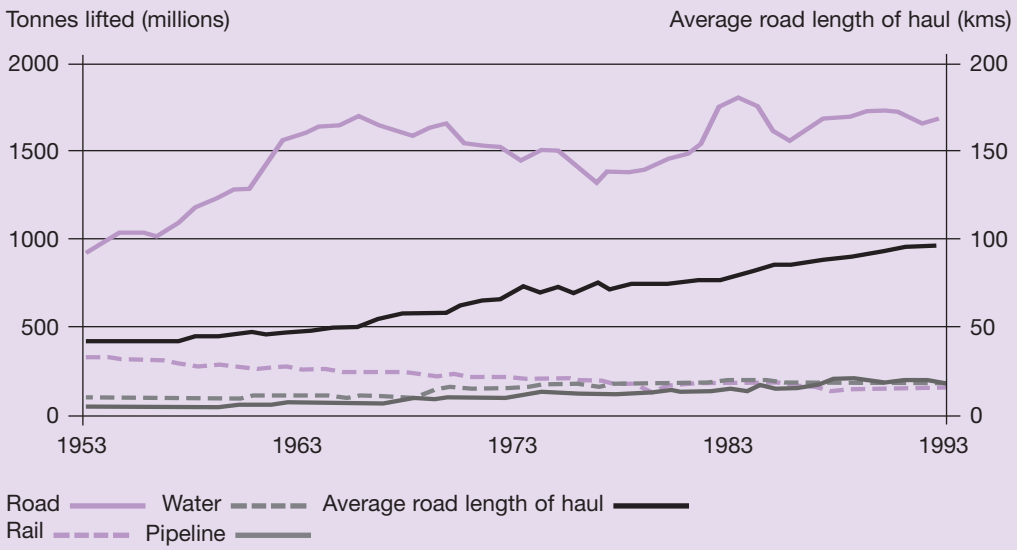


Table 6.2
Domestic freight transport 2000, Great Britain

	Million tonnes lifted	Billion tonne-kms	Average km
Road	1689	158	94
Rail	95	18	190
Water/pipeline	296*	71*	264
Total	**2080**	**247**	119
*of which petroleum products	227	60	
Road share	81%	64%	
Road share excl water/pipeline	95%	90%	

Table 6.3
Road traffic 2000, Great Britain
billion vehicle-kms

	All*	Cars	Buses	Light vans	Good vehicles	Goods vehicles %
Motorways and major roads	299	236	3	32	25	9
Minor roads	169	143	2	18	4	2
All roads	468	379	5	50	29	6

**All includes motorcycles (4 bn) but excludes cycles (4 bn).*

For finished goods, transport represents a very small proportion of the consumer price, with other logistic costs such as warehousing being three or four times that of the transport component.

Goods vehicles (over 3.5t gross vehicle weight) account for 9% of traffic on major roads and 2% on minor roads, although their larger size and lower speed compared with cars means that their impact on traffic flows are perhaps two to three times as great.

The size and productivity of trucks has increased enormously

Light vans account for 9% of vehicles on the road and 11% of total traffic, although this has been rising faster than car travel (26% increase over the past 10 years compared with 12% for cars). The behaviour and characteristics of vans are more similar to cars than goods vehicles. The average distances they travel are short and the average loads they carry are low. Many are employed in cities and towns and because they carry the goods or tools of the trade the drivers are unlikely to switch to rail or bus. They are not considered further in this chapter.

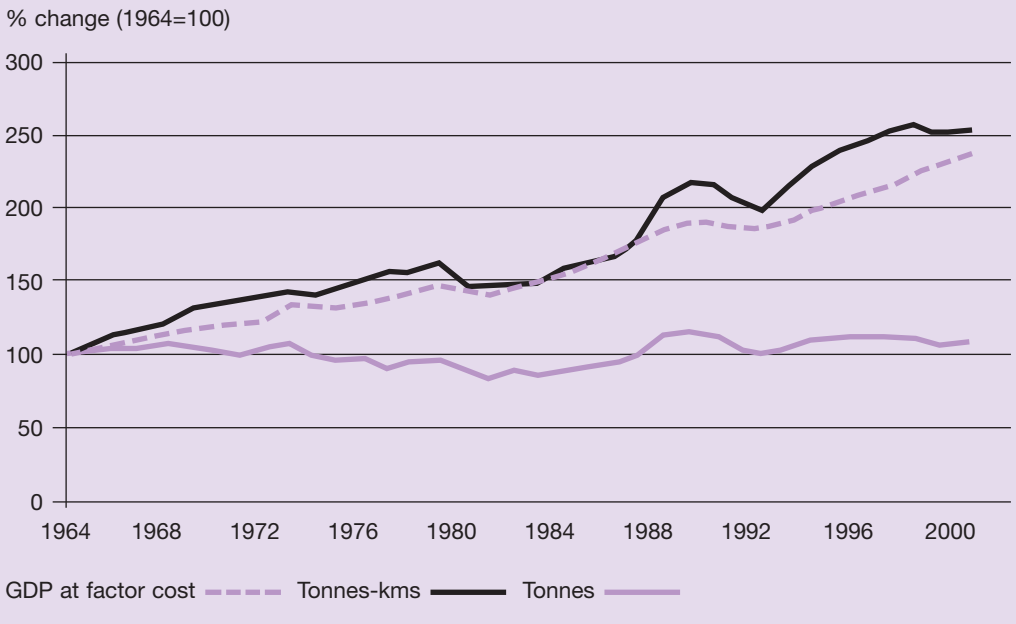
The number of heavy goods vehicles (418,000) is slightly smaller in 2000 than in 1950 (439,000). However their size and productivity have increased enormously so that by 2000 on average they were travelling nearly three times the distance and carrying twice the tonnage.

Over the same period the volume of freight carried by rail fell by nearly a third from 37 billion tonne-kms in 1953 to its lowest point of 13 billion tonne-kms in 1994 and 1995, though since then it has risen by 40% to 18 billion tonne-kms in 2000. However as a proportion of road and rail freight traffic together, rail traffic has fallen from 63% in 1953 to 11% in 2000.

Rail freight

The Strategic Rail Authority estimates that increasing road congestion and the implementation of the European directive on working hours would improve the competitiveness of rail freight. This would result in a 10% increase in demand without further policy measures or major investment; but with such investment they believe the market share for rail freight can increase from 7% of tonne kms (including water and pipeline) to 10% or 32 billion tonne-kms and 9 billion tonnes-km more than would be gained by growth in line with GDP growth. It must be noted that this ambitious target is only equivalent to five or six years' growth in road freight. £4 billion of the £29 billion investment in enhancing rail capacity would also provide extra capacity for rail freight while £300 million is identified as being specifically for freight small schemes.[2] If that growth were realised, the proportion of freight traffic carried by rail would be similar to that in Belgium, Italy, Norway and the Netherlands, though still only half that in France and Germany, levels which might be reached if similar rail freight traffic growth persisted for another 10 to 15 years.[3]

Figure 6.4
Freight and the economy



Although the Strategic Railway Authority believes a greater increase in demand could be accommodated after modernisation of the West Coast main line and other investment, there is concern in the rail industry that it could not be carried without a disproportionately adverse effect on passenger traffic. Therefore the SRA's freight forecasts may be optimistic.

However, there are other reasons for thinking the 10 Year Plan forecast ambitious:

- two thirds of existing rail freight is bulk commodities like coal, metals, construction, oil and petrol, which have been in decline over the 1990s.
- coal, a quarter of all tonne kilometres, will decline further, although the SRA's plans show growth from bulk traffic.[4] However, much bulk traffic is in trainloads over short distances, often not sharing track with passenger trains and not up against capacity constraints.
- the planned increase is concentrated on construction and general freight traffic, but rail is really only competitive over long distances ideally from siding to siding. General traffic does not meet these criteria and the benefits of rail are rapidly eroded by journeys to and from rail depots.

Therefore taking into account only the above demand factors, it is uncertain the expected growth will materialise:

- the cost of carrying freight by rail is high and will become higher. Railtrack has argued that rail freight does not meet the marginal costs of carrying freight by rail.[5] Freight trains are often particularly heavy and impose severe wear and tear costs. Nevertheless rail access charges have been reduced to short run marginal costs yet the Freight Transport Association maintains that rail freight is too expensive for it to increase its market share significantly.[6]
- increases in freight traffic disproportionately reduce the capacity for carrying passengers. Freight trains are usually slower than passenger trains and often cross over passenger routes to a great extent, thus reducing the system's ability to carry passenger traffic. Since freight traffic by rail has less effect on road congestion than switching passenger traffic, there is a strong social, congestion and environmental case for increasing the effective carrying capacity of the railways to carry passengers by replacing freight trains by passenger trains on most routes.
- the reduction of road congestion likely to be achieved by shifting freight to rail is small and will be achieved much less cost-effectively. The average subsidy cost of saving a vehicle hour of road congestion is £25 a year (compared with £11 for passenger rail and £5 for direct investment in road improvement).[7]
- apart from reducing road congestion the case for subsidising freight largely depends on the adverse environmental impacts of HGVs by comparison with rail. If this were to change as trucks become more fuel efficient and cleaner, the case for rail freight subsidy would be much reduced.

The prospect for significant switch from road freight to rail is unlikely

It has also been pointed[8] out that the shipping industry is already moving towards 9'6" (3.1m) containers as standard, which cannot be carried efficiently by rail under the existing load gauge. The investment to modify bridges and tunnels, particularly for rail lines to ports, to enable these containers to be carried is significant but is generally viewed as a worthwhile investment. More and more freight is of a low density requiring large vehicles to be carried efficiently and the industry would ideally like the rail loading gauge to allow 3m high pallets to be carried, which would require an even larger gauge than for 3.1m containers.

Overall, the prospect for significant switch from road freight to rail is therefore unlikely and rail should focus on moving bulk products where it has a significant advantage.

Growth in road freight transport

Whereas for car traffic, we have a theory of ownership growth which leads us to predict a long term decline in the ratio of car traffic to income, for commercial vehicle traffic, no such theory can be adduced. In practice, the picture for heavy goods vehicles has been to show growth rates below that of GDP except in the period 1987-1993, and this decline in intensity is forecast to continue, with latent HGV traffic growing about 0.2 per cent less than GDP growth.

In the case of light goods vehicles growth has significantly exceeded GDP growth from 1987 to 1994 and is forecast to continue proportional to GDP growth to 2025. This forecast implies that HGV traffic is expected to grow at roughly the same rates as cars, with light commercials growing rather faster.

Forecasting freight traffic, and modelling the influence of transport prices and service quality on it, is a very difficult art, since additional goods vehicle kms on the road are the outcome of changes in one or more of six critical factors which affect the way in which a given outpost of goods is translated into vehicle kms of freight traffic (REDEFINE):[9]

- value density: the ratio of product value to weight, which affects the translation of GDP into a physical value of goods
- modal split: affected by relative price and service quality factors
- handling factors: the number of times a tonne of goods is handled from its initial primary product state to finished goods for consumption
- average length of haul: affected both by the spatial pattern of production and consumption, local v regional v national v global, and by logistics patterns through interdependence with the handling factors
- load factor: affected by the relative bulk of loads and size of vehicles as well as scheduling efficiency
- empty running: affected by vehicle specialisation and the feasibility and value of balancing traffics.

The evidence collected by the REDEFINE composition demonstrates that even though tonne-kms and vehicle-kms grew by not dissimilar amounts during the period 1985-95 in four major European countries, the assignment of that growth to the six critical factors differed enormously from country to country.

Freight companies are likely to be more sensitive than individuals to the costs of congestion

This suggests that forecasting what may happen in future even to latent demand is far from straightforward and may depend significantly on industrial organisation influences well outside the transport sector. Nor are the elasticities of freight traffic to transport policy factors such as price and travel time at all well understood, although freight companies are likely to be more sensitive than individuals to the costs of congestion and would be major beneficiaries of road user charging that reduced congestion.

Because of the difficulty of freight forecasting and partly because car traffic is five-sixths of the total, the country-wide traffic forecasts used to measure congestion are based on passenger traffic rather than on freight traffic. However it should be noted that the nature of freight movements such that a higher proportion of them are on motorways and key corridors to and from ports so that their impact on an individual road or bottleneck may be much greater and need to be evaluated on a local basis.

The 10 Year Plan forecasts an 18% increase in HGV traffic without measures to divert freight traffic to rail, discussed in the last section, but only 9% with such measures. This compares with around 15% in the past decade.

Professor Alan McKinnon from the Logistics Research Centre at Heriot-Watt University argues that a relatively small proportion of the freight traffic growth in the past can be attributed to increases in the physical mass of products produced and consumed.[10] McKinnon argues that it is likely that most of the spatial processes that have been driving road freight traffic growth will have run their course within the next 25 years. Any increase in the demand for freight movement is likely to be offset by improved vehicle loading as over the last 15 years the proportion of lorry-kms run empty has been declining steadily. As traffic congestion increases and the real cost of operating goods vehicles increases companies will come under increased pressure to achieve higher levels of vehicle fill. The development of on-line freight exchanges, permitting internet trading of vehicle capacity, will also help companies to raise their load factors and cut empty running.

Table 6.5

Determinants of changes in road freight traffic 1985-1995

	UK %	France %	Germany %	Netherlands %
Value density	-32	23	16	3
Weight transported by road	1	14	82	21
Handling factor	18	2	29	3
Road tonnes lifted	18	16	30	25
Average length of haul	24	36	17	29
Vehicle carrying capacity	9	15	n/a	24
Load factor	-4	7	n/a	3
Empty running	15	21	n/a	7
Vehicle-km	37	28	n/a	30
Overall effect tonne-km	**46**	**57**	**52**	**60**

Overall, McKinnon expects the rate of road traffic growth to slacken over the next 20-30 years. It should eventually fall below the rate of GDP growth offering the decoupling that transport planners and policy makers have been seeking.

The 1997 NERA report for the RAC Foundation[11] suggests that traffic levels could be reduced by 19% against forecast traffic growth as a result of technological developments in the HGV fleet. Long before 2050 the Freight Transport Association and McKinnon predict that satellite tracking and mobile data and voice communication will be standard on all commercial vehicles. Vehicle routing is likely to be rigidly controlled and closely related to the prevailing levels of tolls on particular road links at particular times of day or night. In effect, such tolling could help to increase night time deliveries through the price mechanism. Other developments such as quieter trucks running on 'silent' fuels would also help to facilitate change. These sorts of technological development which will occur over the next 20 years, combined with the effect of time related road charging, would not only reduce the rate of road traffic freight growth but would also divert traffic to less congested roads and quieter times of the day or night.

Night time goods deliveries could reduce day time congestion

Night time movement of freight

Neil Pickles of the Audnel Group, an international haulier and logistics expert, has suggested that the problem of congestion could be solved by most long distance freight being restricted to night time working when the roads are relatively quiet.[12] He argues that deliveries without exception should take place between 2130 and 0700 hrs, vehicles having to be out of the town and city limits by 0730. HGVs over 24 tons should be banned during daylight hours from motorways except when delivering to venues adjacent to a motorway. Lorries are already banned on continental motorways from Friday evening to Sunday evening, though the exemption of perishable goods, medical provisions and 'verifiable urgent goods' led to abuse which undermined the system. Such a scheme in Britain would require a support system of lorry parks and transhipment as well as police enforcement. However, other experts have pointed out that night time deliveries do happen now because of the need to avoid congestion and maintain 24 hour supplies but it is not practical to extend this to all deliveries and a total day time ban would impose unrealistic extra costs on the distribution industry. It would not be practical for many small businesses who do not have the capacity to deal with night time logistics and would cause major labour problems under the night time working provisions of the Working Time Directive.

Such a scheme could reduce traffic during daylight hours on the busiest parts of the strategic road network bearing in mind each HGV causes three times the congestion caused by a car because of its size and speed. Such a drastic solution might be reserved for emergencies - if no more attractive strategy is found for meeting rising congestion. In any case its effects would need to be analysed. Because large trucks would be used less intensively, unit transport and no doubt other costs would rise. Part of the proceeds of congestion charges at other times of the day could be used to subsidise and incentivise hauliers moving at night.

Home shopping

The other area of technological development which is likely to occur over the next 20 - 30 years and have a major impact on congestion is the transfer of retail sales from conventional to on-line shopping and consequent growth in home deliveries. The delivery of groceries to the home could significantly reduce shopping-related traffic levels so long as the virtual shoppers do not substitute other car trips for the trip to the supermarket. A recent literature search by DTRL found little consensus on the effect of home shopping. However, research in Finland suggests that home shopping has the potential to cut traffic levels by a substantial proportion, particularly if deliveries can be made 'unattended' to a reception box at the home. By 2050, McKinnon estimates that most homes are likely to have reception boxes and much of the supply of goods to the home controlled by a system of automatic replenishment. This should allow for the scheduling of deliveries during off-peak periods and will be reflected in improved vehicle loading.

The contribution of road freight transport to congestion should be significantly reduced

The combination of increased use of technology, satellite charging systems, increased efficiency, home shopping, and more night deliveries should mean that the contribution of road freight transport to congestion is significantly reduced over the next twenty years.[13]

Conclusions

- For the foreseeable future, road is going to be the dominant means of moving goods around the country because of the flexibility and cost effectiveness of modern trucks.
- Rail freight will benefit from the planned major programme of investment in the railways but will compete with passenger freight for investment and track access. Although it may show significant growth, this will not have a major impact on road freight.
- Although freight movements are not expected to rise as rapidly as in the past 30 years, many of the efficiency improvements over the past 30 years are now coming to a point where more trucks will be required to move the increasing bulk of goods required as we move lighter finished goods rather than heavier raw materials. On the other hand, telematics can help to ensure that assets are used more effectively.
- However improvements in vehicle technology will make trucks quieter, safer and more fuel efficient.
- Restricting or encouraging trucks to night time use of the motorways could have a significant effect on road congestion if other aspects of the delivery system, such as the willingness of shops and factories to accept night time deliveries, could be adapted accordingly.

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1 All the freight statistics in this chapter are from Transport Statistics Great Britain 2001 unless otherwise noted.

2 Strategic Rail Authority. Various schemes are listed in SRA:FS.

3 ECMT Much higher rail proportions are found in mountainous countries like Austria, Sweden and Switzerland and in eastern European countries with low car ownership; but they are irrelevant to British conditions.

4 SRA:FS,8

5 Railtrack, *Freight Capacity Charges: Railtrack's Proposals , The Periodic Review of Railtrack's Access Charges: Review of Freight Charging Policy-Provisional Conclusions: Railtrack's Response*, May 2001.

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9 REDEFINE, Relationship between demand for freight transport and industrial effects Netherlands Economic Institute,1997

10 A McKinnon, Logistics Research Centre, Heriot-Watt University in response to questions from the RAC Foundation 2001

11 *Motors and Modems* A Report for the RAC prepared by the National Economic Research Associates 1997

12 N. Pickles,*Proposal for Implementing a Radical Response to the On-going and Ever-increasing Traffic Chaos in the World in General, the UK in Particular*, 4 July 2001

13 Geoff Dosseter, Freight Transport Association, in response to questions from the RAC Foundation 2001

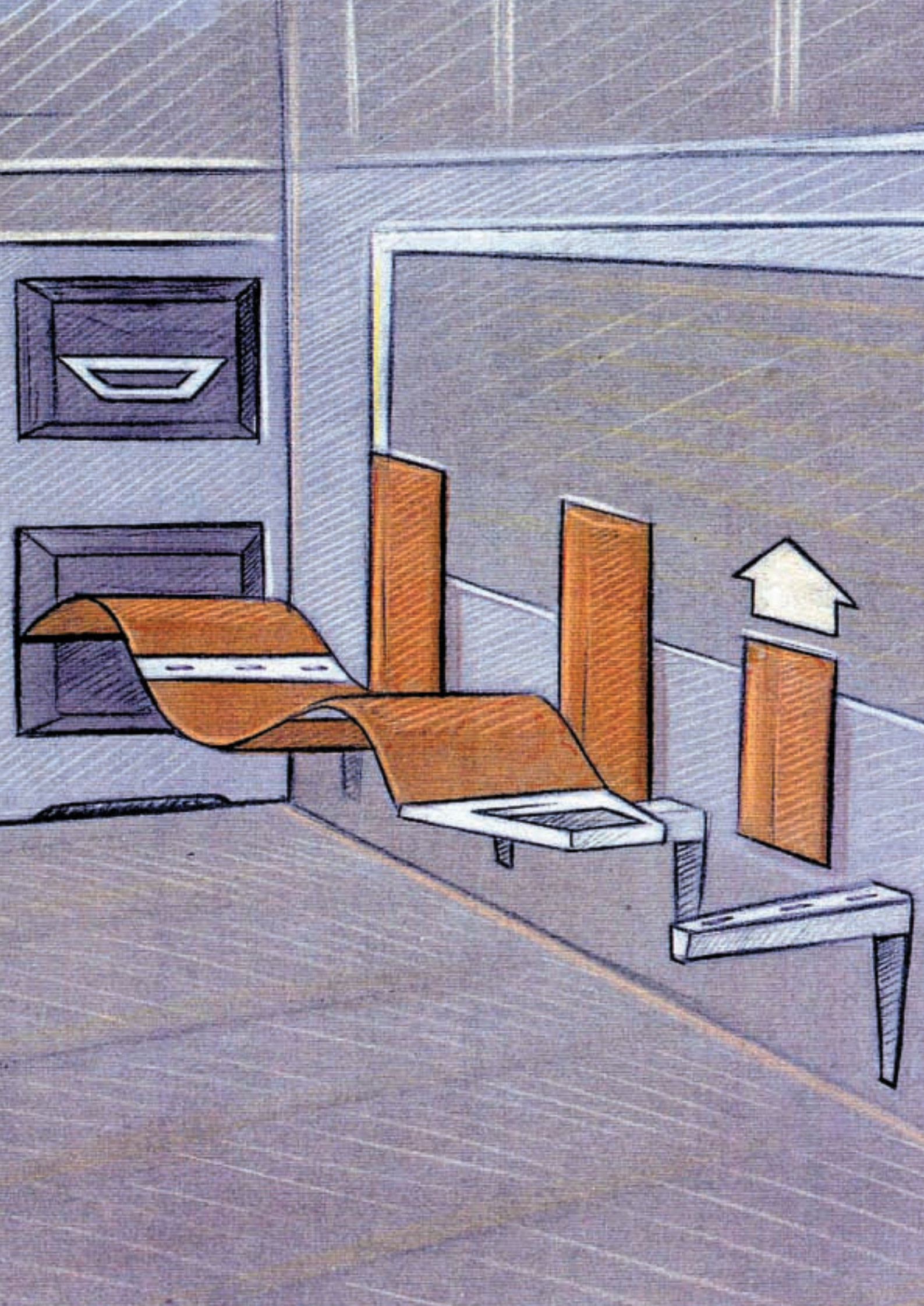
14 *Mobility 2001* World Business Council for Sustainable Development.

How much energy does it take to get cereal to the breakfast table[14]

To move 1 tonne of grain from the farm to the factory and then to the supermarket by rail and road takes an estimated 7 litres of fuel. 1 tonne of grain makes 2,000 boxes of cereal. The cost of fuel per box is therefore inconsequential.

The cereal will be bought from the supermarket by many individuals who will drive to the shop to buy it, together with other items of shopping. Making assumptions about the length of the journey and the proportion that the cereal might represent of the total amount of shopping, it is estimated that 35 litres of fuel would be consumed in taking home the 2,000 packets of cereal, five times as much as in the production process.

In this example the grain travels less than 20 km in trucks and 300km in cars. The forces which created supermarkets have created an extremely efficient system of moving the goods to the stores but at the same time required an increase in personal travel to buy the goods.



7 Reducing car dependence

- An important distinction is between imposed restrictions on car use which forcibly limit personal mobility and affect economic growth, and voluntary measures which people will adopt because they are persuaded they are desirable
- Imposed restrictions should only be taken where there are strong environmental or other social grounds for doing so
- Reducing car dependency by providing better information on alternatives is the best voluntary measure
- Measures such as car sharing or pooling are usually most successful when organised from the workplace
- Telecommunications have the potential to reduce traffic growth by encouraging tele-shopping, tele-working and teleconferencing
- Only 5% of traffic would be cut by these means as some journeys saved may be substituted by others

7 Reducing car dependence

Reducing car dependence

In this chapter we examine the prospects for reducing the demand for travel by voluntary measures. How could we change circumstances so as to promote, encourage and achieve a less road transport oriented pattern of life? Alternatively, what are the prospects for making better use of the transport infrastructure through greater flexibility of use and peak spreading? The road system is only used to a small proportion of its total rated capacity; the problem is that the unused capacity is in the wrong place or at the wrong time.

There are many different possibilities for reducing transport dependence, which overlap and criss-cross one another. We group them into three:

- measures which persuade people to travel less, or differently
- new technology creating opportunities for people to substitute other goods for travel
- intermediate modes of transport and forms of city planning which offer people a new less transport-intensive possibility.

Persuasive measures

Many actual or potential car owners lack information about public transport. So a first step is to provide much better access to information about networks, services, timetables and fares. Another element involves persuading people and households to reflect on their demands on the transport system, and the costs associated, to increase awareness, help people to replan by linking trips, changing destinations, switching modes and so on. Travel blending and travel awareness campaigns come into this category. An example from Perth (WA) has recently been in the news[1] and a case study from Germany is shown below.

Another approach is to operate from the 'destination' end of the problem. Examples here are workplace travel plans and school travel plans which aim to encourage use of dedicated buses, car pooling, reform of parking policy, incentives or help with financing of season tickets, and measure to support cycling and walking. Workplace travel plans (WTP) and school travel plans (STP) have been the subject of various reviews Rye[2] [3], SDG[4], Halcrow[5]. Key findings are:

- around 7% of businesses have a travel plan in place
- early estimates of reductions in car based travel to work are 7-12%
- UK companies appear to be less altruistic on this issue than those in the Netherlands
- they may be influenced by consideration of relationships with the local authority, planning permissions and/or by internal problems such as parking availability on site.

Combined measures to change mobility related attitudes and travel behaviour

Background

During 1994-96, a pilot project in Baden-Wurttemberg investigated the impact of persuasive measures to increase the consciousness of mobility. The basis for the 'conscious mobility' concept is the idea that traditional traffic management instruments alone are not sufficient and should be accompanied by informational, educational and motivational measures.

The pilot project 'Mobile Schopfheim' was carried out in the small city region of Shopfheim (population 25,000). Based on a panel of 1095 people, changes in mobility related attitudes as well as in travel behaviour were quantified.

Measures

Some 80 different detailed measures can be summarised under the following headings:

- conscious use of alternatives to cars (public transport, walking and cycling)
- intelligent choice of activities and destinations
- conscious 'intelligent' driving style
- alternative models of car ownership and use (car sharing, car pooling).

Impacts

Two key results were:

- no significant effect on aggregate trip-making. Person kms for local trips increased by 5% on weekdays and 8% on Sundays with no change on Saturdays. Long distance trips were unlikely to be influenced by this set of measures.
- significant changes in mode split of trips as follows:

Table 7.1

Change in travel patterns

	Mode split (weekdays)		
	1994 %	1996 %	Change in %
Car driver	44	41	-3
Car passenger	7	6	-1
Bicycle	20	26	+6
Public transport	6	7	+1
Walking	23	20	-3

Rather similar results were obtained for weekends.

Conclusion

The measures were targeted more at changing modal split than at destination choice. Relative to what might have happened, this package of measures is assessed to have reduced short distance (<50km) car trip – making by around 300kms/yr, around 4% of short distance kms and so, 2% of all car kms. The measures are considered to be transferable to small towns and cities but not to rural areas.

A survey by Rye found that the measures judged to be most acceptable and effective were:

- organised car-sharing/minibus pooling (18%)
- facilitate to encourage cycling (34%)
- services on site to reduce need to travel (40%)

The percentages refer to the proportions of those surveyed who had implemented this measure.

The Halcrow report for DTLR concluded that:

Travel plans could reduce car travel by 2 billion car kilometres per annum

'A more realistic estimate of the impact of future travel plans would be to assume that an additional 15% of companies implement plans that reduce commuting and business travel by 10% on average. This would result in a reduction in car travel of about 2 billion car kilometres per annum' (Halcrow 2002).

Clearly there are wide margins of doubt in such calculations, but this suggests that a serious concerted effort with workplace travel plans might be able to reduce total car travel by say half of one per cent. Note that this assumes that the car stops at home and is not used for another purpose. The implications for relief of peak–period congestion will be more significant than the global calculation implies.

Turning to school transport plans, it appears that there are opportunities here, but there are also significant barriers. About one fifth of cars on the roads in urban areas at 8.50 am are engaged in taking children to school, and the difference between congestion levels in and out of school terms is a commonly observed phenomenon. According to Halcrow (2002), 507 STPs were being implemented in 1999, but there is little data as yet on their effectiveness in reducing car kilometres. Halcrow note that even taking the most optimistic of the very limited results, the reduction in kilometres on education and education-escort purpose might be of the order of 150 kms per person per year. However, given the range of figures quoted by different authorities and the wide range of circumstances (rural etc.) a comprehensive STP initiative might reduce total car kilometres by half of one per cent. As with WTPs the effect on peak period congestion would be more significant than the global number implies.

7 Reducing car dependence

New technology

Another cluster of possibilities for reducing travel demand is created by new technology. The principal opportunities here are:

- teleworking – substituting remote working for office working on a proportion of working days and/or for a proportion of workers
- teleconferencing – substituting longer distance journeys by 'virtual' meetings
- teleshopping – substituting supermarket shopping by home delivery and/or substituting shop purchases by internet purchases.

A major study - Motors and Modems[6] - of the first two of these areas was carried out for the RAC Foundation by NERA. The report showed that within 5 years (by 2005) in the UK:

- teleworking could cut commuter traffic by up to 10%
- video and audio conferencing could cut business travel by up to 3%
- use of Information technology could cut lorry journeys by up to 16%
- teleshopping could reduce car trips to the shops by 5%.

The report then went on to show that within 10 years the equivalent figures could be up to:

- 15% reduction in commuter traffic
- 5% reduction in business travel
- 18% reduction on Heavy Goods Vehicle (HGV) journeys
- 10% reduction in car shopping.

Teleworking can reduce congestion, improve efficiency and quality of life

Teleworking

More firms could actively embrace the benefits of teleworking. TRL research[7] lists quality of life and reduced commuting time for workers plus employee flexibility and office space savings for employers, as the main reasons for the uptake of teleworking activity. Both motivational and supervisory problems can occur, but there is no reason why these problems cannot be overcome by careful selection of the type of work suitable for teleworking, and the full support of employers for staff working from home or remote locations. There are still psychological barriers to cross for some employers who view 'working from home' as an excuse to dodge work. BT is now actively encouraging the substitution of technology for transport[8]. A survey of 43 BT home workers estimated that more than 5,000 kilometres per employee were saved each year.

The Executive Director of the UK Telework Association, Alan Denbigh[9], feels that the UK is missing out on the environmental and efficiency benefits of the new working practices because employees and employers have not been given the proper incentives to change the way they work.

Teleworking can:

- reduce traffic congestion
- improve efficiency and quality of life
- increase workforce catchments areas
- improve rural employment
- promote all-inclusive employment.

However, little has been done to help UK businesses and their employees to adopt more flexible ways of working. In contrast, in the United States, legislation has been introduced. This legislation recognises that teleworking requires a third of the energy consumed in commuting to work and that it can boost employee productivity by up to 20%. As a result, the US Office of Personnel Management has produced a sample agreement for agencies who employ teleworkers. This lays out guidance for both supervisor and employee on such matters as pay, hours of work and holidays, working conditions, equipment etc. In addition, other legislation is making its way through the Senate, which will allow a credit against income tax for expenses incurred in teleworking. Whilst the Teleworking Association recognises that introducing legislation will not change things overnight, the US Government is showing commitment to teleworking and that a similar approach in the UK would be beneficial.

In August 2001, the Trades Union Congress (TUC) published 'Telework – the New Industrial Revolution?'[10] This studied teleworking, the number and profiles of teleworkers, recent trends, how teleworking in the UK compared with other economies, the US picture, flexibility and the worklife balance and the future of teleworking. The report expressed concern over the basic rights and protection of homeworkers, but agreed that, despite some claims on the benefits of teleworking being exaggerated, it was undeniable that teleworking will grow over the next decade and that it is transforming the traditional image of homeworking and of self-employment.

A recent article in Local Transport Today[11] points out that there has been little research into the impact of teleworking in the UK since 'Motors & Modems' and therefore it is difficult to judge the accuracy of any predictions made. However, a number of pilot schemes have been set up in the Yorkshire and Humberside region which resulted in a total reduction in travel time of 50,000 kms for the 23 volunteers involved in the scheme. All but one volunteer reported an increase in productivity and a reduction in stress. There was, apparently, some resentment from colleagues who could not work from home and who felt that they were taking the front line pressure.

The article also highlights the entrepreneurial teleworking scheme organised by a local businessman in Crickhowell, Powys. The 39 house development was incorporated into the existing village and consists of a mix of cottages and work studios linked to a fibre-optic network. It is designed for people who prefer to work from home, with workspaces separate from the houses. The village also has a purpose built telecentre with internet links and a teleconferencing centre. The development has attracted a range of retired and self-employed people who regard this way of working as very much the way of the future.

There is concern that those who are not self-employed may choose to live further from their place of work and therefore have further to commute when they do have to visit their office – however, it is possible that the motorway office areas being piloted by Moto (Welcome Break) can help to alleviate the mileage travelled. One is already open at Heston Services and others are planned.

The review for Government of this and other international studies by Halcrow (2002) concluded as follows:

Teleworking could reduce car travel by 6 billion vehicle kilometres per year

'A reasonable estimate is that there will be another 10% of car commuting workers involved in some form of teleworking by 2015. Of these 2% could be full-time, 4% half-time and the balance quarter time. As it is the longer journeys that are likely to be affected disproportionately [their] road traffic would be 6% lower than otherwise. This would result in there being about 100 kms less per year per person, or 6 billion vehicle kilometres per year'.

Teleconferencing

Companies are already benefiting from the increased use of video conferencing. Lex Vehicle Leasing estimates that the company has saved approximately 350,000 miles of staff journeys due to extensive use of video conferencing between their offices in Manchester and Marlow. BT also uses video conferencing within certain parts of the company, particularly to avoid overseas travel. However, as video conferencing has specific technological requirements and requires more fixed facilities than audio conferencing, it is not as universally used as voice conferencing. Audio conferencing has now taken off and is widely used. The ability to interact with colleagues in another location and send files through e-mail can now be regarded as a key factor in extending the parameters of the traditional office. Hotels as well as motorway service areas can provide touchdown type offices with workstations to avoid city centre travel.

The Motors & Modems report suggests that all types of telecoms developments could reduce growth in traffic congestion by about 45%. The benefits to the economy in the year 2005 are about £1.3 billion, whilst in 2010, they rise to about £1.9 billion.

Congestion charging may encourage teleworking. Such charges might be the very incentives needed for a vital re-think over UK company working hours, and encourage companies to provide green travel plans, more flexi-time and teleworking at least one or two days per week.

Teleshopping

Many people use cars as load carriers so more extensive home delivery services could reduce the need for cars. By 2005 it is predicted that 5-7% of grocery sales will be made on-line and this could reach 15% by 2010. Currently, most sales transactions consist of books, CDs, computers and tickets. These products share the characteristic that the decision to purchase does not depend on seeing the product.

Road congestion will only be reduced if:

- the mileage saved by individuals (including any new mileage which is created) is more than the mileage run by the home delivery services
- information from the internet does not stimulate extra journeys.

Thus the Halcrow (2002) conclusion is that 'the evidence on the effects of internet shopping is rather mixed … On balance it would seem risky to allow for a substantial reduction in overall road traffic from increased Internet shopping, although car shopping traffic could reduce (with implications for parking requirements)'.

Teleworking could reduce car traffic and take pressure off urban parking

However, Banister[12] suggests that technological innovation must be introduced as part of a set of measures. For example, home deliveries from supermarkets could be combined with public transport services to the supermarkets (as no shopping then has to be a carried), free internet access to the shop (so that there is no need to travel) and parking charges at the supermarket (to discourage car trips). Perhaps in rural areas, where public transport is often poor, the supermarkets themselves might offer a mini-bus service to customers who still wish to shop personally. With this, as with other measures, there has to be a level of commitment from the public.

Intermediate modes

Once individuals own a car, its use will usually be perceived as cheaper, faster and more convenient than public transport except in city centres. It is argued that the fixed costs of car ownership may distort choice of mode. There may be a case for intermediate modes, which offer much lower fixed costs together with higher marginal costs of use than conventional car ownership.

Car sharing schemes could reduce car kilometres by around 1-2%

Halcrow (2002) report that there are two hundred or so car clubs in Europe, operating several thousand vehicles, mainly in Germany and Switzerland. Under this arrangement, club members have access to communal cars on a pay as you go basis. The social car schemes box describes some of the results found by the SPRITE EU Consortium.[13] Clearly this type of scheme will not be suitable for all. Many people will have the wrong pattern of car use, or live too far from a depot. But such schemes could be attractive as an alternative to second car ownership, or in future to permit households to own an 'urban' car and rent a more powerful or spacious car for longer distance use. The case studies suggest a potential to reduce car kilometres by around 1-2%.

Possibilities exist to combine such car clubs with complementary measures such as car free or car-capped housing. Car-free housing is a concept which allows the construction of residential units without providing land for parking. Such development has taken place in Amsterdam, Bremen, Edinburgh, Freiberg, Hamburg and Vienna.

For example in Camden (SPRITE, 2002[13]), planning permissions to build housing without parking places may be granted with removal of the rights of the resident to park in the nearby streets within Controlled Parking Zones. The scheme is voluntary for developers – they face a choice between developing at higher density without parking or at lower density with parking. There is also a complementary policy of car-capped housing. This policy allows the provision of off-street parking spaces for development in a CPZ but bans the resident from buying on-street permits in addition. In Camden, 79 such schemes for a total of 770 new sites have been approved since 1996.

This type of policy is relevant in city redevelopment areas, but has limited application elsewhere. The impact on congestion and pollution is likely to be small. However, probably the greatest impact is in matching the supply of urban residential units to the demand for urban lifestyle which is not car dependent.

Social car schemes

Background

These schemes involve the joint use of cars which are provided at car hire depots near to housing estates or public transport modes. The users conclude a long term contract with the car sharing organisation under which the cars are made available for temporary use. The modern form of car sharing development newly simultaneously in Zurich and Berlin in the late 1980s.

Measure

In Switzerland, the service is marketed as a Club called 'Mobility Car Sharing Switzerland'. A relatively high density of car sharing depots is provided – 600 locations in Switzerland. The car sharing company cooperates with Zurich public transport, Europcar (car hire) and Swiss Federal Railways and is responsible for reservations and coordination. There is value added in the sense that a throughout product is offered.

Impact

The Swiss experience suggests that around 8.5% of the population are 'in scope' to use this system. The remainder are screened out as either not driving licence holders, 'too remote', or too intense or complex use of car. The German study concluded on similar lines that around 3% of the population, or 6% of licence holders were 'in scope'.

This service is attractive to two groups of people:

- those who own one or more cars but are willing to 'trade down' from car ownership to participation in a social car scheme
- those who do not own a car but do hold a driving licence and wish to make occasional use of a car.

Clearly the effect on transport intensity depends on the balance between these two groups.

In the German survey, the following effects were found (shown in Table 7.2)

Table 7.2

Effect of car sharing

	Kms without car sharing	Kms with car sharing	% change
All customers	7000	4050	-42
Car owners			-60 (-6270kms)
Non-car owners			+42 (+1160kms)
Potential at German level (billion)	17.1	9.9	
Total car kms (billion)	525	517	-1.3

Conclusion

Such a scheme, marketed nationwide, has the potential to reduce car kms by around 1-2%. It also extends the benefits of car use to people who prefer not to own a car.

Conclusions

Many of the measures discussed in this section are well worth encouraging as an element in transport policy. The attraction of these measures is that they are in general voluntary rather than coercive, and that they offer people the prospect of a lifestyle which can be less dependent on the car.

Our view, however, is that even a really serious push on all of the measures discussed here would be unlikely to solve the problem of traffic growth. Although there is disagreement in particular on the prospects for telecommuting, we think that the total impact of all these measures, after allowing for behavioural responses and second round effects might be to reduce total vehicle kilometres by of the order of 5% – say equivalent to three or four years growth. This is a prize which is well worth winning. The effects on peak hour urban congestion, and on the flexibility to avoid congestion could be positive. But we do not expect these measures on their own to solve the problems of traffic growth in general, and specifically the problem of growth on the inter-urban network.

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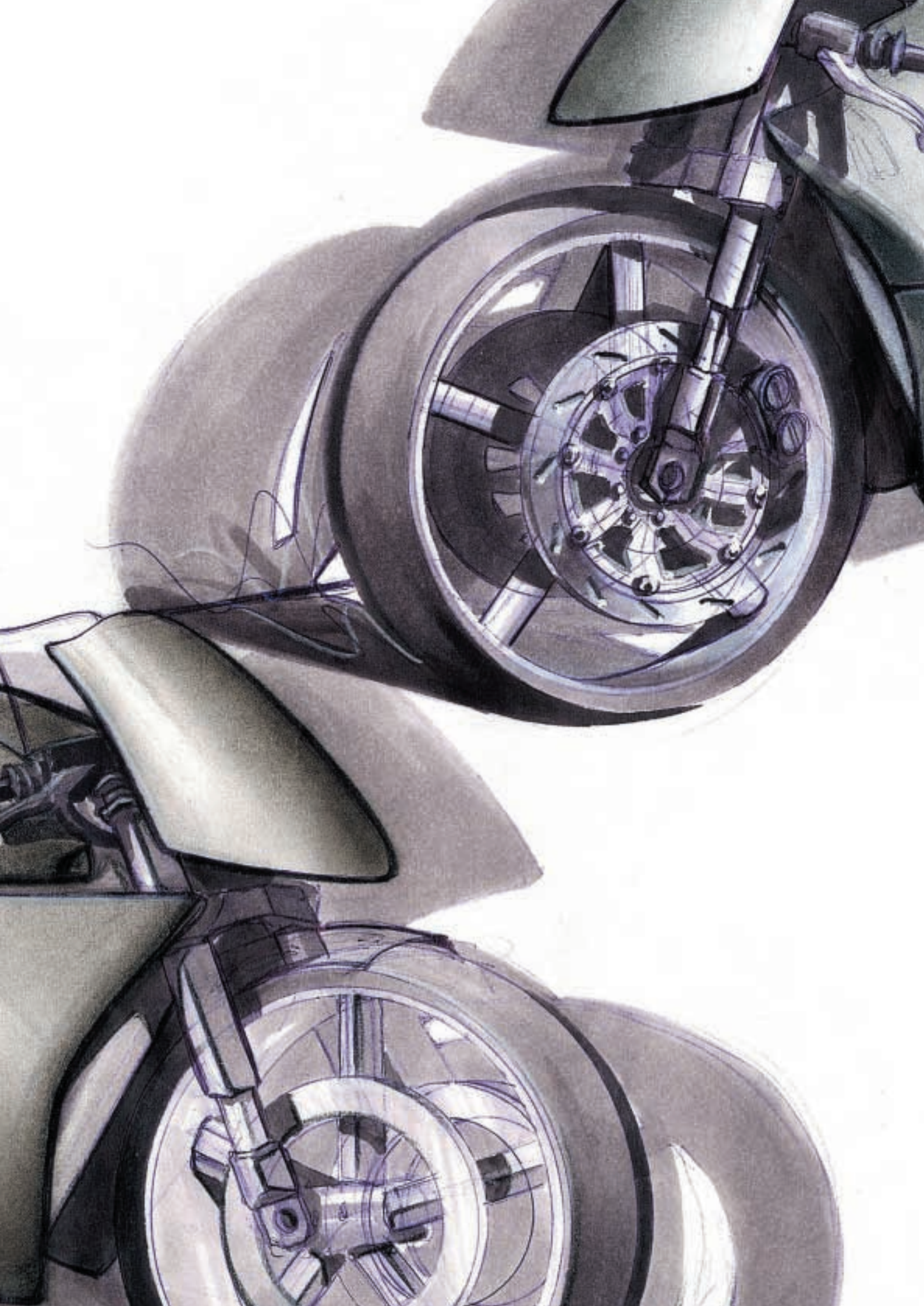
7 Reducing car dependence



8 Walking, cycling and motorcycling

- Walking and cycling have declined over the last fifty years as car traffic has grown
- Walking and cycling are sustainable forms of transport which can produce health benefits
- Motorcycles use less road space or parking spaces and are good at beating congestion
- Many short journeys currently undertaken by car would be quicker on foot or by cycle
- More needs to be done to improve the poor safety records of pedestrians, cyclists and motorcyclists and hence encourage their use

8 Walking, cycling and motorcycling

Walking has been one of the most healthy and stress-free forms of exercise since man could stand upright. 'Walking is the nearest activity to perfect exercise'[1]. Bicycling appeared in the early 19th century as velocipedes or 'bone-shakers' because of the uncomfortable ride. Motorcycling, an Edwardian innovation was cheaper than the automobile, which in the early 20th century, was beyond the means of all but the rich.

Walking and cycling are: sustainable forms of transport, pollution free, congestion beaters in towns and cities, cheap (and in the case of walking, free) and provide proven health benefits.

Motorcycling is: a congestion beater, economical on road space and parking space, uses less fuel than a car and pollutes less.

Statistics

Walking and cycling have declined. Why is debated. Is it because walkers and cyclists feel threatened by adverse traffic and environmental conditions? Or are they often too slow? Or are we just lazier? Also more choice in how people can travel may affect their decisions.

In 1949 people in Britain cycled 23.6 billion kms on public roads, or 37% of all road traffic, falling to a low of 3.7 billion kms in 1973; but rising in 2000 to just over 4 billion kms, less than one fifth of the amount in 1949 and only 1% of all road traffic. Cycling seems most popular in July and August, with about one third more cycling than in an average month.[2]

Kilometres walked fell by 21% between 1975 and 2000. People on average walked 411 kms a year in 1974 but only 299 kms in 2000.

Motorcycle travel fell from 5.6 billion vehicle kms in 1990 to 4.4 billion vehicle kms in 2000[3]. However, the number of motorcycles in use in 2000 was 825,000 and the number of motorcycles, mopeds and scooters registered for the first time has jumped from 94,400 in 1990 to 182,900 in 2000, an almost 50% increase in motorised two-wheelers – probably because many people see them as 'jam busters' in congested urban environments.[4]

Walking and cycling continue to decline but motorcycling is increasing again

The BMA[5] has drawn attention to the increase in car use for very short journeys that began in the late 1970s, increasing from 4 to 7% of journeys of less than half a mile; and from 15% to 24% of journeys between half a mile and one mile. Those of less than one mile have increased from 6.4% to 8.2% of all car journeys. Of time spent travelling, approximately 80% is in a car The Bristol Local Transport Plan states, 'Within Bristol 13,000 car journeys to work are less than 2km in length'.[6] Hampshire County Council's objective[7] is to help implement the National Cycling Strategy[8] in the county by a quadrupling of cycle trips by 2012 from 1996 levels. The RAC Foundation states in its 1995 report[9] that many short car journeys would be quicker on foot or by cycle.

Why do people not walk and cycle as much as in the 1950s?

Safety and environmental concerns

Walking, especially in urban areas, could be much more pleasant. The Civic Trust suggests[10] that all too often a walk through the streets of a British town is blighted by noise, conflict with vehicles and other pedestrians, a variety of obstacles and, especially at night, the fear of attack. Personal security is raised as an issue in the DETR report on 'Personal Security Issues in Pedestrian Journeys'.[11]

One of the biggest social changes in childhood in the last 20-30 years has been the unwillingness of most parents to allow their children to walk or cycle to school for fear of accidents or assaults. In Britain, 72% of seven year olds walked to school alone in 1970, compared with only 7% in 1990. The school run now accounts for up to 20% of morning traffic.[12] According to the BMA[13] many parents now feel obliged to constrain the leisure activities of their children to safeguard them from road traffic. The long-term effects on the mental and physical health of children are a concern to the BMA.[14]

In the past, planners have given priority to traffic movement over other activities. For decades local and central government have under-invested in the public environment so that in many communities local streets have become dirty, dangerous and unattractive places. Local services have declined. Traffic has increased. Litter, vandalism, graffiti and crime scar public streets and open spaces in many parts of the country, despite polling evidence that the public attach great importance to clean, safe streets.[15] In addition, country roads have become busier with vehicle traffic. The Countryside Commission maintains[16] that risks to pedestrians, cyclists and horse riders from traffic have reduced people's choice of ways to move around the countryside safely and reliably.

Passenger death rates for travel by car, bicycle, on foot and motorcycle are all higher than death rates on public transport

Fear of accidents undoubtedly influences the thinking that keeps people from walking or cycling on busy thoroughfares.[17] But the accident rate amongst pedestrians and cyclists in the UK is twice that in the Netherlands or Sweden where cycle routes and tracks are not 'add-ons', but entirely separate from the road network.[18] Passenger death rates for travel by car, bicycle, on foot and motorcycle are all higher than death rates on public transport; but death rates for motorcycling, cycling and walking are much higher – that for motorcycling being over 46 times greater – than that for the car.[19]

Moreover motorcycling death rates have increased in recent years. Motorcyclists are more vulnerable to adverse road conditions like ice, potholes, diesel spillage and other road users. (About 60% of Powered Two Wheeler (PTW) accidents are caused by other road users). Factors that might beat higher casualty and injury rates are:

- better training and testing for both riders and car, lorry and bus drivers
- 'Think Bike' campaigns for better pedestrian awareness
- improved engineering construction and design of motorcycles
- improved road design, including advance stop lines and use of bus lanes
- reduced VAT on motorcycle safety clothing.

Changing shopping patterns

The growth of out of town and edge of town food and retail stores has encouraged increased car use for domestic shopping. Many people do not have time to shop every day. Their choice of where to shop is more restricted since local shops have closed. A week's food shopping for four people (the average family) cannot be carried home on foot or on the bus. Shopping has also become a leisure activity. Bulk goods are ordered and delivered, but people still go to the retail outlets to look and choose. They almost invariably travel by car, because public transport does not always serve these outlets and also the huge convenience of door to door travel.

Changes in shopping habits are not the only ones to have encouraged greater car use. Don Mathews of Sustrans points[20] to the extra motor traffic generated by the run-down of urban and rural shops, post offices, libraries, hospitals and other health facilities, banks, pubs and magistrates courts. Transport 2000 estimates that three banks closing in East Sussex generated an extra million miles of traffic. As these trends are repeated all over the UK, both traffic congestion and the problems of social exclusion will increase.

Changing patterns of commuting

Many people now live further from their workplace. Many who can afford it move towards or into the country where they feel that there is 'a better quality of life'. Thus commuting distances become longer. 'Walking in Great Britain'[21] shows a trend towards longer trips since 1986. Though gradual and small on average, it may deter people from walking or cycling. Meyer Hillman[22] suggests that to walk and cycle more we must sharply lower the geographical catchments within which we conduct our lives.

Table 8.1

Passenger death rates by mode of transport - Great Britain
Rate per billion passenger kms

	1981	1991	2000
Motorcycle	116	94	130
Walking	77	75	48
Pedal cycle	57	50	30
Car	6.1	3.7	2.8
Van	3.7	2.1	1.0
Water	0.4	0.0	0.8
Rail	1.0	0.8	0.4
Bus or coach	0.3	0.6	0.3
Air	0.2	0.0	0.02

In addition, the fixed costs are such that, having bought, taxed and insured the car, some feel that they should use it as much as possible.

Increased car use leads to:

- increased congestion with its economic, social and health implications.

  Despite the most congested road network in Europe, successive governments have taken little account of the 'hidden' costs of increased ill health, congestion, stress, pollution exacerbated by decades of under-investment in the UK transport system.

- declining health and increasing health costs.

  The BMA suggests[23] that only one in ten take enough exercise. The recent CfIT report[24] tells us in the ten years to the mid-1990s, the number of overweight boys in England nearly doubled to 9% whilst the percentage of overweight girls rose to 13%. In almost the same period, about 400,000 fewer children walked to school and cycling numbers fell from 300,000 to 100,000. The increasing cost of dealing with more cases of Chronic Heart Disease (CHD) and strokes in the future from lack of exercise, coupled with unsuitable diets and other factors is a burden on the NHS.

- fragmented towns and cities with little social interaction.

  Appleyard and Lintell's study[25] of the impact of traffic on three similar streets in San Francisco helped illustrate how traffic volumes and speed affect street use for non-traffic functions and 'liveability'. Aspects of perceived 'liveability' examined included noise, stress, pollution, levels of social interaction, territorial extent, environmental awareness and safety. All were inversely correlated with traffic density and therefore with congestion.

Best practice

Some of the world's best examples of integrated transport systems can be found in northern European countries.

European countries provide examples of successful integrated transport systems

Holland

Since the early 1900s, bicycles have been among the most popular modes of transport for the Dutch. Thanks to long-term, supportive government policy and helped by relatively flat topography, the bicycle today remains one of the principal means of travel both in and around Dutch cities.[26] The Dutch have also invested heavily in their public transport systems and their roads, They use their numerous waterways and have developed one of Europe's best integrated transport systems. If one uses the bus, tram or train in Holland, one can rely on the fact that they all run on time and are clean and efficient. Moreover, there is plenty of parking for cycles and motorcycles at railway stations and places of work.

Germany

Although the Germans own more cars per head than the British, they use them less as their excellent public transport system is better. More Germans walk or cycle to school or place of work. Cycling accounts for 11% of trips in Germany compared with 2% in the UK. Many German cities are better planned, much more pedestrian and cycle friendly and have better security for bicycles and motorcycles than in the UK. For example, in Munich, conditions for cyclists have been enhanced through extending the cycle path network. Cycle parking is available outside public buildings, stations and popular destinations. There is a cycle rental scheme. Munich plans to increase its already high cycle modal share from 10% to 20%. Similar schemes exist in other German cities such as Cologne, Bonn and Stuttgart (where cycle use is high though the city is far from flat). These cities also have clean and efficient public transport including trams and light rail, which again run on time and have good safety records.

Denmark

It is another good example of a country that has developed an excellent integrated public transport system. It also has the highest cycling rate per capita (18% of trips) in Europe[27] after the Netherlands. It has a similar climate to the UK and a reasonably flat topography. There is a different cultural attitude and cycling is fully accepted as a mode of transport.

Recommendations

- *Co-operation.* Firstly, and most importantly, other professionals should work together with transport experts as an integrated team. Such a team might consist of transport planners, architects, urban planners, health professionals, educationalists, environmental management specialists and criminologists. These groups often do not have a good record of co-operation.[28]
- *Work travel plans*. Employers should be encouraged to produce work travel plans to promote walking, cycling, motorcycling, car-sharing and public transport. Sustrans[29] produced a series of information sheets on the web on becoming a cycle friendly employer. Work travel plans are now being put forward by a number of employers, notably Boots Pharmaceutical Company.[30]
- *Improved routes for cycling and walking/safety benefits.* These should not be 'add-ons', but treated as in the Low Countries, Scandinavia and Germany for example. Despite present low levels of bicycle use in the UK, there is strong interest in cycling and cycle sales are buoyant. There is no reason why this interest in cycling should not be converted into increased levels of cycle use. In Switzerland (where 15% of trips are made by cycle) there are more hills, Sweden (10% of trips), has colder winters and Germany, higher car ownership; yet each has five times the UK's share of bicycle trips. Trip patterns in the UK, where half of all trips undertaken are less than two miles in length, offer great potential for increased levels of walking and cycling.[31]
- *Education: Improved 'routes to school' for children*. 'Walking Buses' are being introduced, some authorities are considering US style yellow school buses, and Sustrans is encouraging schools to develop school travel plans[32] as are the DTLR and Transport 2000. Road safety courses could also encourage children to ride bikes safely. RAC Motoring Services' 'Grass Routes' competition has encouraged school children to develop green transport plans.[33]
- *Health benefits*. Promoting the health benefits of walking and cycling includes: less risk of coronary heart disease and stroke, lower blood pressure, reduced cholesterol levels, reduced body fat, and enhanced mental well-being[34], though cycling brings a higher risk of accidents unless radical measures are taken to reduce accident rates.
- *Cost-benefit*. Encourage the use of the motorcycle, scooter and bicycle as a 'half-way house' for journeys that would take too long on foot, but for which there is no need to take a car. Promoted as 'jam busters', they could replace many shorter trips presently made by car. Often futuristic design and economical running costs could be promoted as selling points. In turn, there should be better security for motorcycles, scooters and cycles at points such as railway stations, public car parks, and places of work. At the same time campaigns and better street design are needed to promote safety and bring down accident rates. Experience elsewhere in the world shows motorcycles, scooters and cycles can be ridden safely and not as a threat to others and to themselves. All this would encourage more people to use these environmentally sensible forms of personal transport and to link with public transport where possible.

Conclusion

Cars are here to stay. But overuse and over-dependency on them, particularly in the UK, has contributed to pollution, congestion, stress and ill health. Encouragement to reduce the 20% of short car journeys may help. Sensible use of and integration of all modes of transport is part of the package. Especially in urban areas local authorities, backed by central government, need to plan for greater walking for more and safer cycling, motorcycling and use of scooters at the same time as they plan investment in an efficient, integrated transport-and-land-use system, which takes into account the needs of all, including the socially excluded, and redresses the balance in favour of alternative means of transport, particularly for short journeys, rather than continued emphasis on the car.

8 Walking, cycling and motorcycling

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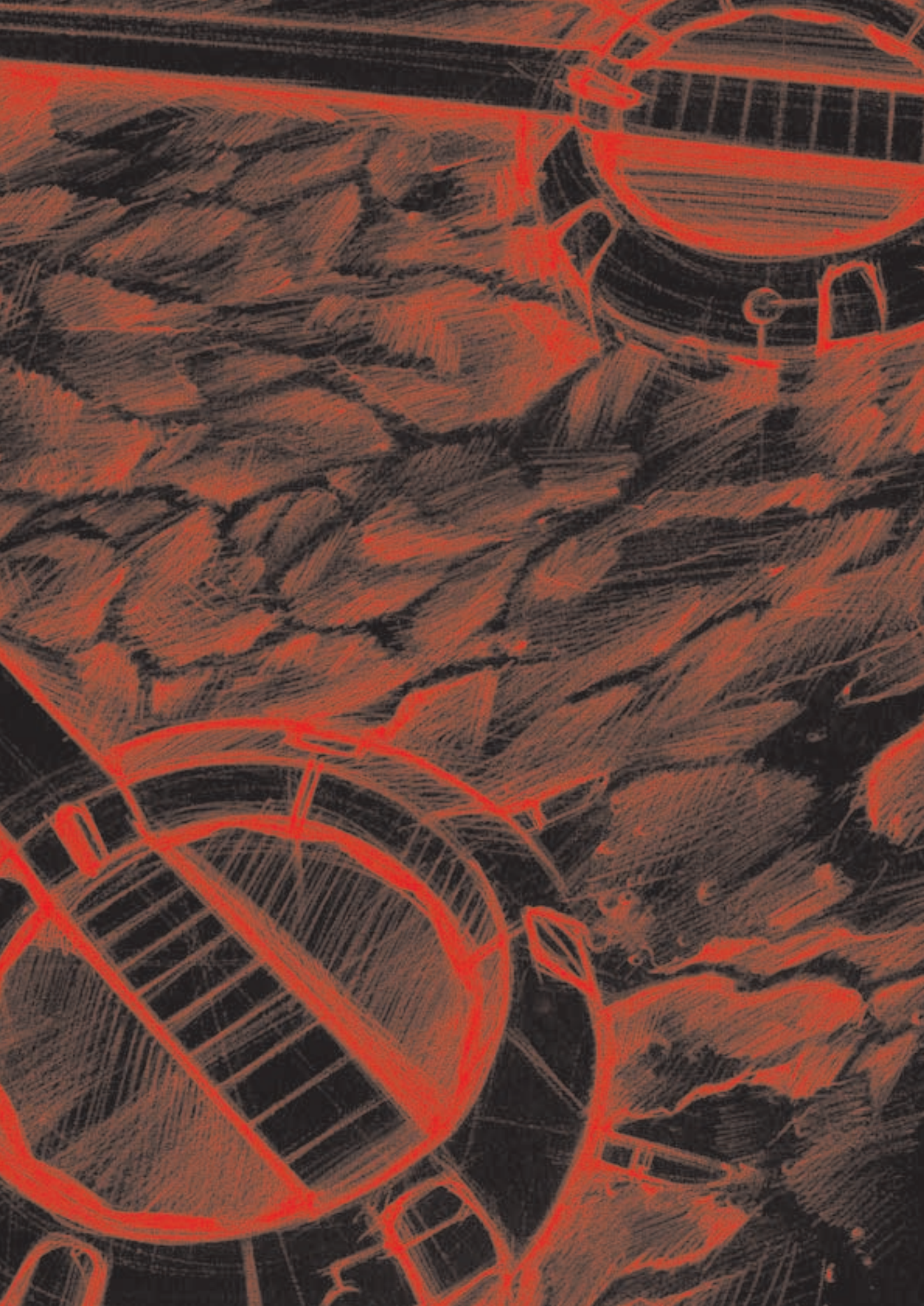
8 Walking, cycling and motorcycling



9 New modes of transport

- The Dan Dare vision of flying cars and cities linked by mono rail has not materialised
- 76% think people will still own individual cars in 2050
- The individual car with four wheels and a steering wheel will still be driving along – and below – the highways and byways of the UK in 2050
- The driving licence of the future will be electronic – the car will not start if you do not have a licence
- You will be recognised by your iris and the car immobiliser will disengage only if you are authorised to drive that car at that time
- You may have to book a time slot for your journey
- Royal College of Art ideas include a novel concept car with an interior, which adjusts to the occupant's body shape
- Only 3% think cars will park themselves by 2030

9 New modes of transport

Fifty years ago, people predicted the flying car and cities linked by monorails. The vision of the future was very much the one portrayed in the Eagle comic strip of the 1950s with Dan Dare and the Mekon attempting to outsmart one-another using a variety of futuristic transport, including individual flying saucers and personal space pods. But, even by 2002, this has not really happened. The car still basically comprises four wheels, a metal body, and a petrol engine. The great innovations have come elsewhere – getting a man on the moon, the World Wide Web, and research into genetics being examples.

Future Visions

But what do people, especially younger people, think the future of transport entails?

We have looked at a number of sources that might point the way to the future.

The Transport Visions Network led by Southampton University has come up with a series of visionary reports of which the latest is 'Vehicles and Infrastructure'[1]. The Network was established at the end of 1999 and membership is open to anyone under the age of 35 working in the field of transport including academics, local government staff and consultants. Membership is worldwide and needless to say, with the enthusiasm of youth, ideas coming from this group are wide-ranging and innovative.

Typical of the Network's visions of the future are 'overcoming resistance to change' for example. Julia Perlew (a fictional IT specialist) has (somewhat reluctantly at first) become a convert of the Government Silver Shuttle Service (SSS) scheme. She now regularly picks up the mini-shuttle vehicle which passes her house every five to ten minutes, travels to her local SSS hub (only 12 minutes away) and then picks up a Silver Shuttle train (four per hour). On arrival at her destination, she then hails a Silver Shuttle taxi and pays the small premium to be taken to the door of the company that she is visiting. Payment is, needless to say, all electronic, by means of an UCAT device (smart card, mobile phone, Internet console and GPS system all rolled into one). Far fetched? Maybe not, if we look at some of the ideas, which can be found on internet websites and other submissions made to us.

Interacting electronic systems will not let you drive without a licence or insurance

Ian Pearson, BT's Futurologist[2], suggests that, despite improvements to public transport, 'Most people will still have cars though. Of course, the driving licence of the future will be electronic – the car simply will not start if you do not have a licence. You will be recognised by your iris and the car immobiliser will disengage only if you are authorised to drive that car at that time – it may be that you have to book a time slot for your journey. The Government Direct initiative will ensure that your driving records, including the date that you passed a test, what accidents you may have had, speeding offences etc, are all accessible via a single point of contact, along with any other personal material such as your criminal record.' Big brother, or a sensible means of deterring car thieves, banned drivers and other irresponsible users of valuable road space? We are probably going to have to adapt to this kind of thinking in the future.

Much research is going on in the US, Japan and Europe, in the area of concept vehicles. A glance through some of the available literature in print and on websites shows us that there are a number of futuristic looking concept cars in the pipeline – some actually in production. Corbin Motors[3] in California has a number of concept vehicles, including the Merlin Coupe and the Sparrow II. They are advertising the Merlin (which is due to come into production in 2003) as 'the ultimate commuter car' which is powered by a gasoline combustion engine with a 300-400 mile range on a tank of gas (petrol) and a projected fuel consumption of 70-90 miles per gallon. The vehicle is a three-wheeler and will register, be insured and park as a motorcycle.

In 1997, a little electric vehicle known as the CyCab[4], developed in France by Avenir-Havas (a subsidiary of the Vivendi group), was rolled out to the general public. The CyCab is entirely under computer control and can be driven manually with a joystick, or automatically under various modes. Ideal transport in historic city centres, airports and railway stations, university campuses and holiday resorts – they are billed as being easy to drive, with access by smart card and can be used from door to door. There is automatic parking and re-charging and all vehicles carry a multimedia information terminal. They can transport up to two people at a maximum speed of 30km/h. It will be possible to form a 'virtual cars train' of these vehicles if necessary.

From Denmark, we might board a 'Maxi-Ruf' which is described as being a collective vehicle, which offers door-to-door transport and very easy access[5]. It is 6 metres long and has room for 10 seated passengers plus a chauffeur. There is no room for standing passengers. The Maxi-Ruf has a door for each seat and all seats are single seats – comfortable and roomy. There is also wheelchair access. Up to three of these vehicles can be coupled together to form an articulated bus or tram driven by

one chauffeur. Magnetic fields guide it around sharp corners, and the bus runs on rubber wheels so is comparatively silent. Trips can be ordered via a hand-held 'smart' device and picked up at special stops or stations, which are easily accessible. There are proposed 'Ruf' monorail systems for Seattle and Los Angeles.

ULTra offers a novel approach to personalised public transport

There is also the ULTra PRT (Urban Light Rapid Transport Personal Rapid Transit) scheme, which may be installed in Cardiff Bay in Wales[6]. In January 2002, trials began on a test circuit. The Advanced Transport Group at the University of Bristol developed the concept initially. ULTra is now being realised by Advanced Transport Systems Ltd and is a 'beacon project' under the Foresight Vehicle programme. This means that the project has been identified as one of the key technologies in the UK automotive sector for which the DTI will provide research support. ULTra consists of a network of 'pods' which are essentially driverless taxis. It is hoped that these will whisk passengers around the City of Cardiff in comfort – and silence – on a set route at speeds of up to 25mph. The vehicles are powered by electricity and follow a line of magnets on tracks. Each 'pod' will hold up to four people who can select their destination on the computer-controlled system and pay by means of a smart card. Other British cities interested in the system include Milton Keynes, Swindon, Edinburgh, Glasgow and Bristol.

Other ideas mentioned in recent press articles include details of the Segway Human Transporter[7]; cars that park themselves[8], automatic parking in multi-story car parks[9] and cars that stop when the driver is suffering from road rage[10]. In Basalt, Colorado, an American company is developing a Hypercar, which will be lightweight, functional, highly fuel-efficient and emission free[11]. It will also be sporty and fun to drive.

The RAC Foundation asked at the end of 2001, 'Is there life in cars?'

She walks to her car. It's blue today, yesterday it was orange – and tomorrow? She can decide that on her way to work according to the RAC Foundation's vision of the future.

She extends her thumb and speaks a password while the car's security system scans her finger and voice print and unlocks and opens the door. It's hot today but as she settles herself in the driver's seat, the air temperature has already been adjusted to suit her predetermined preference and the intelligent upholstery fabric will adapt to maintain her cool.

After that call to the boss, however, she feels anything but cool. The car's automatic mood sensory system, detecting this, plays soothing music and the de-stressing aroma of lavender is wafted into the cabin. Her electronic licence has already been inserted and approved and her retina scanned to ensure a cross match with the licence. Any attempt to drive while banned would, of course, result in immobilisation.

She 'tells' the car of her destination today – the 'work-hub' in the next town where she can access a huge range of technologies along with workers employed by a dozen different businesses and the time she wishes to arrive. Thank heavens she no longer has to worry about forgetting anyone's name...her active contact lenses simply relay a picture of anyone in her field of vision to her computer which can instantly feedback their details if required.

Powered by hydrogen fuel cell, the car is performing even better since she downloaded that new engine management software. Her slot on the highway has been booked with the network management system – but on her way to join the car-pod on the motorway, she receives a communication asking her to stop and pick up a passenger travelling in the same direction. Her satellite navigation system gets her swiftly to his address and it's always worth the effort, giving a lift exempts her from 25% of the toll charge on the road.

As she joins her 'pod' of vehicles travelling for the next three junctions on the motorway, she can relax. The on board computer takes over, checking speed and controlling braking systems to ensure collision avoidance as well as monitoring road and weather conditions, while she catches up with the e-mail and newspapers. She is directed to a parking space as she approaches her destination and informed that a tyre technician will be there to meet her. Her sensor has detected that her tyres are reaching the recommended limit.

She arrives at work precisely 30 seconds before her estimated arrival time, ready for the day. Having had its tyres changed, the car is now taking someone else to a meeting before being returned to the pool station – where it has been re-booked for her journey home.

Sci-fi fantasy for car buffs? Futuristic nonsense or a vision of the future?

All of the technology described is, in fact, either in existence or in development stages by the motor industry and telematics companies.

In addition, Royal College of Art students from the Automotive Design course have been commissioned to come up with a selection of futuristic designs, some of which have been used to illustrate the text of this report. These include a novel concept car, which has side panels coated with copper for aesthetic aging and an interior, which adjusts to the occupant's body shape. Other concepts include wind and submarine cars, the latter docking onto floating pontoons and powered by harnessing the energy of the sea. Another student came up with the idea of a fully automated, driverless taxi with guidance by passive transponders embedded in the road markings. This vehicle would be especially useful for non-drivers and the handicapped. It may be thinking 'out of the box' but that could provide us with some of our best ideas for the future.

Future thinking

The RAC Foundation commissioned a survey in March 2002 by NOP Automotive[12] to test future thinking. The table below shows the responses to 'How likely do you think each of the following will be by 2020?'

Other practical suggestions in the survey included:

- 'Road works could be carried out at more suitable hours'
- 'I think we will have controls that will prevent us from driving with either drugs or alcohol'
- 'I think there may be a limitation on the number of cars per household'
- 'More people will be working from home'
- 'We have been expecting a decent public transport system for the past 40 years and successive governments have still not put the investment or the thought into a viable alternative to what we have now.'

Conclusion

Chapter 5 (Vehicle technology) has clearly indicated that the 2050 car will be cleaner, greener, quieter and safer. These will be important improvements, but the individual car with four wheels and a steering wheel will still be driving along – and below – the highways and byways of the United Kingdom in 2050.

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NOP Automotive survey amongst 500 principal drivers in Great Britain, March 2002

	Likely %	Unlikely %	Don't know %
Cars will park themselves	13	84	3
There will be fingerprint identification to enter cars	66	28	6
People still own individual cars in 2050	76	20	4
Cars will be 'beamed up'	5	94	1
Cars will never break down	16	81	3

Motoring towards 2050
Part 3: The options

10 Rail and express buses

- The density of Britain's railway network is the lowest in Europe in relation to the size of its population
- Rail use in particular is concentrated in London with 76% of commuting journeys by rail
- A 10% decrease in travel by car would be equivalent to a 65% increase in travel by public transport
- The cost of rail investment is much greater than that of the equivalent road investment, it is more difficult to carry out and the cost benefit ratios are much lower, especially for safety
- Britain has the lowest bus and coach travel per head in the EU and it is falling
- Long distance buses and coaches could play a bigger part in the national transport system because they are cheap and flexible but their success depends on adequate road investment

10 Rail and express buses

It is often argued that more use of public transport would substantially relieve road congestion. This chapter looks at the contribution of railways and express buses. Local buses are considered in chapter 11.

Britain (apart from London) has a less developed public transport system, bus and rail, than most of the rest of the European Union. In 1998 it had the lowest bus and coach travel per head in the EU. Long distance bus and coach traffic was particularly low[1]. Britain's railway network is less extensive per head of population than most countries except Spain and Portugal. Rail's share of passenger traffic in the UK, measured in passenger-kms, is substantially lower than that in most EU countries.[2] If one excludes London, that proportion falls substantially since the average Londoner makes five times as many rail journeys in a year than do those living outside the south east.[3]

Most UK motorists say they never use public transport

Most UK motorists say they never use public transport for the main purposes of travel: journeys to or in the course of work; visiting friends and family; or shopping, sport or leisure; or for taking children to school or a playgroup.[4] 75% say they never use rail or underground for these journeys and 81% say they never use buses. The average household spends 2% of its weekly travel budget on public transport.[5]

The use of public transport varies widely between regions and population groups. Nearly 70% of all rail journeys and nearly 90% of rail and metro journeys are in Greater London and the neighbouring counties. Three quarters of central London commuting journeys are by rail (57% by surface rail and 43% by underground).[6] Generally the groups which use public transport most are elderly people and those on lower incomes.

Without public transport congestion in towns and cities would be much worse. The RAC Foundation supported the building of the Paddington rail link to Heathrow because it would relieve road congestion. But transport integration can only give motorists better access to city and town centres through, for example, park and ride if there are much improved bus services, as are already running in Oxford and Leicester. Ken Livingstone's congestion charging scheme in London will not succeed unless there are better bus and rail services to carry people who no longer drive.

Changes in modal share

Public transport's share of total travel has fallen from 60% in the early 1950s to 13%

Chapter 1 noted that the whole of the increase in land travel (measured in passenger-kms) over the last 50 years has been in cars, vans and taxis. Travel by public transport is now less than it was 50 years ago, and its share of total travel has fallen from 60% in the early 1950s to 13% currently. Travel by bus and coach halved over the period: travel by rail declined until the mid 1990s since when it has increased by 35%. The share of total travel which people do on foot or on bicycle has halved over the last 25 years, and now accounts for just over 3%. Domestic air services account now for about 1%.

Experience in other European countries has varied. UK car traffic has increased by slightly less than the average, but substantially more than in France, Germany and the Netherlands. Bus and coach travel per head has fallen by more than in any other country (except Germany, affected by reunification). The recent growth in rail travel was higher than in France, Germany and the Netherlands.[7]

Is it plausible that the growth we foresee in the demand for car travel could be diverted to public transport (or walking and cycling)?

Our forecasts of road traffic growth are repeated below (from chapter 2). The first line assumes that road capacity increases so that congestion does not deteriorate below current conditions; the second that road capacity does not keep pace with growing congestion.

Assuming that road capacity increases enough for congestion not to deteriorate, our model predicts that car travel would in 2031 retain roughly its present share of total travel, walking would decline by about a third, and rail would increase its share from 6% now to 10%.

Table 10.1
Forecasts of car traffic growth over 2000

	by 2031	by 2051
If road capacity keeps pace with congestion	46%	78%
With growing congestion	33%	47%

The future demand for rail services

Our forecast that the railways will start to reverse the secular decline in their share of travel may at first sight seem surprising. There can, of course, be no certainty about such matters. But rail traffic increased by 35% from a low point in 1994. In 2001 it was at its highest level since 1946. The main reason why our model predicts that rail passenger traffic has the potential to grow by some 32% further by 2010 is that rail is important for journeys to work, on employer's business and for leisure, all of which are expected to grow. Such increases are plausible given the railways' inherent characteristics. Railway industry sources suggest that economic growth alone should produce most of the increase which we forecast, and that increased congestion on the roads will probably push some extra traffic on to rail and keep motoring costs roughly in line with rail fares.

Demand for rail travel could increase substantially but its share of total travel will remain small

But most of the well-used routes, including most routes into London, are running at or near capacity now. Overcrowding is likely to cut growth back by a few percentage points. Its effect will be heaviest on the London and south east peak services. The Government's 10 Year Plan, and the plans of the railway industry itself, envisage increases in capacity by a range of measures including investment of about £60 billion divided between £33.5 billion public and the remainder private expenditure. About two thirds of the total growth predicted, but little in the peak, can be accommodated by the system as it is. Some more can be done by re-timetabling, altering public service requirements and better management of track possessions. But about a quarter requires completion of investment schemes already started (of which West Coast modernisation accounts for most), and of additional schemes in the Strategic Rail Authority's plan. Further growth is achievable through a mixture of minor measures and investment, though possibly not until several years later than 2010 because a year's investment was lost after Hatfield and the conditions have not yet been met for all the 10 Year Plan's requirement of £23 billion private finance to be forthcoming.

We cannot comment on the possibility that other factors such as physical constraints and skills shortages will further delay investment in capacity. But given that only about 10% of the predicted growth in demand depends on uncommitted investment, it seems plausible that the railway will be able to cope within the next 10 years or so with the increased demand predicted. Growth will not be accommodated uniformly across the system: 40% of the increase will be off-peak journeys in London and the south east; another third will be off-peak interurban journeys. Only a fifth will be peak journeys, most outside London and the south east; not much more than a tenth will be journeys on regional railways.

Forecasts for the period after 2010 are more speculative. The railway industry has no forecasts beyond the 10 Year Plan. On the assumption that business and leisure traffic continue to grow strongly, as they have since the mid 1990s, our model forecasts that the potential demand for rail travel could increase as shown in Table 10.2.

On either assumption, rail's share of total travel (in passenger-kms) would remain small.

We argue in Chapters 12 and 13 that even with a substantial level of new road construction future Governments will need to introduce demand management on the inter-urban road system to prevent congestion reaching damaging levels. Depending on the level of charges, that would, like congestion, suppress some road traffic demand and shift some traffic to rail.

Table 10.2
Forecasts of increased demand for rail travel: base: traffic in 2010

	by 2031	by 2050
If road capacity keeps pace with congestion	66%	160%
With growing road congestion	71%	173%

Table 10.3
Railways' share of total travel

	by 2031	by 2050
If road capacity keeps pace with congestion	10%	13%
With growing road congestion	11%	15%

Factors affecting the transfer of traffic from road to rail

The forecasts set out in the preceding section are derived from our modelling of travel demand. The key questions they raise are:

- is the travel demand displaced from road by congestion or by demand management likely to switch to rail?
- could the railways cope with the increased number of passengers?

Demand after 2010

The demand for travel is not homogeneous, and is not indifferent to the characteristics of the form of transport. Trips vary enormously in length and purpose and are sometimes part of a chain. Some, but not all, are suited to rail. The greater the number of journeys predicted to shift to rail, the less likely it is that the marginal passenger will find the switch attractive – or even feasible. As we explain in Chapter 1, many people's patterns of life and work have been built round the car. If travel by road becomes more difficult as a result of congestion it is likely that an increasing number of journeys will not be made at all. Whatever the purpose of those journeys, whether business or personal, they will be frustrated and some damage or inconvenience will be caused.

There are a number of reasons why increases in rail traffic will not materialise, over and above the traffic growth to be expected because of the inherent advantages of rail:

Motorists are reluctant to switch to rail and many road journeys are too short to transfer to rail

Most motorists are reluctant to shift to rail. When motorists were asked how they overcame congestion, 29% said they put up with it, 24% said they would allow more time to make their journey, 22% chose a different route, 18% altered their time.[8] Only 2% said they would take public transport. When asked how they could contribute to relieving congestion, only 22% said they could use train or bus more. Asked what they would do if the chances of encountering unexpected congestion were to double, only 2% said they would use public transport instead. When asked what car journeys they would give up, they chose short journeys unlikely to be suitable for rail.

Many road journeys are too short for transfer to rail. In 1998/2000 56% of car driver trips were under 5 miles, 7% over 25 miles; and only 3% over 100 miles. In contrast only 8% of surface rail trips, a higher proportion in London, were under 5 miles; 37% were over 25 miles and 7% over 100 miles.[9] The average car trip lasts 20 minutes, the average rail journey 80 minutes. However the distribution of rail trips is heavily biased by the influence of the high proportion of short journeys in London and south east. Outside London rail trips are on average longer.

There are too many journey purposes for which the car is more convenient than rail.[10] Asked if they had to give up a car journey once a week, 27% chose shopping. Of these 17% said they would use public transport for shopping. 18% said they would use public transport for the journey to work instead of using a car if forced to do so.

- 4% of journeys to work are by surface rail.
- 70% of journeys to work are by car.
- 8% of journeys to work are by bus.
- 1% of those going to school use rail.
- 2% use public transport other than local bus to go shopping.

Such trips are unlikely to divert to rail.

Outside the London area rail journeys are heavily concentrated on business travel and long distance leisure travel. Long distance road trips are most likely to be for a holiday or to visit a friend at home. Cars are especially convenient for a couple or family staying away for a night or more.

Willingness to use rail declines rapidly with distance from a station. Many rail users live within 26 minutes' walk of a station. Even though a third of rail journeys start with a car trip, people living within 6 minutes' walk from a station make 20 times the rail trips made by those more than 27 minutes' walk-time from one.[11] [12] Better park-and-ride facilities at stations may encourage the use of rail, but not if the ultimate destination at the other end is far from the station.

The cost of rail travel is continually rising relative to road. While the cost of motoring has fallen over time, principally because of improved but cheaper vehicles, that of public transport has risen, mainly because of rising wages, labour costs being a substantial proportion of its costs. That tendency is expected to continue. Relative prices could only be kept in line through greatly increased road user charges or substantially increased fare subsidies. (In recent years rail fares have been kept down mostly through increased rail subsidy.)

The prospects for increasing railway capacity after 2010

It is implausible that the railways would attract much more travel from road even if there is more congestion and road user charges are introduced. There are in any case formidable constraints on the capacity of the railways to carry such displaced traffic if it materialised. Even when the investment planned in the 10 Year Plan is completed, be it by 2010 or later, it is expected that the utilisation of capacity will be very high in the peak in London and the south east and in both the peak and offpeak on interurban services. Spare capacity will still exist on the London and south east offpeak services and on regional railways. The prospects for significantly increasing railway capacity beyond what is in the 10 Year Plan are not encouraging, for the following reasons:

The cost of rail investment is much greater than that of the equivalent road investment, and the investment is more difficult to carry out. Since the 10 Year Plan the cost of rail relative to road has risen further mainly because of additional safety requirements. So the cost of achieving the capacity increases required by the 10 Year Plan will be more than the £60 billion envisaged in the Plan.[13] Moreover the disruption caused to existing traffic tends to be much greater with rail than with road improvements which adds to its costs and to objections to many rail improvements.

More important, while only 20% of the increased capacity to be achieved under the 10 Year Plan requires significant investment, capital investment will be needed after that to achieve virtually all further capacity improvement, except for:

- offpeak services in London and south east
- regional railways, (where all trends suggest that increases in demand will be modest). The easier improvements will have been made, and so the costs of increasing capacity will in general will be much greater per additional seat-mile than under the 10 Year Plan.

Widening rail routes is generally more difficult than for interurban roads

Improvement in some corridors will be very difficult if not impossible. Widening rail routes, when passing through built-up areas, is generally more difficult for rail than for interurban roads. Whenever land has to be taken, even more when a new route is required, as is proposed with the new north south high speed train route, objections are likely to be as great as to new road construction. However, problems will vary geographically. The Great Western main routes, Chiltern and what used to be the London, Tilbury and Southend railways may offer the best prospects of improvement. By contrast to increase capacity on many lines in south and south west London would need massive expenditure if it could be done at all. On many routes, new tracks on new alignments would be needed. They would be as expensive as new motorways – more expensive per passenger-km – and would meet as much opposition.[14] It is worth noting that the few investments the SRA currently propose for after 2010 look costly: the new north south high speed route (which may also carry freight on it so releasing capacity for passenger and freight traffic on other routes),[15] the South London Metro, Crossrail, the Merton-Hackney Line, the King's Cross-St Pancras superhub, and Airtrack from Heathrow to Waterloo.[16] Industry sources suggest that it will be virtually impossible to increase the capacity of Liverpool Street and south London termini. Further radial traffic in the London area will require underground lines intersecting with the surface rail system further down the line from those termini. For example, Crossrail, intersecting at Farringdon with Thameslink would relieve capacity at Liverpool Street.

Chapter 7 argued that rail freight was likely to remain a small proportion of all freight traffic. As freight trains are slow and often cross the paths of fast passenger trains they limit route capacity in that way, so the most cost-effective way of increasing passenger capacity may be to get rid of freight trains on heavily trafficked rail routes. Given that the environmental case for preferring rail to road traffic is likely to decline with improved road vehicle technology, on many routes the cheapest and most effective of freeing up capacity for passenger traffic after 2010 may be to re-route or discontinue freight traffic using them.

10 Rail and express buses

The benefit-cost rates of return on rail investment already tend to be much lower than on road investment. Professor Newbery and his colleagues at the Department of Applied Economics at Cambridge have shown this by comparing a number of road and rail schemes.[17] Professor Glaister of Imperial College has pointed to the attractive returns are from 68 road schemes appraised by DETR[18]: 53 had benefits more than twice their costs, 36 had benefits of more than three times costs, 18 more than four times.[19] (The Cambridge-Huntingdon road improvement, the only major scheme approved in 2001, promises a benefit-cost ratio of 4.) The adoption of road pricing could turn these benefits into financial returns.

No financial returns have been published for individual rail schemes. Nevertheless it can be inferred that economic benefits are less than costs, and therefore they will be unprofitable because all rail investment seems to require additional government subsidy. Therefore we have reason to believe that no major new rail scheme in the Plan is financially profitable in any normal commercial sense, despite higher fares than in the rest of Europe.[20] Since later rail projects will be more difficult and costly, it is even less likely that any will show a positive return.[21] That is why private finance cannot be expected to support rail schemes without what amounts to a taxpayers' guarantee. In the interests of open, clear decision making when such vast expenditures are involved, we urge the Government to live up to its promises and publish the detailed appraisal of each rail investment scheme so honouring the commitment in John Prescott's 1998 Consultation Document, that 'appraisal of policy options and investment proposals in terms of their costs and benefits will therefore remain at the heart of decision making and central to the review process'. The Government should publish the returns, social and financial, it expects from rail schemes in the 10 Year Plan and further major investments.[22]

As chapter 2 pointed out, it is also worth noting that rail services are mostly used by the more affluent who therefore benefit from the substantial rail subsidies.

It would be more cost effective to reduce congestion by direct investment in roads rather than railways

The cost effectiveness of rail in relieving congestion is less than that of road improvement. A valid case for loss-making investment can be made if there is a positive social benefit-cost ratio. For the most part the existence of such a social net benefit from rail schemes depends on three factors: their reducing congestion on the roads, their enhancing safety and their environmental benefit. However as both Professor Newbery and his colleagues and Professor Glaister have pointed out, the decongestion argument for rail investment is a convoluted one insofar as that road congestion is a consequence of under-investment in the road system in the first place. Where possible it would be more cost effective to reduce congestion by direct investment in roads, all the more so, as will be argued in chapter 13, if excess demand is limited by congestion charges. The Background Analysis to the 10 Year Plan supports this view: it states that to achieve a reduction of one vehicle hour by improving speeds on trunk roads costs £5 of public expenditure compared with the £11 it costs if achieved through rail improvement.[23]

There are places – particularly in London and perhaps in some major towns and cities – where the disproportionate cost or the impossibility of road improvement makes rail improvement the most effective means of reducing road congestion, but as a generalisation, it cannot hold throughout the railway system. It also suggests that it is by investments, often underground, to improve commuting in cities that the railways can develop to be of most social use.

We believe that the Government, or the Strategic Rail Authority for it, should urgently review its priorities where peak capacity is short, as it will be on most main-line routes by 2010, so as to decide whether:

- priority should be given to long-distance passenger traffic, which will probably be preferable on financial grounds, or to
- stopping commuter services outside London for which the social case – in terms of the relief of road congestion – may often be greater.

Such decisions are needed now to help local authorities in their planning. We note that the West Midlands Multi-modal Study at first proceeded on the assumption that it could rely on substantial rail improvements, including a new underground station at New Street, in its planning to reduce congestion in the Greater Birmingham area, only to be told by the Strategic Rail Authority that most of these improvements cannot be provided.

The trend towards building in greater safety into rail operations and investment at very great cost is realising substantially diminishing returns by comparison with other ways of saving lives. Despite the improving record of rail safety in recent years, tragic accidents such as those at Ladbroke Grove and Hatfield have led to heavy pressure for further improvement. It is difficult to challenge the view that almost any cost is worth incurring to reduce the risk of accidents; but such costs have to be borne by the passenger or the taxpayer. Given that funds are not unlimited, Governments will have to face the choice between increasing safety and increasing capacity. It is interesting that the present Government has decided that accelerating European Train Control System (ETCS), as the Cullen Inquiry recommended, is not a sensible move to cut fatalities, given its high cost. At a cost of about £600 million, Train Protection and Warning system (TPWS) is expected to save one or two lives a year: the implied cost of saving a life is about £10 million by comparison with £300,000 on the roads and less in the NHS.[24] At a projected cost of £3.5 billion, ETCS is expected to save one or two lives a year at an implied cost of about £100 million a life; but there are indications of a project cost nearer £6 billion which, if upheld, would increase the cost per life saved even further, though there is controversy over how much of the ETCS capital expenditure might still be justified inasmuch as it increases reliability and capacity. The case for this still needs to be made.

There are other ways in which railway safety can and should be improved at lower cost, such as the better training and organisation of people. Undoubtedly much of the money now increasing the cost of rail relative to road travel could be used far more productively to reduce road accidents, where the risks are much greater than on rail, or still more cost effectively in the National Health Service.

The cost-effectiveness of rail safety measures versus road safety needs to be evaluated very carefully

The environmental superiority of rail over road transport is important now but it will become less so. The 10 Year Plan indicates the current extent to which the railways cause less air pollution and global warming than road transport. In the short term it is a substantial element in the justification for rail investment despite negative financial returns. However, as chapters 3 and 6 argue, improvements in vehicle and fuel technology will reduce and may eliminate those negative impacts of road transport. Insofar as they do, this argument for rail investment will disappear, indeed it may have already have done so, as the case for most substantial rail investment depends in large part on traffic decades into the future.

The potential for express buses

The UK has fewer buses and coaches than most other European countries. They constitute 1% of traffic on our roads, about half that on motorways.[25] Long distance buses account for about a third of all bus and coach journeys and 57% of vehicle-kms.[26] They carry about two thirds of the journeys made by rail, though passenger-kms are far less. Holiday and travel excursions are estimated to be 60% of long distance travel by bus and coach, only 14% being express buses.[27] Thus of 713 billion road and rail passenger-kms in 2000, under 0.3% was express bus. There are routes, like London-Oxford, where there are very high express bus frequencies, but they are very few and usually where the alternative rail route is much longer. Otherwise they tend to be used by the less affluent.

Long distance buses could have a wider appeal but are unlikely to be a substitute for car travel

Express buses could play a bigger part in the national transport system than they currently do, though some operators do not seem as yet keen to develop their long distance coach services in competition with rail. Their potential for dealing with extreme congestion in certain places may be better than that of rail. The costs of buses when they are moderately full are lower than both rail and car. Their flexibility in journey origins and destinations could make them much more useful and accessible to more people than rail. Rail is already most chosen by the more affluent.[28] Long distance buses could well have a broader appeal than they do now.[29] We note that some of the current multi-modal studies of transport problems are looking at the contribution which express buses might make. There may be some places where express buses might be the most cost-effective, or possibly the only, way of dealing with a particular congestion problem, (but we cannot see them extensively becoming a substitute for car travel, given the far greater comfort and convenience of the car). Such a strategy would require careful planning and analysis, for example of how the conflict between express buses and other road users for scarce road space might best be resolved.

10 Rail and express buses

Conclusions and recommendations

- Though public transport currently accounts for only 13% of all travel by mechanised transport it is a vital part of the transport system, national and local. Its development and use should be encouraged.
- Since 1994 rail passenger traffic has increased by about 35% - the first significant increase for 50 years. Demand is expected to grow over the next 10 years by a further 30% or so, particularly for those journeys for which rail is most suited – travel to work, travel on employer's business, and long distance leisure travel. The railways can probably meet most of the demand, though not at peak times on many services and only at the cost of more overcrowding, severe on routes into London.
- Only 25% of the additional traffic forecast requires major investment. Although yielding a low benefit-cost return by comparison with most road investments, it is worth making because of the urgent need described in chapter 2 to increase almost any kind of transport capacity, given forecasts of traffic increase.
- Thereafter until 2031 our forecasts suggest a strong demand for rail, which might lead to a doubling of rail passenger traffic over that period. But the investment required to carry most of it will cost much more per unit of capacity than that in the 10 Year Plan. It would be helpful if, where track capacity will be scarce, the authorities decide the priority to be given commuter and freight traffic, compared with long distance passenger traffic.
- Technological advances in motor vehicles are expected dramatically to reduce their environmental impact. As the environmental case for large-scale rail investment will be much reduced, especially outside London, the economic and social case for each investment will require careful evaluation.
- It is likely that the social case for more rail investment, most of it underground, will be at its strongest in London, despite its very great cost. The case for further investment outside London will usually be greatest where it will serve the long-distance business and leisure traffic for which it is best suited; but there will often be conflict between developments to serve those objectives and developing short-distance commuter traffic outside the London area.
- However bright the future for long distance passenger rail, and in general most would benefit one way or another from a good rail system, neither in the short, medium, or long run is it likely to reduce substantially the growth of road traffic. The car is a much more flexible and convenient mode of transport for many journeys and people's patterns of life and work have been built round it. It is probable that if road congestion became more severe, journeys would be suppressed rather than transferred to rail. In any case, since a 50% increase in rail travel is equivalent to only one year's growth of travel by road, the provision of enough capacity to carry the traffic displaced from road would involve huge financial and environmental costs: in some areas it would be impossible.
- Express buses could make a bigger contribution to travel needs, as they do in other European countries. If there were to be a continuing trend towards greater congestion on many of Britain's roads, there may be places where express bus services would provide the most cost effective solution. Careful analysis would be needed of the conflicting demands for road space in such situations.

References

1 *European Best Practice in the Delivery Of Integrated Transport. Stage 1: Benchmarking*, W.S.Atkins, November 2001, 26, subsequently referred to as EBP1

2 Transport Statistics GB 2001

3 Transport Statistics for London, 1999

4 RAC Report on Motoring 2000,10

5 Family Expenditure Survey

6 Public Transport Statistics, 2001 (PTS), Table 5, TS Table 4

7 EBPI

8 RAC Report on Motoring 2002,45-48

9 Focus on Personal Travel (FPT) 3.3

10 FPT 32,3

11 FPT 47

12 FPT 23

13 Comparison of the schemes mentioned in the Plan, in Railtrack's 2000 Network Management Statement for Great Britain and the SRA's 2002 Strategic Plan, as well as common sense, given the increase in costs, suggests it must be so.

14 The CTRL cost £39m a route-mile while TGV-Med cost £16m, Modern Railways

15 Interview with Richard Bowker, chairman of the SRA, The Times 2 April 2002

16 SRA:SP, 53

17 L Affuso, J Masson, D Newbery, *Comparing Investments on New Transport Infrastructure:Roads vs. Railways?* DAE Working Paper 0021, November 2000.

18 S Glaister, *UK Transport Policy 1997-2001.* Paper delivered to the Economics Section of the British Association,September, 2001.

19 DETR, *Understanding the New Approach to Appraisal*, 1998.

20 DETR 10 Year Plan: Background Analysis (TYP:BA) 55 talks of a significant proportion of investment being commercially viable but it is not clear if any of this is in any real sense major.

21 Any scheme can be given the illusion of a positive return if weights in the NATA assessment are chosen to achieve this outcome which is why it is important that the outcome should first be calculated with all measured inputs being given a money value (upon which substantial research exists) so that one can see how far the political outcome depends on intangibles or the re-weighting of quantified inputs.

22 There is an appraisal table at TYP: BA, 37 but its quantification is very limited.

23 TYP, 31-3 Comparable figures for local transport (8), London (12), rail freight (25) are given

24 Communication from Professor Andrew Evans University College, London

25 TSGB 2001, 4.7 and 4.9

26 PTS Table 6

27 PTS, 9

28 FPT, 102 Expenditure on rail by the highest quintile around 6 to 8 times that of the lowest 2 quintiles

29 Long distance buses are being considered by the M25 Multi-modal Study as an alternative to widening the M25 or otherwise enhancing capacity in its corridor.


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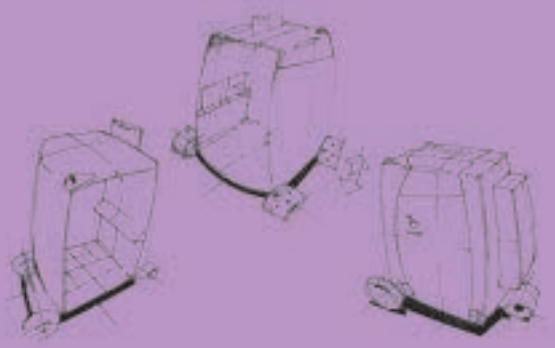
11 Local transport planning



- Car ownership and traffic growth put pressure on local transport infrastructure but localities differ in their capacity to absorb traffic
- Different solutions are required for small towns and rural areas, free standing towns, conurbations and London
- Local transport plans are over ambitious in their belief that they can choke off car growth without providing adequate alternatives
- They challenge at their peril the inevitable increase in car ownership
- There are serious skills shortage of transport planners and engineers to be overcome

11 Local transport planning

After cars, buses are the most important form of local transport. About 70% of all public transport journeys are by bus.[1] But the bus and coach share of total passenger traffic was over 40% in 1950, it is now about 6%. The UK has the lowest bus and coach travel per head in the European Union, but also comparatively low car ownership. A challenge for local authorities is how to meet the aspiration for higher car ownership while releasing road space by facilitating good public, usually bus, transport for the journeys for which it is most suitable. Many local authorities' planning does not give enough weight to their electorates' strong wish to own and use a car. In most circumstances diverting a small proportion of journeys to buses or other public transport will reduce congestion significantly and enable people to make the journeys by car for which it is most suitable, provided traffic restraint is used to limit traffic to fit road capacity. A danger is that either unrestrained congestion or restraint policies, used wholly negatively, will disrupt people's lives, their mobility and the local economy.

Virtually all car, bus and coach, and rail journeys begin and end on local roads, whatever their length

Diagnosis of the local transport problem begins with the car. An almost 50% increase in latent demand for car traffic on the national road network was predicted by 2030 (chapter 2). Our cities, towns, countryside and the local transport networks, serving them, must expect similar latent growth, because the same forces operate: rising car ownership and underlying that, increasing incomes, more, though smaller, households, and more women, young and elderly drivers. Moreover, virtually all car, bus and coach, and rail journeys begin and end on local roads, whatever their length, so that as motorway and trunk road congestion increases, more long distance journeys will use local roads instead. Everywhere, but particularly in areas like East Anglia with few motorways, long-distance journeys are already made extensively on what also serve as local roads. As motorway and trunk road congestion increases, more long distance journeys will use local roads instead. For such reasons, latent car traffic should grow similarly off the motorway and trunk road network as on it, as for different reasons will freight traffic.

But places differ in their capacity to absorb that traffic. Their topography, densities, extent of urbanisation, settlement patterns, jobs, configuration of the built environment, of major roads and of street patterns vary endlessly. So will future transport requirements. Six issues are considered:

- local areas' ability to cope with traffic growth
- appropriate traffic restraint policies
- the adequacy of bus policy
- the need for longer-term planning
- area differences in solutions needed
- the structure and powers of government.

Local traffic growth and congestion

Almost no local authority looks beyond ten years to estimate the effect of growing road traffic in increasing congestion on its road system. However, there are several reasons why local congestion should be worse than on the national network:

- when city and town centres were re-built – usually for better shopping - few attempts were made to reconstruct them for the car or for a first-class public transport system
- more satisfactory urban rail and bus systems could have been developed to relieve congestion, but for persistent underinvestment compared with many other European nations
- because many local authorities were slow to restrain car traffic, buses became unreliable, slow and liable to bunching so that their use and numbers declined, unlike in continental Europe
- urban areas find equivalent traffic growth harder to assimilate, having to cope with parked cars as well as movement. Many urban roads perform more than one function
- for many years increasing congestion was delayed and defeated by feats of traffic engineering: the imaginative but disciplined use of linked traffic lights, parking meters and yellow lines, in future increasingly hard to perform in many urban areas. Some local authorities are now using traffic engineering to make car journeys harder without detectible improvement in bus services.

However, Greater Manchester – uniquely we believe – has attempted forecasts similar to ours in chapter 2.[2] By 2020, it predicts an 8% increase in trips by all modes but with substantial modal shift:

- bus, cycling and walking trips falling;
- rail trips staying the same;
- car trips rising by 39%, though park and ride would increase markedly.

Without major improvements to the highway system planned, except completing the M60, congestion would rise unacceptably.

Can we generalise from the likely future of Greater Manchester? Not in detail, because of variations in the relation between local demand and transport capacity already mentioned. However, it is a not untypical UK metropolitan area of many closely interconnected urban and rural areas of comparatively high population density. Similar analyses in many areas - which should be undertaken everywhere – might reach broadly similar conclusions, namely a continuing fall in bus trips, walking and cycling and a continuing increase in car traffic and therefore in road congestion. There may be similar problems in some rural areas with strong environmental arguments against increasing road capacity to cope with more tourist traffic.

Parking controls and congestion charges

Parking, growing with traffic growth, reduces road capacity, but lack of parking is unlikely to constrain ownership

Parking, growing with traffic growth, reduces road capacity. So parking control is extended progressively, usually concentrated on the major roads, which diverts parking to less important roads which become increasingly congested. As car ownership increases, so does obstruction in many areas, particularly those without off-street parking, so worsening access for residents, emergency services and deliveries, intensified by poor enforcement. Remedying a worsening situation can require both widespread extension of restrictions and better enforcement.

Some argue that physical problems of parking could be a constraint on car ownership.[3] The increasing number of cars requires a huge length of road space to accomodate them when they are parked, bearing in mind that cars are rarely actually moving for more than an hour a day. However, 71% of cars are parked off the road at night[4] a figure which, despite increasing multi-car households, has increased slightly over the past ten years and is unlikely to reduce as long as suburbanisation continues. Even amongst single person households who could be expected to live in areas where off-street parking may not be available, 60% of cars are parked off road. As noted in chapter 1, on-road space is increasing as new roads are built, not trunk roads or motorways, but roads to new housing estates. Allowing for parking on both sides, they could cope with most of the growth in cars on the road and therefore in most areas, lack of parking is unlikely to constrain ownership. However, shortage of parking at the destination is an effective control on car use.

But, as in Oxford, carefully planned parking controls can be a forceful instrument in improving journey times when combined with improvements in bus services and traffic engineering. Local authorities can now reinforce parking controls by congestion charging. Again in conjunction with positive bus and other transport improvements, it could reduce car traffic without damaging accessibility and mobility. Securing acceptance for it will be difficult and require major commitment. Capital and current costs would be substantial. But, otherwise urban congestion will continue to grow in many urban and suburban areas so that access and movement become severely impeded.

Table 11.1

Proportion of passenger kms by different mode (%)

		Car	Bus	Metro	Rail	Commercial vehicles	Total billion passenger kms
London	2001	39	8	13	34	7	37
Manchester	1997	74	7	1	1	16	9
W Midlands	1997	67	15	0	3	14	7
W Yorkshire	1997	73	8	0	2	17	8
S Yorkshire	1997	71	9	1	1	18	5
Merseyside	1997	68	14	0	6	13	3
Tyne and Wear	1997	69	14	4	1	12	4

Another reason for studies 20 years or more ahead is to decide if and when parking controls will not be enough restrain traffic growth. We expect many areas looking forward 20 or 30 years will reason that that by or even before then parking controls will not be enough; that they will need congestion pricing instead; and that they had better prepare now so as to incorporate it in their planning to make it acceptable to the local community.

Bus policy

Since the 1950's, bus use in Britain has progressively declined. Passenger journeys by bus have fallen by two-thirds from 13 billion in 1950 to around 4 billion at the turn of the century. The Government has a target of increasing bus patronage by 10% during the 10 Year Plan which, against that background, might at first sight seem ambitious.

Despite decline, the bus remains an essential mode of transport in medium-sized towns, cities and, as the Table 11.1 shows, in the conurbations:[5]

- outside London, buses have several times rail market share for local trips, unsurprising given the skeletal nature of the rail network
- car dominates, but the bus market share is significant in metropolitan areas (as in cities like Nottingham, Bristol, Middlesborough and Hull)
- since bus market share is negligible for many journey-types – orbital, across town, etc. – it must retain an important market share of radial journeys, for which it is well suited, within corridors or to the city centre which are among the most congested territory in the system
- as buses can achieve around ten times a car's load factor, while taking about twice the road space, they ought to be able to do more to free up road space for other journeys by car.

A policy to promote greater use of the bus might be:[6]

Fuel duty rebate for buses should be replaced by a per passenger subsidy

- replace fuel duty rebate by a per passenger (or per passenger kilometre) subsidy. As an input subsidy, fuel duty rebate is not well targeted towards the objective of carrying more passengers. It also operates against technical change: the bus should lead in applying new vehicle and fuel technologies
- extend concessionary travel to more categories of people. The bus is used more by lower income groups than by higher (chapter 2). Extending concessionary travel could be an effective way of improving accessibility for the less well off
- insist on a higher rate of formation of Quality Partnerships between local authorities and bus operators. A negative effect of bus deregulation was that operators and local authorities had not the incentive, or institutional arrangements, to work closely enough together. Yet for the passenger, the bus' ability to compete depends on the total offer in terms of fare, journey time, reliability and comfort relative to the car. Bus time and reliability in congested cities depend as much on the local authorities' performance as on the operator
- deliver priorities for buses – signal priorities, kerb-guided bus and so on – where and only where justified in social cost-benefit terms. Operators should be willing to make a financial contribution to such schemes as in the current York Road guided bus scheme in Leeds. Such schemes are much more cost-effective than light rail schemes except in unusual circumstances
- ensure that car journeys also benefit from the reduced congestion achieved
- monitor commercial bus operators' profit margins. It is plausible that the form of route contract in London creates a more competitive environment than the area monopolies in which the system has settled down elsewhere. Where current arrangements create super-profits, a new arrangement like Quality Contracts may be needed.

Increasing bus patronage and market share in those markets where it can perform well is often essential to combat congestion. We propose the Government establishes a ring-fenced fund within the Local Transport element of the 10 Year Plan funding and calls for Bus Quality Partnership bids[7] from all cities of over 100,000 population. Some Quality Partnerships have achieved this already. Particularly in historic cities like Oxford, Cambridge and York, some public acceptance of the overall good sense of park and ride has already been achieved, though the detail of such schemes is likely to be controversial. If bus patronage increased on congested urban radials by 10%, around one third of it would come from car. Dedicated services, like park and ride with bus priorities on the radials, can achieve higher transfers, although the net effect on car mileage is more complicated.

The bus is an essential element in an urban life which provides accessibility for all

So the bus is an essential element in an urban life which provides accessibility for all, and offers motorists a decent, more reliable alternative to the frustration of some urban driving, while better enabling them to make other car journeys. It has to be achieved by giving the bus an appropriate degree of priority over and protection from traffic congestion. Nevertheless, however successful bus policy is, it will not solve the general problem of traffic growth without traffic restraint.

Longer-term planning

The focus in this chapter is on passenger traffic but local transport planning must also maintain road safety, now at a level among the best in Europe, and where possible improve it; deal with areas of particularly poor air quality if they have them; begin to act so that transport impacts are considered in the siting of schools, hospitals and other public services, as has not happened in the past; and develop a freight strategy.

The future most people seem to want is one of high car ownership – if not as high as in the US, then at levels already found in Italy, Germany, Austria and France which themselves will rise further, especially among the socially excluded, as personal incomes rise.[8] Among the objectives of local transport planning should be to find purposes for which other means of transport are an acceptable substitute for the car while recognising that most journeys will still be made by car.

Especially in conurbations and larger freestanding towns, much can be learnt from overseas, especially from northern Europe. Many German, Dutch and Scandinavian cities and towns enviably combine vibrant centres, pedestrianisation, excellent public transport and yet high car ownership. Of course many continental European, as well as North American and other city centres are as unlike this ideal as most of our own cities and towns are.

Among the difficulties in catching up on good continental European examples are:

- underinvestment in local transport systems
- the radical measures sometimes needed
- the time required to overcome the lags in planning and development
- the difficulty of doing so without high future levels of investment and restraint.

Because few local authorities have looked beyond five or ten years, they have also not been able to assess quantitatively the likely success of different policies (as again the chapter 2 analysis made possible in broad terms for national traffic). Rather, they have too often made assumptions about what initiatives like more parking controls, bus services or park and ride would achieve which are frequently stronger on aspiration than demonstration.[9]

In a rare example of forward looking, Greater Manchester followed the analysis, discussed earlier, by constructing a package of policy options to avoid the hypercongested future predicted a major programme of:

- new Metrolink lines
- bus priority measures (achieving a 20% reduction in bus waiting times and 10% improvement in bus speeds)
- public transport improvements like better information, improved reliability through fares on public transport eliminating a cost penalty to those changing vehicles or modes
- congestion charging at 6p a vehicle-km.

The consequences predicted were a 5-8% fall in car trips, a 50-90% rise in bus trips, a 100% increase in light rapid transit trips and tolerable levels of congestion. Such radical measures were needed to keep car traffic growth down to acceptable limits. Even so, after 2021 both very substantial additional investment in public transport and further restraint would be needed, which in our judgement brings into focus the value of considering how far a longer-term development strategy could improve that outcome.

Local authorities should take a longer-term view

How far can we generalise from the likely future of Greater Manchester? Again not in detail. Because the urban geography varies, local solutions must be different, once their long-term problem is diagnosed. Though we have much to learn from Munich, Frankfurt or Heidelberg, Amsterdam or Copenhagen as every city and town with its hinterland requires its own blueprint. But overseas experience reinforces the conclusion that more possible courses of action open up, the further ahead one plans. Rather than muddle through with increasing difficulty, it is better to know the worst to be able to plan to avoid it.

11 Local transport planning

Too many local transport plans do not match up to the stretching and stringent standards required.[10] They do not allow for the inevitable long lead times on major projects. They too often battle only with the intractable problems of the next five years, rather than sketch a vision for the future and then develop a strategy for their city or town. Changes in land-use, whether planned or unintended, take many decades to alter the distribution of homes and activities substantially; but over 30 to 50 years development strategies can help accommodate the desire for greater car ownership at the same as making easier the substitution of public transport for some car journeys.

A Long-Term Local Plan should begin with economic objectives. What are the area's economic strengths and weaknesses? How may its strengths be made greater, its weaknesses addressed? How may incomes be best raised and social exclusion be avoided? Then how may its built and physical environment be retained, if good, and improved, if less so? What indicators should it develop against which its planning achievements may be judged?[11] Into this framework the implementation of transport policy needs to be set with a full realisation of the importance of car ownership and personal mobility to people's sense of their own social and economic well being.

We believe all planning authorities should provide a better context for their short-term Local Transport Plans by engaging in longer term analysis, at least 30 years ahead, but preferably 50 if they are to consider how far development strategies could alter long-term traffic requirements.

Possible solutions

Small towns and rural areas

In rural areas buses should be replaced by more economical forms of public transport

In most rural areas and less densely populated urban areas car travel could continue the norm, except perhaps when travelling to the local town at the edge of which park and ride will become more common, reinforced by parking controls. Outside London and the south east there will be towns able to remain almost wholly motorised if that is what their inhabitants want. In many areas it should be possible to widen or otherwise improve roads as traffic builds up without strong environmental opposition. The car might continue providing 90% or more of passenger transport within our time-period. But such high levels of existing and feasible future road infrastructure provision, relative to latent demand, need testing and in most areas are far from certain.

In many rural and dispersed urban areas public transport is mainly for those without access to a car. We believe buses there should be largely replaced by more economical forms of public transport, both in terms of the subsidy per passenger they need and the road space they occupy: subsidised taxis, shared taxis, minibuses and new demand responsive forms of taxi. Where rural areas draw large numbers of tourists one would expect park and ride in reverse, tourists parking their cars and using local minibuses or taxis to where they want to walk, if necessary, or hiring cycles.

Free-standing towns

Most local authorities rely on buses, as the cheapest and most flexible form of public transport, and will continue to do so as congestion builds up. In many congestion can also be relieved by local by-passes, often combined with parking controls and by other road improvements like grade separation and other intersection improvements. Cities like Oxford, Cambridge and York, which still retain high concentrations of jobs in their central business districts, can increase journey speeds along radial routes by a combination of rigorous parking controls and high quality bus routes together with the greater provision of Park and ride.

But most urban areas have a greater geographical dispersion of jobs. There are still only 500 kilometres of bus lanes, of which 200 are in London.[12] Even so, bus quality partnerships are proving their worth as in Brighton and Cambridge. Many local authorities have been slow to develop effective bus strategies and spend central government funds available to them for the purpose.

If measures to improve car movement and bus services are not enough, it may be helpful to stimulate car-pools and sharing to replace car commuter traffic, especially for cross-town journeys. Some with flat terrain may be able to stimulate cycling as happens in Cambridge and Oxford, (though significant increases in cycling have been achieved in hilly Edinburgh and in Stuttgart).[13] It too can be combined with park-and- ride where cycles as well as buses may be mounted. Or part of the solution may be to encourage commuters and others to walk more. The UK has the lowest walking per head in Europe after Greece and Ireland.[14] If the accident rate could be reduced (it is lower in much of continental Europe), a highly cost-effective solution would be for some commuters, despite the weather, to replace their cars by motor-scooters for this journey, as is common in Italy, Greece and Barcelona.[15]

With a longer time-horizon, land-use planning can help. In many areas towns and their surrounding smaller towns and villages are close enough to be economically interdependent. Often the satellites want economic autonomy, but that may be a mistake. A better economic and transport future may be largely as dormitories for the main urban centre. In such circumstances, commuter road traffic may be reduced by planning adjacent towns and villages as 'pearls on a string', connected by high-capacity public transport. Sometimes settlements along railway routes may be used to this end. Elsewhere re-opening old lines may help (though both Oxford and the Cambridge-Huntingdon Multi-Modal Studies found it very costly and that the same job could be done more cheaply and effectively by busways).

The conurbations and London

If conurbations are densely populated, their constituent communities are tightly packed and large flows of traffic are non-radial, the importance of improving public transport, usually requiring well-planned traffic restraint, increases. An example of a successful Bus Quality Partnership is Line 33 in Birmingham.

A balance has to be struck between long distance passenger traffic and stopping commuter trains in the use of track

The larger the metropolitan area, the stronger the case for fixed link transport. More satisfactory systems could have been developed if not for persistent underinvestment, again, for instance, compared with many other European nations.[16] There have been a few metros and some undergrounds built in the UK, and several examples on a small scale of the systematic urban use of surface rail for commuting. But their share of commuter traffic is always small, except in London – where the key developments were pre-Second World War – and Glasgow. Uniquely Glasgow has such an excellent transport system that its citizens are likely to continue to have an ample choice of modes of transport.[17] In London and the south east rail commuting is extensive, but elsewhere an urgent review of rail policy is required to determine the balance to be struck between long distance passenger traffic and stopping commuter trains in the use of track. Financial considerations will almost always select the first; but the social case (demonstrable by cost-benefit analysis) for the second may often be stronger, especially where city centres and inner cities cannot, or for historic or aesthetic reasons should not, be re-engineered or restructured for easier car movement or better buses.

One can extend existing light rail systems, or build new ones, though expensive. Spending the available money in this way to improve only one radius (unless as part of a long term development strategy such as 'pearls on a string') provides no lasting advantage without the resources to alleviate other congested routes. Moreover in conurbations highly used interurban rail routes for long-distance are often in conflict with local, slower commuter traffic. (Local commuter traffic, operating only in the peak, in addition uses expensive rolling stock inefficiently.) In many instances, where central streets are not too narrow, buses in bus lanes or guided buses could perform the same role more cheaply.[18]

In central and inner London almost no scope exists for new roads or otherwise expanding the capacity of the road system at an acceptable financial or environmental cost.[19] Nearly 80% travel by surface and underground rail to work in central London and public transport use generally is high and increasing. (Alone among continental European cities, Paris has almost as high a proportion commuting by rail.) But there are severe limitations on expanding the traffic carried on its existing rail systems in the peak. When the 10 Year Plan is complete, most termini in London, certainly south of the river and in the east will be full and unable to increase their capacity. The growth of latent car-demand is likely to be greatest in the glue-pot rings outside the central business district where public transport is least adequate, especially for non-radial journeys. Currently congestion charges are planned only for the central area.

Yet the Mayor of London predicts substantial increases in population in and around London and therefore in commuting.[20] We trust the London authorities are right in believing that the introduction of congestion charges will be accompanied by such an improvement in the speed and reliability of buses, that almost everyone will have the chance of a much better service by bus than their current car journeys provide. Still after 2010,the transport requirements of all travelling in London, including motorists, and other road-users wanting comparatively uncongested roads to use, will necessitate construction of several underground lines with interchanges with surface rail, the existing Underground, and bus routes. The routes we recommend for urgent final preparation and immediate implementation are the Hackney-Merton, South London Metro, Crossrail and the East London lines.

11 Local transport planning

New rail links are urgently required in London

Do governments have the right structure and powers ?

In this integration of transport and other planning, local government must have the lead role. To put together a good plan requires local knowledge and experience, sensitivity to local wishes and to the local environment as well as technical competence. Local politics has been in decline. Vigorous local discussion of the options is necessary to test for acceptability. The detailed analysis, exploration and explanation of options should be a recurrent exercise in which local politicians and staff ought to be able to fire the interest of the electorate. It will also always be necessary to find ways for people to travel who cannot drive cars because of age or disability and to plan to avoid social exclusion limiting accessibility to jobs and other activities, another activity best done by local government.

We have deliberately not considered how the structure of government and its supporting agencies might be altered in the interests of better policy, planning and implementation, but have left it to others. But there is one important exception where we believe the present fragmentation of responsibilities between levels of government and agencies makes sensible planning, decision-making and operations almost impossible. In our judgement the right level of government to co-ordinate transport policy, planning and investment in conurbations and other widespread, urbanised areas is at what used to be the metropolitan county or other sub-regional level, where much greater co-ordination of powers is needed.

Regional government must ensure such matters as enough consistency in traffic restraint policies to avoid unhealthy rivalry between localities wanting to attract development; to deal with problems of the transport connections between them as well as between the region and other regions. It should enter local debates to question the realism of what is proposed, but not use a heavy hand in revising local plans and initiatives except where genuine cross-area issues are at stake.

Central government should provide the policy framework, reconcile regional differences, but also help overcome the skills shortages which make successful planning difficult. An increasing proportion, perhaps most, of resources needed could come from local revenues like parking and congestion charges.

Conclusions

- Rising car traffic will mean by 2030 that congestion will in most areas be at least as bad, if not worse, on local than on national roads.
- Almost everywhere radical measures will be needed to provide alternatives to the car for some journeys; but diversity in local circumstances will require different solutions.
- Too many local transport plans are over ambitious in their belief that they can choke off car growth without providing adequate alternatives.
- Too often they pay insufficient attention to the need for high mobility as a pre-requisite of a healthy local economy. Indeed economic and mobility objectives are given too little weight by comparison with those to do with the quality of life.
- A study of local transport plans for the RAC Foundation suggests that most do not look ahead far enough to enable them to make decisions now to provide for a tolerable future in 2030-2050.
- There are serious skills shortage of transport planners and engineers to be overcome.
- Local authorities challenge at their peril the very high impetus there is behind increasing car ownership.

Recommendations

- All urban areas should look 20 to 30 years ahead to estimate the likely impact of traffic growth on their transport network and plan accordingly.
- Most urban areas will need to assess how long parking controls can contain traffic growth and when it would be sensible to strengthen them by congestion charges.
- Replace fuel duty rebate by a per passenger (or per passenger mile) subsidy. As a subsidy on an input, fuel duty rebate is not well targeted towards the objective of carrying more passengers. It also operates against technical change: the bus should lead in applying the vehicle and fuel technologies discussed in chapter 6.
- Extend concessionary travel to more categories of people. The bus is used more by lower income groups than by higher. Extending concessionary travel could be an effective way of improving accessibility for the less well off.

- Insist on a higher rate of formation of Quality Partnerships between local authorities and bus operators. A negative effect of bus deregulation was that operators and local authorities had not the incentive, or institutional arrangements, to work closely enough together. Yet for the passenger, the bus' ability to compete depends on the total offer in terms of fare, journey time, reliability and comfort relative to the car. Bus time and reliability in congested cities depend as much on the local authorities' performance as on the operator.
- Deliver priorities for buses – signal priorities, kerb-guided bus and so on – wherever justifiable in social cost-benefit terms. Operators should be willing to make a financial contribution to such schemes as in the current York Road guided bus scheme in Leeds. We believe that such schemes are much more cost-effective than light rail schemes except in unusual circumstances.
- Ensure that car journeys also benefit from the reduced congestion achieved.
- Monitor the commercial bus operators' profit margins. It is plausible that the form of route contract in London creates a more competitive environment than the area monopolies in which the system has settled down elsewhere. Where current arrangements lead to super-profits, then a new arrangement like Quality Contracts will be needed.
- Propose that Government establish a ring-fenced fund within the Local Transport element of the 10 Year Plan funding and calls for Bus Quality Partnership bids from all cities of over 100,000 population.
- All planning authorities should provide a better context for their short-term Local Transport Plans by engaging in longer term analysis, at least 30 years ahead, but preferably 50 insofar they need to consider how far development strategies could alter long-term traffic requirements.
- In rural areas more economical forms of public transport should generally replace the bus.
- Most local authorities need to accept and plan for a substantial local roads programme.
- The routes we recommend for urgent final preparation and immediate implementation are the Hackney -Merton, South London Metro, Crossrail and the East London lines.

References

1 *Public Transport Statistics 2001*

2 SELNEC, Annex D. As it assumes a 2.5% fuel duty escalator, its forecasts will be lower than in chapter 2. Most multi-modal studies look 15 years ahead. However, the West Midlands looks 30.

3 Prof John Adams: The Times 10 January 2002.

4 RAC Report on Motoring 2002.

5 Glaister (2001)

6 For more detail see Grayling (2001) *Any More Fares?* Institute for Public Policy Research, London.

7 Huntley in Grayling 2001

8 *European Best Practice in the Delivery of Intergrated Transport 1*. WS Atkins for CfIT, November, 2001

9 J Wootton and G Marsden, *Local Transport Plan Submissions*, TRG for RAC Foundation, Southampton, February 2001

10 J Wootton and G Marsden op cit

11 DTLR and RAC sponsored work on Civilising Cities

12 Confederation of Passenger Transport estimate

13 EBP 3

14 EBP 3, 5

15 EBP 3, 6

16 EBP 1

17 Some have 20 year strategies but do not report similar analysis, e.g. West Midlands Passenger Transport Authority/Centro *20 Year Public Transport Strategy*, June 2001

18 When consultants looked at a long cherished scheme to re-open the rail line to Witney for commuter traffic to Oxford, they found it several £million more expensive than a bus along the verge of the A40. *Oxford Times,* 25 January 2002

19 Schemes for road tunnels under London have been designed but fitting the traffic to and from them into the urban landscape remains a problem.

20 K Livingstone 12 March 2002
J Wootton and G Marsden point out that central government does not help in its guidance by being unclear over what is meant by an efficient and sustainable economy

12 Highway capacity

- Road capacity has not matched increased demand
- Drivers have adapted to rising congestion by changing the route or time of their journeys
- The road network could cope with10–15% more traffic through advanced traffic engineering and management
- Local by passes and road improvement schemes should be speeded up significantly
- Projecting the 10 Year Plan road investment to 2030 will improve the road network but congestion still worsens after 2010
- Expansion of the strategic network will produce positive benefit cost ratios and can reduce congestion significantly, depending on the level of investment
- New road developments will have to be more environmentally acceptable and make greater use of tunnels at higher cost
- In practice, an intermediate package of investment and demand management will be required

12 Highway capacity

Previous chapters have identified the strong forces underlying growth in car ownership and use and hence in road traffic, and have reviewed the scope for accommodating and limiting this growth by transfer to other modes, land use planning measures and other measures aimed directly at reducing car dependence. Each should be pursued for its contribution, but they cannot reduce growth in demand for road use substantially.

Any effective approach must combine all available measures for increasing capacity and managing demand. The right balance between them is crucial. This chapter looks at the options for continuing to improve the network, starting with the Government's 10 Year Plan[1] and looking forward to 2050. We look also at how technology might improve communication between roads and vehicles, and at operational developments which could enable vehicles to move on the road network subject to external guidance and/or control.

We focus on the strategic motorway and trunk road network. This is directly the responsibility of the Government and managed by the Highways Agency. It carries about a third of all traffic and two-thirds of freight though it comprises less than 4% of the total length of the road network. But traffic growth on the much more extensive local road network will also have to be accommodated; and the links between the local and strategic networks will also need to be improved.

Current situation

For more than 20 years the capacity of the road network has grown more slowly than traffic. Following the 1997 Integrated Transport White Paper, the Government's consultation document, 'What Role for Trunk Roads in England?'[2] predicted that by 2016, based on policy at the time and of forecast traffic increases from 1996 of between 36 and 57%, the proportion of the motorway and trunk road network subject to severe congestion – regular at peak hours and extending into the off-peak – would increase from around 5% to around 25%. That 25% includes all the crucial core links between the main national centres: the M1, M25, M62 and parts of M2, M4. M6 and M40.

It has been shown[3] that congestion in the UK is considerably worse and investment substantially lower than in other major European countries. During the 1990s, UK investment in transport infrastructure per capita was about two-thirds of France and Germany's and, as a proportion of GDP, about half. Britain's roads are the second most heavily used in Europe, after Spain, in terms of vehicle kilometres per kilometre of road.

Drivers have adapted to growing congestion by diverting to avoid it, using other roads or travelling at different times

The road network has only coped as well as it has with the growth of traffic because drivers have adapted to growing congestion by diverting to avoid it, using other roads or travelling at different times. The RAC Report on Motoring 2002[4] records that 22% of respondents to its survey avoid congestion by choosing a different route and 18% by changing the time of their journey. But as congestion spreads to more links and across wider time bands, avoiding it becomes harder and harder and the costs and inconvenience of diversion become greater. So we shall be able to rely less on the adaptability and ingenuity of drivers in the future.

Measures for increasing capacity

Measures for increasing capacity and reducing congestion fall into five main groups:

- facilitation/management - making the most effective use of road space
- advanced technical – interactive communication between vehicles and between vehicles and infrastructure, external control of vehicles
- basic physical – bypasses and other new roads, widening, junction improvements, climbing lanes and other segregation
- advanced physical – elevated sections, tunnels
- control of access – charging, other.

Facilitation/management

The box outlines the main features of measures already in use or under consideration.

Ramp metering. – Entry to motorways controlled by traffic lights on slip roads.
Already in limited use. Smoothes flows. Reduces flow breakdowns and incidents. Can transfer congestion to network around motorway

Controlled motorway. – Speed limits on motorways set by reference to traffic conditions
Already in limited use. Smoothes flows. Reduces flow breakdowns and incidents.

High occupancy vehicle (HOV) lanes. – Lanes restricted to vehicles with more than a set number of occupants. *In certain circumstances can yield benefits in terms of numbers of people transferred with reduced delays. Must be effectively enforced if not to be abused.*

Narrow lanes. – Lanes narrower than the standard. In suitable locations can allow an additional lane without substantial new construction. *Regularly used as a temporary measure at roadworks. Some short permanent stretches. Wider use would probably require lower speed limits, as at roadworks.*

Using hard shoulders as running lanes
Regularly used as a temporary measure at roadworks. Potential for wider use quickly. Dealing with accidents and breakdowns more difficult; permanent standby facilities used at major roadworks. Effective permanent use will probably need lay-bys at regular and frequent intervals, around every 0.5 km.
Experience from Germany[5] indicates:
- *improved traffic flow without major safety disbenefits at a cost considerably below that of providing an additional lane*
- *the best cost-benefit relationship is achieved by confining use to times of high traffic volumes. The policy is to use the practice only as a temporary measure.*

Tidal flow – Direction of use of particular lanes changed in the light of traffic conditions, particularly at peak times.
Already in limited use – A38(M) Aston Expressway in central Birmingham. Road from central Washington DC to Dulles International Airport.
Management must be effective and safety maintained, involving substantial cost, but, on certain links at certain times, particularly radial links into, and orbital routes around, major conurbations, there is scope for considerable easing of the heaviest congestion.

Permanent standby recovery facilities – Breakdown vehicles continuously available
Already used at major roadworks.
Could be cost effective in reducing the consequences of incidents in locations with regular and extensive congestion and, as noted above, if hard shoulders are used as running lanes.

Information systems – Monitoring road conditions and giving drivers advice on these with possible options or directions
Monitoring by induction loops in the road and by CCTV, and facilities for communication by radio and variable message signs (VMS) are already in place on substantial parts of the strategic network and provision is being extended.[6] The Highways Agency is establishing a Traffic Control Centre to improve the collection, management and distribution of information.[7]
The commercial TrafficMaster system provides similar capability with messages communicated to in-car receivers.
An experimental system, Road Traffic Adviser, on the M4 has investigated communication between vehicles and road-side beacons, providing information on conditions to participating drivers and information on journey times to the Highways Agency.[8]

Active Traffic Management (ATM) – Aimed at gearing up and making more effective use of the existing and planned facilities above by more active real-time management
The Highways Agency is preparing a trial.[9]

All these could help relieve congestion but are generally not yet fully tested. Costs involved will be substantial. The best current estimate is that the maximum benefit, in terms of increased capacity, from such measures is likely to be 10-15% where they are applied.

Advanced technical measures

Various countries are investigating measures based on electronic communication between vehicles and between vehicles and information and/or control sources. These have potential for enhancing safety as well as increasing effective capacity.

Hi-tech highways

Intelligent Speed Adaptation (ISA), based on communication between vehicles, would allow vehicle speed to be adapted to road conditions as perceived in the speeds and manoeuvres of other vehicles, helping to prevent collisions. Initial implementation would almost certainly be through warning drivers but the technology could be developed to intervene actively and exercise some control over the vehicle.
A project in Japan, SmartCruise, aimed at safety improvements, is trialling electronic lane keeping and collision avoidance. The first phase will provide warnings to drivers but later phases should extend first to active vehicle control and then to full automation. A research project in the UK commissioned by the Department of Transport Local Government and the Regions (DTLR) is looking at aspects of possible ISA systems including user behaviour, design, standards, costs and benefits.

Automated Highway Systems (AHS) – road trains, vehicles linked electronically with their separation maintained. These might run alongside conventional traffic or on dedicated lanes or roads.
Some initial trials have been carried out and a further test is planned in California shortly. Potential for major increases in capacity utilisation by reducing vehicle separation, but marshalling vehicles into trains and subsequent separation is likely to require additional capacity. Specific flows must be large to justify investment.

Full journey management – 'drivers' indicate their destination and pass control to the network which would select their route and adapt it to reflect local conditions. On the journey, use might be made of road trains together with collision avoidance and other facilities.
Would require extension and enhancement of the above facilities. Their development and validation would be an essential stage in preparation.

These systems raise critical issues:

- drivers would surrender control, raising issues of responsibility and liability
- participating vehicles must be equipped to appropriate standards
- complex, flexible and reliable control systems necessary for AHS and journey management
- setting up the system would need strong commitment to putting in place all the components and to ensuring participation
- extensive testing needed to build confidence
- areas of network would probably need to be brought into the system progressively. The approach might be confined to relatively small sectors like the motorway core or used more extensively. Initially operation on roads carrying non-participating traffic would be likely.

Such systems should be able to increase effective capacity within the 50 year period of this study, unless unforeseen intractable problems are found, but it is not yet clear to what extent. Given this uncertainty and the fundamental changes in equipment and attitude required, the development process must start soon and be carried forward with strong commitment. Firm programmes are needed for:

- developing and testing the components
- establishing necessary changes to the physical network
- driver behaviour, etc
- promoting awareness
- preparations for appraisal.

The potential for increasing safety and other benefits, such as quickly tracing stolen vehicles, with implications for insurance, should help acceptability.

Basic physical extension

Physical extension involves adding new road surface to the existing network, principally by building new roads or adding new lanes to existing roads. These activities have reduced in recent years because of expenditure constraints, concerns about acceptability leading to resistance to road building, and constrained availability of land for road use, particularly in urban and suburban areas. Various special measures, discussed below, can assist. Widening some lengths of roads with wide margins already owned by the highway authority can be progressed more quickly.

Segregation of heavier from lighter vehicles, as with climbing lanes, can provide better flow conditions and reduce congestion. Similarly, if segregation of through from local traffic, as with motorways, can be extended to other parts of the network, some congestion relief can often be achieved.

In some cases, adapting the design of the road and its surroundings to environmental concerns may be sufficient to produce acceptable results. All new roads now need careful landscaping and measures to protect those living and working in the vicinity from noise and other impacts. As well as building quieter new roads, where possible, steps should be taken to reduce noise levels from existing roads. The 10 Year Plan has a target of installing quieter surfaces on over 60% of the network, including all concrete stretches.

Advanced physical measures

Any road improvements and new roads must be carefully and sensitively planned and built so as to cause the least possible damage to the environment. As well as landscaping, including putting roads into cuttings where feasible, increasing use should be made of tunnels to remove traffic from sensitive locations and reduce the noise and severance effects of major roads. New tunnelling methods have brought costs down but they are still around 5-8 times greater than for the surface equivalent, depending on local conditions. Continuing development and wider application should bring costs down further. Bringing the full environmental and social benefits of tunnelling into the equation should help make the case in certain locations.[10]

Tunnel maintenance costs about 10 times that of an equivalent surface road. Confining use of a tunnel to cars and lighter vehicles can improve operation and reduce construction cost by around 40%, to about 3-5 times that of a new surface road.

Tunnels

Pressures on space, environmental concerns and technological developments have increased the provision of tunnels throughout the world in recent years.

Under construction in the Paris suburbs is a tunnel link on the new A86 outer ring road. A tunnel was adopted because the route passed through residential locations, and areas of outstanding natural beauty and of historic interest. The tunnel will be tolled. Another new tunnel on the Paris peripherique was opened recently.

In the outskirts of Salzburg, a 500m tunnel is replacing an autobahn, greatly reducing noise and re-uniting areas currently separated by the surface road.

Tunnels have been used in Britain for a few road developments at environmentally sensitive locations, such as the M25 and the North Wales Coast Road, and considered for others, notably for the M3 at Twyford Down and the Newbury Bypass, but rejected on cost grounds. There is a long running proposal, currently being considered again, for a tunnel on the A3 at Hindhead to remove the impact of traffic on the Devil's Punchbowl. The possibility of a tunnel to minimise the impact of the A303 on Stonehenge is being examined.

Tunnelling can keep traffic out of towns with heritage features, where, despite sustained effort, a suitable surface bypass project has not been identified, such as Salisbury. Such a project was considered for Bath but rejected. In planning tunnel projects of this kind in urban areas, care must be taken that they do not bring additional traffic into already congested areas.

In certain circumstances, where land is not available for widening, an elevated roadway above the present road can increase capacity on some existing road lines. This will be more obtrusive than the existing road but, where environmental opposition can be overcome, may deliver capacity where the need is great and the options limited, as on the M25 or motorway networks in large cities. Where industrial and urban activity alongside roads is already adapted to their presence and impact, adding an elevated section should be less unacceptable. The cost will be about 5 times higher than the surface equivalent, less if use is confined to cars and light vehicles. Providing fewer interchanges than usual with the surface network, where practicable, could help network operation by restricting the elevated section to through traffic as well as keeping cost down.

In summary, many existing and potential measures are available, to contribute to increasing network capacity and reducing congestion. The Highways Agency plans to extend those already in limited use and introduce others.

Control of access

Controlling access to all or part of the network can reduce traffic and relieve congestion. Ramp metering provides a limited form of access control, holding traffic wishing to join the motorway until capacity is available. Some advanced technical measures would also involve control. For example, joining a road train would require control to match demand to the availability of the facility.

The 10 Year Plan provides a framework to 2010, our study looks forward to 2050

Although the primary purpose of tolling at present is to raise revenue specifically to pay for the original construction cost, it is also a form of access control, charging for use of specific parts of the network. In the UK currently such charging is largely confined to major estuary crossings but the M6 Toll around Birmingham, under construction, will introduce around 30 miles of tolled motorway, and applying charges to use the M6 between Birmingham and Manchester has been proposed by the consultants carrying out the Multi-Modal Study.

Controlling access to only part of the network will divert congestion from the controlled link to other parts of the network as drivers deterred by it seek alternative routes. Planning and providing for the effects of such diversion is essential if control measures are to be effective in overall network terms.

Issues raised by managing demand and setting charges are discussed in the following chapter.

The Options

The previous section sets out the toolkit of measures available and we now consider how it might be used. Traffic management will be required in all cases.

The Government's published network strategy extends only to 2010. Our study looks forward to 2050.

The 10 Year Plan, announced by the Government in 2000, provides the current frame for network development. It relates only to England and where appropriate the discussion reflects that.

Its aims for 2010 include 'a well-maintained road network with real-time driver information for strategic routes and reduced congestion'. For inter-urban motorways and trunk roads it specifies 'reduction in congestion to 5% below current levels'. Achievement of this target depends on both road improvements and progress with plan initiatives in areas other than roads.

Many of the individual projects within the plan are not specified but will be identified through Multi-Modal (MMS) and other studies and in Local Transport Plans. Delays with the MMSs mean that few of these schemes are identified as yet. Motorway and trunk road schemes approved following MMSs must be taken through full preparation, consultation and inquiry procedures before they can be implemented. They currently take ten years on average. The Plan proposes reducing this and the Highways Agency is developing appropriate arrangements but it is still likely to be late in the plan period before work can start on any of these schemes. There is therefore a strong possibility that congestion in 2010 will be substantially worse than now.

The 10 Year Plan

For motorways and trunk roads, the strategic network, the plan provides for:

- 30 trunk road bypasses
- widening 5% of the network and associated junction improvements
- 80 major schemes (over £5 million each) tackling bottlenecks at other junctions
- £130 million a year on smaller targeted improvements, including £90 million on congestion and safety hot spots
- widespread introduction of new technology for better network management to reduce delays and improve reliability
- new incident warning systems to prevent multiple collisions, and other safety improvements at accident hot spots
- quieter surfaces installed on over 60% of the network including all concrete stretches.

For local roads the plan provides for:

- 200 major improvements, including over 70 bypasses
- a £30 billion programme to eliminate the backlog of local road and bridge maintenance, complete the bridge strengthening programme, and replace life-expired lighting
- extensive investment in, and support for, public and integrated transport developments.

A particular factor in the slow progress of scheme preparation is land procurement and compensation for those affected. We believe that it would be cost effective in terms of earlier delivery to increase levels of payments.

Increased land compensation would speed road developments

Three illustrative scenarios are considered for how the strategic network might be developed from 2010 to 2050:

- the first, Do Nothing after 2010, involves no further substantial improvement of the road network after completion of the Plan
- projecting the 10 Year Plan comprises packages of measures, broadly similar to those in the plan, implemented steadily throughout the period
- the High Provision case would provide capacity to maintain journey-times on the network broadly as at present in response to forecast demand.

All cost estimates are at current prices.

Do nothing after 2010

Without further improvement to the strategic network after the 10 Year Plan, congestion would worsen rapidly after 2010, speeds falling from an average around 80kph to around 65 in 2030 and 50 in 2050. Deterioration would be much worse in the most congested locations. The choice for Governments would be between ever-worsening congestion and raising motoring taxes and charges to levels that would be so high that demand would be choked off. On a rough estimate, the increase in taxes and charges needed to restrain traffic to its present level would be about 6% each year. Neither course has anything to commend it.

Projecting the 10 Year Plan

This case assumes that the network would be improved steadily from 2010 to 2050 at the rate proposed in the 10 Year Plan.

Projecting the 10 Year Plan

The following notes illustrate in broad terms what improvements might be undertaken progressively over the 50 year period.

For the strategic network:

- 25% of the network to be widened
- new bypasses or relief roads to continue to be added to the trunk road network at a rate of around 2 or 3 a year
- increasing recourse to more expensive solutions – tunnels, elevated sections – to overcome constraints on space and acceptability
- upgrading of the entire road network by junction and other local improvements to continue at around present levels
- use of facilitation measures to improve network management to be extended progressively. Where the case is strong, this would include Advanced Traffic Management and standby facilities for incidents.

For local roads:

- 190km of principal roads (A roads managed by local authorities) to be added to the network or improved each year
- other improvements to local networks to be made, including introduction of city congestion charging schemes.

For public and integrated transport, improvements will continue to be made throughout the period.

Capacity: these measures would increase the overall capacity of the strategic network by around 25%, but targeted at the most congested areas.

Cost: it is assumed that the cost of making these improvements to the strategic network will increase progressively through the period as more difficult locations need to be improved and greater use of more expensive measures is made. A broad brush estimate for the cost of the programme is that it will rise from around £2.5 billion in 2010 to around £6 billion in 2050, about 0.2% of GDP throughout.

Improvements to the local road network in response to traffic growth might involve a similar order of cost. Investment in improvements in public transport and integration would be substantial. Some of the expenditure in each of these categories would be essential if the improved strategic network is to be used as effectively as possible.

These improvements would make a substantial contribution to relieving inter-urban and some local congestion but not enough to contain it to present levels. The 10 Year Plan sets a target of reducing the level of congestion in 2010 to 5% below current (2000) levels but this could not be maintained in later periods by a similar level of activity. At the rate of traffic growth predicted the network will become progressively more intensively used, with congestion developing more widely and demand increasingly constrained.

High provision

This case would try to maintain current average journey-times on the network as demand increases throughout the period. The box illustrates a possible form of package.

High provision case

For the strategic network

Almost all the network to be widened over 50 years with the capacity of some key sections more than doubled. Widening would be on line or by providing new parallel routes. Some motorway junctions would be closed to segregate through from local traffic. All trunk roads would be at least dual two-lane. Some would be upgraded to motorways.

New roads, principally bypasses and relief roads, to be provided at a higher rate than in Projecting the 10 Year Plan.

Widespread provision for:

- automatic speed control, ramp metering
- permanent standby facilities for incidents
- hard shoulder running at peak times
- advanced Traffic Management, enhanced over time
- ISA

Provision on some links for tidal flow operation.

Where justified by very heavy use and subject to satisfactory development, platoon operation (AHS) to be introduced either on dedicated lanes or separate links. The number of links justifying this treatment is likely to be small.

Tunnels

The problems of finding suitable routes and of achieving acceptability will require innovative approaches to the design of roads and their surroundings. It is anticipated that tunnelling would need to be widely deployed as part of this process with as much as 10% of the trunk road network in tunnels by 2050.

For local roads

The principal (A) road network to be improved and upgraded similarly to the strategic network, including use of tunnels and other special measures.

Some of the remaining network to be brought up to A road standard and transferred to that network. Improvement throughout the local network to be undertaken in response to traffic development, including introduction of city congestion charging schemes.

Improvements to public transport and integration to continue throughout the period.

Capacity: the measures noted would increase the capacity of the strategic network overall by 40-50%. Motorway capacity would more than double and that of trunk roads would increase by 30-40%. As with Projecting the 10 Year Plan, improvement would be directed to the most congested locations.

Cost: in very broad terms, the annual cost of the implied programme for the strategic network is estimated at around £10 billion initially rising to about £30 billion in 2050, of the order of 1% of GDP throughout.

The extensive improvements to the local network needed to deal with growing traffic would involve substantial cost.

The full package would require that some technical elements currently being developed are progressed to a point where they could be implemented effectively and economically, and that concerns about liability and interference with independent action arising from greater management of operation and control of road use would be satisfactorily resolved.

Delivering this option would involve much higher levels of activity than ever before and therefore a commensurate base of planning and construction capabilities. Work would need to start soon. Despite the extensive use of tunnelling, road construction on this scale would be bound to attract opposition on local environmental grounds, even if compensation were more generous. It would be expensive, taking 1% of GDP over a long period, and the money would have to be found either from higher taxation or user charges.

The use of land to build roads should not in itself be a limiting factor

The use of land to build roads should not in itself be a limiting factor. The whole British road network occupies less than 2% of the total land area. The strategic network accounts for around 10% of this. The High Provision scenario would require additional land but less than pro rata with the additional capacity provided, because use would be made of existing highway land for widening wherever possible and greater use of tunnels would reduce the need for surface land. The proportion of land occupied by roads would not increase by no more than 0.1%. For Projecting the 10 Year Plan the increase would be even less.

The choice before us

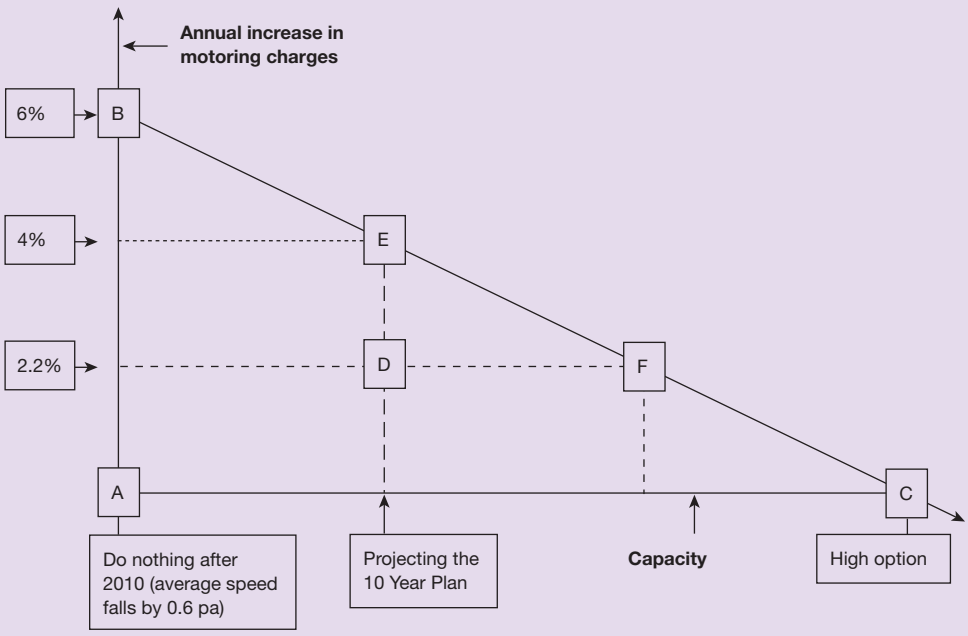
We have considered the balance between increased capacity and increased motoring charges, including taxation. The next chapter discusses the case for using congestion charges instead of fuel duty as the principal means of restraining traffic. There is also a third possibility, to allow congestion to increase. In making its plans the Government should balance these possibilities against one another – we believe transparently.

Figure 12.1 illustrates some possible combinations and their effects. The figures have been calculated for 2031, but are expressed as annual rates of growth which can reasonably be assumed to continue to 2050 for the purposes of current planning.

The Do Nothing after 2010 Case is represented by Point A on the figure, and results in a deterioration in conditions measured as an annual speed reduction relative to present conditions of 0.6%. This reflects the predicted 21% increase in average journey time between 2001 and 2031. Point B represents a Charging Option in which, rather than congestion, a 6% annual increase in motoring charges maintains current journey times at the expense of pricing a substantial proportion of demand off the network.

The other basic option for combating such a deterioration is High Provision represented by Point C. The solid line connecting points B and C implies that various combinations of raising motoring charges and capacity provision could produce a similar effect overall in terms of maintaining journey times.

Figure 12.1
Possible combinations of increased capacity and motoring charges



A particular combination illustrated is at Point D in which Projecting the 10 Year Plan is combined with increasing charges in line with the projected rise in income per head, 2.2% pa. This income growth reflects past experience over a very long time and is consistent with current Government forecasts. Such an increase, in line with average real incomes, does not seem unreasonable. However, Point D lies below the solid line. In other words, with this combination, there would still be an increase in congestion, despite the increase in charges, though at a much lower rate. Average journey times are predicted in this case to rise by 6%, equivalent to a reduction in speeds on average across the network of 0.2% pa.

Government must decide on the balance between investment in roads, increased congestion and traffic restraint

To implement the Projecting the 10 Year Plan package without such deterioration a larger rate of increase in charges would be needed, estimated at about 4% pa, bringing the vertical line from Point D up to the solid line at Point E. Alternatively, if the rate of increase is to be contained to 2.2%, the capacity of the network would need to be increased by somewhat more than Projecting the 10 Year Plan would provide for. This Intermediate Option is represented by Point F, with the horizontal line projected from Point D to the solid line.

Figure 12.1 thus shows that, in terms of what is considered acceptable for the charging and capacity options, some deterioration in average speeds could be considered as well. In other words, there is a three-way tradeoff – between worsening journey times, additional capacity, and higher charges.

In the Do Nothing after 2010 Case congestion would rapidly worsen. In Projecting the 10 Year Plan, continuing improvement activity would not prevent congestion from rising. Congestion charges would be required for effective operation of the network. The High Provision Option would avoid the need to restrain congestion through motoring charges, though it would cost much more than present plans and it would be controversial on environmental grounds.

Charging for access to the strategic network would tend to transfer congestion to roads to which access is not controlled. The provision of suitable arrangements for maintaining their effective operation when congested would be needed as well.

Approaches to charging are discussed in the next chapter.

It is for the Government to decide how to strike the balance between investment in roads, allowing congestion to increase, and restraining traffic growth by charges or taxes. On the basis of our analysis, continuing investment will be necessary on the strategic roads on a scale at least as great as that in the 10 Year Plan. If it were at the level of the Plan, we estimate that there would be some increase in congestion, unless charges and taxes were to rise faster than incomes. Governments would probably consider the case for a higher investment programme. In any event, we believe that governments should explain publicly the combination of investment, charges and congestion that they have chosen, and the reasons for their choice.

Table 12.2
Summary of capacity and charging options. All the figures are illustrative

Capacity option	Do nothing after 2010		High provision	Projecting the 10 Year Plan		Inter-mediate
Annual increase in motoring charges	0	6%	0	2.2%	4%	2.2%
Point on Figure 12.1	A	B	C	D	E	F
Capacity increase	small	small	40-50%	25%	25%	30-35%
Average speed kph 2001	80	80	80	80	80	80
2031	65	80	80	73	80	80
2050	50	80	80	70	80	80
Cost in 2031 (£ billion)	<1	<1	15-20	3.5	3.5	8-12
Cost in 2031 (% of GDP)	<0.1	<0.1	1	0.2	0.2	0.5

We would hope there could be enough investment to limit the growth in motoring charges, including taxes, to not more than 2.2% pa, that is, broadly in line with income per head. Initial predictions by CfIT[11] suggest that, in 2010, congestion charging would not be needed on more than about 10% of the network and then not for the whole day. We would like to believe that investment – mainly in roads, but also in public transport – could continue to keep that part of the network on which congestion charges are needed to restrain traffic to roughly that level. For that to be possible there will need to be enough cost-effective and otherwise acceptable schemes. Periodically the Government would need to review how likely it is that such an aspiration can continue to be achieved. Depending on the quality and cost of the schemes available, the Highways Agency might be able to reduce the proportion of its network with charges to restrain traffic to less than 10%. If it cannot do so, the options available – in particular the balance to be struck between higher congestion charges, tolerating more congestion, and higher investment would need to be reviewed.

Some people might prefer something more like our High Option where:

- congestion generally would not get worse
- the investment programme would be much more substantial, and
- except to control high congestion in specific locations, there should be no need for annual increases in congestion charges. It might be argued that with such a high and sustained level of investment, road-users might need to expect motoring taxes and charges to rise by as much as 4% a year to pay for it.

Many road schemes currently not in the build programme show very high economic returns

Investment appraisal

Increasing levels of congestion and its cost in lost time mean that road improvements directed to relief will usually offer high benefits in relation to costs and can readily show very high economic returns under the established appraisal procedures. In reviewing the road schemes under consideration in 1998 the Government published ratios of benefit to cost for 68 schemes[12] which all showed positive benefits. We are encouraged therefore to believe that there may be enough schemes with the high returns generally expected currently in the pipeline, but needing to be implemented.

Where meeting acceptability criteria requires higher cost, particularly where tunnels or other special measures are used, these returns will be less but the full environmental and social benefits realised should be brought into the appraisal.

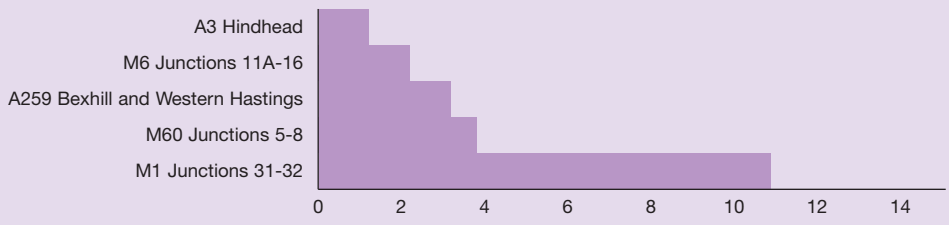
We believe it important that the Highways Agency should look at least 30-40 years ahead in forecasting the likely build up of congestion on the whole network, so that it may design and progress timely and, as far as possible, environmentally acceptable schemes, given the very long lead times in the process.

Other issues

The size of the strategic network

The Government should review the extent of the strategic network. The distinction between the motorways and trunk roads for which the Government is responsible and the network of principal roads, those A roads which are the responsibility of local authorities, is historic and to some extent arbitary. Growing traffic pressure makes it important to develop more active road management. Use of new technology will increasingly require single point responsibility for development, implementation and operation.

Figure 12.3
Benefit cost ratio of some major road schemes



Source: DETR, Understanding the New Approach to Appraisal, 1998

These concerns suggest more integrated management of the more important roads, and that these should include some of the local authority managed principal A roads which frequently serve similar purposes to the government managed trunk A roads. We believe that the strategic network should be expanded in this way with responsibility for management assigned to a single dedicated organisation whose priorities reflect the importance of an effective national road capability. The current role of the Highways Agency essentially matches this criterion. We believe that this change would allow framing and addressing of objectives appropriate to the progressively more critical role of the wider strategic network.

Figure 12.4
2000 stress level on the trunk road network

Source: Highways Agency

Programme delivery

Delivery of the programme of works envisaged in Projecting the 10 Year Plan or comparable programmes will require:

- a sustained high level of application
- consistent funding, guaranteed subject to demonstration of value for money
- appropriate levels of skills and expertise, and of construction capability
- a comprehensive and detailed programme scheduling individual projects with the aim of ensuring that problems are effectively addressed at the appropriate time.

The inefficient cycles of activity which have characterised recent decades must be avoided. A first requirement must be a continuous, comprehensive review assessing the performance of the network into the future in detail, based on monitoring and forecasting updated throughout the period. It can identify when and where problems are expected to arise and how best to tackle them, so as to establish priorities and schedule preparatory work.

This scheduling should aim at using resources effectively and be based on economic appraisal incorporating as many of the relevant factors as possible, including those relating to the environment. At the same time a critical aspect of project design should be to minimise environmental disbenefits so that success in this can be reflected in appraisal.

The Multi-Modal Studies will provide many initial elements of the new programme but momentum must be maintained when they are completed. To do so, the comprehensive review process outlined above should be initiated immediately. Acquiring the necessary planning and construction resources and skilled personnel involves long lead times and should be put in hand quickly. None of this will be simple and the review process must be adequately resourced and strongly led, with firm backing from Government.

The present slow process of identifying and preparing road schemes entails an inefficient deployment of resources. Some attempts are being made to speed it up but more is necessary if resources are to be used efficiently to deliver improvements when and where they are needed.

Independent monitoring of network condition and performance

The road system is operated as a public utility and needs an authoritative independent assessment

The road system is operated as a public utility but, unlike the majority of utilities, its performance is not monitored by an independent body. Extensive concerns about condition and performance, and about value for money spent on roads management, suggest the need for authoritative independent assessment to highlight concerns to network managers. The main job of an independent body would be to set standards within overall government policies and monitor performance. A major element of its work would be identifying and bringing to attention particular sections of the network where condition, safety or environmental performance were deficient, and monitoring the progress made with putting them right.

Conclusions and recommendations

Past under-investment and failures to deliver roads policies have resulted in severe congestion on some important parts of the road system. This is causing serious economic and environmental damage. The shortage of capacity has been mitigated by drivers adapting their travel to less congested routes or times, but as congestion spreads the scope is diminishing.

The Government should give high priority to increasing the capacity of the strategic road system by traffic management and, where needed, new construction. The 10 Year Plan has the right approach, but we are concerned that its implementation will be delayed either because road improvement schemes are not prepared and pressed forward quickly enough, or because the resources needed are diverted to other programmes.

The Government should press ahead with work on the application of new technology for road traffic in the form of vehicle to vehicle and road to vehicle communication. We do not at present know enough about the capabilities of such developments to be able to form a view of what their contribution might be. Work on the possibilities should cover all aspects, including legal, operational and institutional issues. Strong central commitment will be needed to apply this technology to full effect.

New road capacity will need to be provided by a continuing programme to widen existing roads, and build bypasses and some new routes after the 10 Year Plan period. Otherwise, congestion will increase steeply. The Government will need to decide the best balance between investment to increase capacity and charges to manage demand. We examined a number of options for investment, ranging from doing nothing after the 10 Year Plan is implemented to a high investment option designed to increase the capacity of the strategic road network sufficiently to prevent congestion getting worse than it is at present.

On the basis of our projections and our analysis of the options, we recommend that the future road improvement programme should be on a continuing scale at least as great as in the 10 Year Plan. With this level of investment, we estimate that there would be some increase in congestion unless charges rose faster than incomes. If this is right, Governments will probably consider the case for a bigger investment programme. We recommend that they should explain publicly the broad combination of investment, charges, and congestion which they choose.

We recommend a new approach to road design and construction:

- the greatest attention should be given to designing roads so that they fit as unobtrusively as possible into the environment, with more use of tunnels, cuttings and other measures to avoid severance and damage to surrounding areas, and minimise noise
- the Government should ensure that there are enough financial and technical resources to carry out a sustained programme at the required level
- statutory processes should be speeded up so that, without curtailing objector's rights, delay and uncertainty are minimised
- increased compensation for people whose property is affected.

Clear targets should be set for the performance of the road network in terms of service levels, safety, and environmental effects. An independent body should be created to set and monitor these standards.

It will be essential to make the best use of all the main roads and manage them coherently. So the strategic network should be extended to include some of the principal A roads: it should not be reduced by transferring roads to local authorities.

In due course, the DTLR should make available its traffic model to enable alternative scenarios to be investigated in the same way as the Treasury provides access to its model of the economy.

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4 RAC Motoring Services (2002) *RAC Report on Motoring 2002* (Feltham: RAC Motoring Services) page 45, Figure 4.11

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6 Highways Agency (2000) *Strategic Roads 2010, Highways Agency 10 Year National Roads Strategy*

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13 Influencing demand

- Some form of restraint on demand for road travel will be required
- Restoring the fuel duty escalator would be unacceptable as it is unfair and ineffective
- A flexible charging system varying charge with level of congestion is required to keep congestion down
- Extra revenue from charges must be for transport improvements and reducing fuel duty not for raising general revenue
- More work is needed on technology, diversion, social exclusion, civil liberties and public acceptability
- Without charging, access to the network or car ownership would need to be restricted or highway capacity would have to be increased substantially

Road congestion is already worse here than in the rest of the EU and will become more severe over coming decades. There is no agreed figure for its cost. But it is clearly high and damaging to the economy and environment, and probably also, in time, in political terms. With existing policies we expect the economic cost to grow faster than GDP, by about 4% a year, as the value of time rises with GDP, traffic volume increases, and speeds fall as a result. We believe it is urgent to face up to this mounting problem now and to work out a staged but active response to manage demand. Realistic appraisal of the future increase in road capacity is needed for this. As chapter 1 showed, governments since the war have not been able to provide either.

We do not believe that existing policies meet this need. These include road taxes, parking controls and limited road charging. The Transport Act 2000 added two new powers for Local Authorities (LAs) to impose charges on private non-residential parking and on road use in order to reduce congestion; and to spend the revenue on transport. The Government is planning to introduce by 2005 or 2006 a distance-based charging scheme for lorries but this is not aimed primarily at congestion.[1]

The 10 Year Transport Plan assumed there would be 12 local authority parking schemes and 9 local congestion schemes by 2010. Although the London congestion scheme, which we hope will succeed, will come into effect in 2003, it is uncertain whether these assumptions will be fulfilled. Even if they are, we expect congestion to worsen after 2010, if not before. We believe that a much less tentative and permissive approach to road charging will be needed. We present evidence in chapter 14 that this is becoming acceptable to the public, given certain conditions.

Congestion partly arises from the gap between what cars or lorries pay to use roads and the costs which an extra trip imposes on others

There is no painless or ready-made solution. But congestion partly arises from the gap between what cars or lorries pay to use roads and the costs which an extra trip imposes on others. These 'marginal social costs' are mainly congestion (see Table 13.1). Congestion would be reduced if journeys whose full costs exceed their value to the people making them, were no longer made. This would make more efficient use of the road network.

Fuel duty and VAT on it can be thought of as a form of charging. But charges need to be at levels equal to marginal social costs including congestion which varies sharply by place and time. Charges can be differentiated to recognise this far more than fuel duty can. In the last chapter it has been useful to set out illustratively the rates of growth in charge which might be needed to prevent worsening congestion assuming several different options for increasing road capacity.

Much of this argument is widely accepted in principle in the UK and the EU. But translating it into an acceptable and workable scheme for differentiated road charging challenges the capabilities of any government in analysis, implementation and long term political decisions.

As well as overall public acceptability, the issues include: the basis of charges; possible conflicts between transport and revenue objectives; the use to be made of revenue including possible tax changes; diversion of traffic to uncharged roads; technology; and the division of responsibilities between local, regional and central government.

No scheme with differentiated charges is yet operating in any OECD country. In Europe several countries are working on plans for charging lorries. But the only country with comprehensive proposals for charging cars as well is the Netherlands.

Table 13.1

Costs of using roads – summary of estimates for 1998 in Leeds study
pence per vehicle km in 1998 prices and value

	Fully allocated costs		Marginal social costs	
	Low	High	Low	High
Congestion	–	–	9.71	11.16
Environmental costs (air pollution, noise, climate change)	0.73	3.10	0.51	3.10
Other*	2.61	4.10	2.10	2.79
Total costs	**3.34**	**7.20**	**12.32**	**17.05**
Total revenue	7.14	7.14	6.17	6.17

**'Other' includes: costs of capital, operating costs & depreciation for infrastructure, external accident costs, bus operating costs and VAT not paid by bus services.*

This chapter explains the Report's support for charging as a means of influencing the level of demand and its pattern in time and place; and discusses the main issues it raises.

Road costs summaries

A recent report from Leeds[2] which estimates costs and revenues from taxes, fares and other receipts in 1998. It uses two approaches:

- fully allocated costs (the total shared out between users), often called the cost coverage approach. Congestion costs are excluded from this definition
- short run marginal costs (those imposed by an additional road user on other road users and on the rest of society), called the economic efficiency approach.

Of total revenue, fuel duty is 4.42p and VAT on it adds 0.77p, making 5.19p together. VED adds 1.10p to fully allocated costs and 0.14p to marginal costs.

Revenue almost covers the high estimate of fully allocated cost and is about double the low estimate. But marginal costs, two thirds of which are congestion, are much higher. Even the lower marginal cost is well above the higher fully allocated cost and also above revenue.

Marginal costs vary widely for different categories of roads around the averages shown in the table; the range for congestion in the low column is 1.3 to 85.8p per km (for rural and major urban peak times respectively).

So the Leeds analysis implies that:

- the widespread saloon bar view that 'we pay enough in road taxes already' can be supported by figures based on average or fully allocated costs
- but the marginal cost figures, which are relevant to charging, are much higher and the gap will grow as congestion increases.

Existing policies to influence traffic

Taxation

Road fuel duties, including VAT on them, and vehicle excise duty were about £31 billion in 2001-02 or nearly 8% of total Government receipts. Table 13.2 compares this with other taxes, and with total public expenditure on roads.

Road taxes produce much more revenue than road charges might raise in the near future. If the assumptions in the 10 Year Transport Plan were fulfilled, the revenue raised by LAs from charging schemes would reach about £800m a year by 2010. The inter-urban charging variant mentioned but not included in the Plan would raise £1.5 billion. The charging proposals in the recent CfIT report[3] would raise £5.7 billion.

The revenue from road taxes is more than 7 times larger than public expenditure on roads. But although their primary aim is to raise revenue, the relative level of VED now reflects the 'track costs' which different vehicles impose. There has also been a progressive shift in tax from VED, a fixed annual cost, to fuel duties, which vary with vehicle use. Changes in VED and fuel duty have often been justified in terms of environmental effects (pollutants and greenhouse gases).

Table 13.2

Revenue and public expenditure projections for 2001-02

	£billion	% of total current receipts
Fuel duties	22	6
VAT on fuel duties	4	1
VED	5	2
Total road duties	**31**	**8**
Total road spending	4	1
Total current receipts	**391**	**100**
– of which: Income tax (gross of tax credits)	110	28
Social Security contributions	64	16
VAT excl fuel	55	14

Source: Pre-Budget Report, November 2001

Fuel duties are the largest source of revenue. An 'escalator', a policy of regular annual increases in real terms, was introduced in 1993. It started at 3% and was raised to 5% in 1994, when it was described as

'an essential part of…plans…to deliver healthy public finances…and…of the...strategy to return carbon dioxide emissions to their 1990 level…'

In 1997 Gordon Brown raised the escalator to 6% a year.[4]

At 6% the escalator offset half of the historic growth rate of nearly 3% a year in traffic: '…since duty represents of the order of 80 per cent of the pump price this policy would have offset the 3% or so annual growth due to rising real incomes by about 6 x 0.8 x 0.3= 1.4%.'[5] This was a substantial measure of demand restraint. But after the fuel protests in 2000, the escalator was suspended and the Government claimed that traffic does not respond to fuel prices. This policy change seems unlikely to be reversed soon.

In summary raising revenue remains the main purpose of road taxes. But they have also been used for environmental reasons. The policy reversal on the escalator means that annual increases are no longer restraining the growth of traffic.

Parking controls

Since 1958 controls over on-street and off-street parking have been the main instrument available to local authorities for influencing demand. They are partly regulation and partly charging.

On street parking controls include:

- prohibitions or restrictions
- charging and time limits for meters
- permits and charges, confined to household or business residents
- park and ride schemes, combining charged parking spaces on the outskirts of towns with frequent buses to the town centre.

Off-street parking. The levy on private non-residential parking would provide an incentive either to employers or to employees, depending on who bears the cost, to sharing cars or minibuses. The initial interest among LAs does not seem to have been sustained, perhaps because of anxieties about local competitiveness. So far only Nottingham has firm plans to introduce a levy scheme in 2004.

Parking controls are flexible, can be combined with other measures to make a package, and have sizeable effects. But they do not discourage though traffic and may encourage it.

Parking policies will remain an essential instrument, often sufficient where congestion is not serious

Parking policies will remain an essential instrument, often sufficient where congestion is not serious. There may well be scope for extending the focus of park and ride schemes beyond the town centre: both to other nearby destinations (e.g. big sites of employment, education or entertainment) and to longer journeys by bus, coach and rail. Parking for motorbikes and bicycles also probably needs improvement.[6]

Charging for road use

Charging for road use has been much analysed, since the 1964 Smeed Report on Road Pricing.[7] It concentrated on congestion, though charges can also be used in other ways.

Costs and benefits. Charging schemes involve costs and losses and these need to be compared with the benefits before they are adopted. Costs include setting up, operation, and enforcement. The minority of road users who are priced off bear losses, whether their journeys are 'suppressed' or 'diverted' to other roads, times or modes. Over time these losses will be reduced by adaptation and innovation.

When charging reduces congestion, efficiency should improve. The majority of business and individual users who pay the charge will benefit from time and fuel savings produced by higher speeds and reliability. The benefits of increased efficiency will be diffused through the economy.

Table 13.3 shows that the CfIT charging proposals produce benefits from time savings and reliability greater than the losses of the priced off, but these net benefits are smaller than the revenue from charges. This difference mainly represents the loss of 'consumer surplus' by charge payers.[8]

The difference should be more than outweighed by the benefits from spending the revenue either on reducing road taxes or on transport improvements.[9]

Present policy. Charging is scarcely used in the UK, except for a few estuarial crossings by tunnels or bridges and the privately financed Birmingham North Relief Road (M6 Toll) now under construction. Charges in these cases are designed to remunerate the capital invested, not to reduce congestion.

The Government's guidance to LAs says the focus of charging schemes should be on reducing congestion. But it leaves open whether raising revenue, as well as congestion objectives, can be a criterion for setting charges. This potential conflict of objectives needs to be watched when the DTLR decides whether to approve proposed schemes.

Road user charges for lorries. The Chancellor of the Exchequer confirmed in the Budget of April 2002 that such a scheme would start in 2005 or 2006, using satellite technology and would be distance-based.[10] The original consultation document had some interesting features:

A lorry distance charging scheme should start in 2005-2006

- 'the government would ensure that costs would not increase for the UK haulage industry…through reductions in other taxes…'
- the charge for lorries could be administered automatically either through microwave or global positioning satellite-based technology. It would take about 4 years from legislation to set up
- paper-based administration could cater for infrequent users unwilling to install electronic equipment
- no charge was mentioned for the UK but figures of 20 p and 9-12 p per km were quoted for Switzerland and Germany
- it might be possible later to differentiate the charge to help tackle congestion.

The proposals for distance-related charging of lorries in the UK, Germany and Netherlands will stimulate a debate about charging and development of the technology for it. The Netherlands proposals for a 'pay per km' charge for all vehicles including cars will also do this.

Pay per km – Netherlands proposals in a progress report for Parliament in 2001

A charge will be levied for every kilometre driven in Holland by all Dutch registered vehicles. There will be no overall increase in central government revenue. The charge will replace:

- the annual tax on vehicle ownership
- the 'Eurovignette' for lorries
- a quarter of the purchase tax on vehicles
- and 18% of fuel duties.

The first three of these are lump sum taxes.

The charge per kilometre will be the same initially for all roads but will vary with vehicle type and weight, fuel, emissions and a provincial surcharge. The average for a petrol driven car of 1100 kg will be about 2p per km. More than half of all car owners will be better off.

The full switch from fixed taxes to a distance-based charge will reduce traffic, emissions and hours lost because of congestion. In Holland fixed and variable taxes produce more revenue than fuel duties. In the UK fuel duty plus VAT on it is more than 6 times the value of VED.

All vehicles will be fitted with a 'Mobimeter' between 2004 and 2006. It will register the distance travelled and transmit the charge monthly to the tax authority or a private service provider. The mobimeter, excluding installation and VAT, will cost £60-90 per car.

The technology will allow the charge to be differentiated later to cover congestion.

The Government will define an open standard for the mobimeter. Companies will be encouraged to build in capacity for additional services. The scope for these may induce supplying companies to bear part of the cost.

Strengthening policies to influence the level and pattern of demand

Medium term charging proposals

The broad pattern of charging we propose for the medium term would be similar to those in the CfIT report. Both are aimed at controlling congestion through differentiated charges based on the marginal costs estimated in the Leeds study. The system would in principle apply to all roads, though much of the network would have a zero charge. CfIT proposes that charges would only apply to 10% (in length) of the motorway network and other trunk roads…[and] only at times affected by congestion and that 63% of all 'travel' would be free. It would also eventually cover all vehicles, except perhaps those that never use charged roads or can rely on a paper based system for occasional users as in the Government's lorry proposals.

Road capacity or fuel duty cannot be moved enough to avoid charging

The shape of the CfIT proposals is summarised in Table 13.3

Although the broad shape of our proposals would be similar to CfIT's, their absolute level might not be the same. The level required for a given congestion outcome will depend on how far road capacity can be expanded and on the level of fuel duty. The larger road capacity and the higher fuel duty (in real terms), the lower the required level of charges. For example, if the escalator were restored at 2.75% a year or slightly below its original level, the growth of traffic might be halved. But in practice we do not believe that road capacity or fuel duty can be moved enough to make it possible to avoid charging. The initial level of charges will be higher, other things being equal, the longer the delay before they are introduced.

Charges would clearly need to be high enough to reduce congestion noticeably, perhaps enough to offset the rise in travel times that would occur over the next, say, 5 years if there were no road investment, or over a longer period if investment continued. The charges would need to be raised enough to offset the traffic induced by any reductions in fuel duty.

We believe that the UK should aim to be sure that it could introduce widespread charging by the end of this decade.

The new powers the Government has given to LAs were a big step forward. The Government has also done two things that would help to extend charging beyond LA areas to interurban roads. The DTLR has commissioned trials to test whether the technology used for charging by LAs would be 'inter-operable' with schemes for charges on interurban roads, so that diversion could be controlled and motorists would face a single billing system. Secondly the DTLR commissioned 'multimodal studies' in over 20 areas.

Two studies so far have made recommendations on charging.

Because of several weaknesses in current policy, we do not believe we are now on course to meet this aim:

- it is uncertain how much use LAs will make of their new permissive powers, which may depend on success of the London scheme, and the government lacks levers to promote LA activity
- there is no policy commitment by Government to introduce charges on motorways or other roads within the responsibility of the Highways Agency
- it is unclear whether the split of responsibility between central and local government for roads could deliver the comprehensive charging system we favour, particularly while the Government distances itself from the subject.

Table 13.3
CfIT charging proposals

	England	London	All con-urbations	Motorways	Rural
Charge: p/km	2.6	16.6	3.5	2.2	0.6
Change in traffic: %	-4.2	-13	-7	-2.6	-2.4
Revenue: £ million	5,666	1,838	882	1,140	494
Net benefit, before collection: £ million	2,031	1,017	235	363	32

Note: table omits other cities, towns and urban roads where revenue would be £1,310m and net benefit £384m

A programme of exploratory work

If the Government is unwilling at present to back charging of the kind which we, like CfIT, recommend, there is nonetheless a pressing case for exploratory work, to ensure that if such a decision were taken later, it could be implemented without excessive delay or cost. A high level political lead is probably needed to get this work done. A public statement about it need not involve any commitment to introduce charging. It would mean acknowledging that mounting congestion will become acute after 2010 if not before; and that road charging is a sufficiently promising option to justify a programme of work. It would cover difficulties as well as advantages and any decisions would depend on its results. There would be a deadline for completion it, preferably not beyond the end of 2003.

The presentation of the 10 Year Plan, said that congestion would fall slightly by 2010 and implied that it should be manageable without adding to existing policies. But this small departure would match most people's experience and expectations and could well be welcomed.

The exploratory work would cover:

policy questions such as:

- the objectives of charges and criteria for setting them
- whether they should be uniform (as initially in Holland) or differentiated by time and place from the start, to reflect congestion
- uses of the revenue from charges and the future of road taxes

implementation:

- timescale
- technology, its cost and dissemination
- collaboration with manufacturers and EU
- review of local and central government roles and content of legislation.

broad lines of presentation, consistent with the above, including complementary policies.

Without attempting to anticipate this work, some key arguments and promising approaches are outlined below. These aim at clarity and coherence and ensure that charging will not be a bonanza for the Treasury and a rip off for motorists.

Policy issues – charges and congestion. The aim of the charging system would be to reduce congestion (though some local charges may have other purposes for example to service the capital invested in new high quality roads such as the M6 Toll or to protect beauty spots). The differentiated pattern of charges and the length of uncharged road would demonstrate this aim. National revenue needs could be pursued as now through road taxes even if the taxes were reduced when charging comes in.

Congestion charging would need to be raised or lowered according to the desired level of congestion

The level of charges in different places and at different times would be based on marginal costs – mainly congestion – as estimated in the Leeds study. This should produce the optimum pattern of road use and congestion in economic terms. If this is too abstract to be saleable politically, broad targets – close to the expected effect of such charges – might be set for reducing congestion and increasing speed and reliability, perhaps announced by politicians. The criterion for setting charges would then be what was required to reduce congestion to the target level. In either case the setting of specific charges would be a judgement, which would initially be highly uncertain, but it would in principle be evidence-based and might best be done by technical experts. A further safeguard against excessive charges might be to set up a regulator.

Congestion charges might need to be raised (or lowered) in different places or at different times, if congestion turned out to be above the desired level (or below it). The need to change the initial charge might reflect simply a misjudgement, or the build up of congestion over time, or the effect of investment to remove or at least to improve a bottleneck. Congestion charge rates would not necessarily be a ratchet and virtue would be made of this.

Policy issues – uses of congestion charging revenue and future of VED & fuel duty
Although congestion charges would sometimes go down, in general revenue would probably rise over time, as a result of economic growth, the difficulty of increasing road capacity sufficiently, and the estimated elasticity of demand. Either there would be increased traffic at a given congestion charge rate or the rate would be raised over time to maintain desired congestion levels. The revenue, net of start up and operating costs, from inter-urban charges would go to the central government.

There was a pledge in the 10 Year Plan that:

'…..if we decide there is a case for introducing charging on congested parts of the inter-urban network, the proceeds would be used to benefit transport'. This rules out using the money for tax cuts or spending outside transport. The choice is between:

- revenue neutrality through cutting road taxes
- a measurable increase in transport spending; or
- a mixture of these.

In all cases the budget balance would be unchanged by introducing charging but in some cases spending and revenue would both be higher. We favour the last - mixed - option.

Revenue neutrality. One great advantage of this, as CfIT has shown, is that it demonstrates charging as a measure of tariff reform. Motorists as a whole do not suffer; those who now pay too little pay more and those who now pay too much pay less. Tax reductions would, however, only be perceptible once charge revenue is significant compared with existing taxes.

One option would be to cut VED. This would be worth more proportionately to poorer car owners with lower mileage. But it would probably also reduce the tax concessions designed to influence purchasing decisions.

Congestion charging should be used to cut road tax and increase transport spending

Another option would be to cut fuel duty. Table 13.1 shows that with fuel duty at 4.42p/km there would be room to cut it without taking it below total environmental costs (high case 3.1p) or for climate change alone (high case 0.6p). These might be seen as a minimum for fuel duty.

Lower fuel duty would result in more traffic and so congestion charges would need to be higher than if fuel duty were unchanged. If this point is ignored, estimates will either overstate the effect of given charges on congestion and/or understate the net cost for motorists paying congestion charges. If charges were raised to leave unchanged the total cost of using congested roads, the effect would be that only those who pay no or low congestion charges would get any net benefit from a fuel duty cut. But those who live and drive in the country and others who use uncongested roads would benefit. This would reinforce the logic of congestion charges. So if a tax cut could be afforded, lowering fuel duty seems at present to be preferable to lowering VED, though this might change in time.

Spending. If all the congestion charges revenue went on cutting road taxes, none of it would be available for transport expenditure to help those who are 'priced off' their preferred roads and other losers.

We see a good case for using some of the charge revenue to make alternative routes, times of travel or modes either better or cheaper. This cannot be done comprehensively or precisely, but some offsetting measures are desirable.

Some of the revenue could also be used to expand the capacity of the charged roads, where feasible, which might allow specific charges to be lowered. This will be particularly important when there is no alternative to the charged road or only one which is very much worse.

There should also be spending measures, partly channelled through LAs, that help lower income car owners and the overlapping categories of the disabled, the old and the poor, whether or not they are directly affected by charging. 63% of households in the lowest equivalent income quintile do not have a car. But over 70% of the miles travelled by members of these households are in a car or van and only 17% of their travel is on buses, rail or other public transport.[11] We do not know, however, what proportion of their car travel would be on charged roads.

Spending measures may not offset the effect of charges on public sector workers. But this is part of a wider problem, probably best dealt with by their employers. Spending can also lower fares or increase the frequency of public transport services; provide better information and interchanges; remove obstacles to less agile pedestrians and people in wheelchairs wishing to use stops and buses; pay for more taxicard and dial-a-ride schemes for the disabled who cannot use public transport; and for exemptions from charges for tightly defined categories, perhaps based on criteria for mobility allowance.

Implementation – technology, collaboration

Technology. Technology is moving very fast in this field. The technology could be based either on detection of vehicles as they pass microwave beacons; or on self-charging by means of position fixing using the GPS satellite or some other flexible system, which would need more sophisticated in-car equipment. In each case appropriate billing/payment and enforcement arrangements would be needed.

The former technology would involve less delay, risk and cost. With the microwave system it might cost around £1.5 billion to equip all cars, motorways and the back office, compared with about £10 billion to equip all cars for self-charging with GPS or equivalent system if the cost per car were £400. The latter would be better able to deal with changes of all kinds from correcting initial mistakes (on charges, areas, or diversion) to progressive extension of charging over the network. Charges and in particular the place and time at which they are imposed could be readily varied without changing the roadside infrastructure. And the GPS and communication capability open the way to a range of added value services.

GPS technology offers many advantages but there may be alternatives

But there are now signs that, with development, it may be possible to have both cheapness and flexibility by using the GPS approach with an off-vehicle communication process. For example the in-car unit would use GPS information to calculate the charge and then score it against a smart card. Enforcement would rely on inspection from fixed or mobile points sufficient to convince road users that cheating would be detected and lead to unacceptable penalties.

This approach would only be possible if vehicle identification and the link to the registered vehicle keeper were efficient and reliable. DTLR is working on Electronic Vehicle Identification (EVI) techniques. There is also a general move to tighten up VED enforcement and reduce the current evasion rate of about 4% worth £180 million a year. The Driver and Vehicle Licensing Agency (DVLA) is already aiming to cut evasion by a quarter. EVI could cut it by a further half, as well as improving DVLA's database, particularly addresses.

A system on these lines should protect privacy unless a vehicle does not have a smart card or credit units. The cost per car of the basic system might fall below £100 – less than a quarter of the figure quoted earlier – though vehicle owners would be able to buy more sophisticated devices offering better services.

Prof. Peter Hills has suggested that a way of distributing the basic GPS or similar receiver would be for the DVLA to supply it, when vehicle owners pay their annual VED, instead of the existing licence disk. Some free credit units could be included as an incentive. This would be part of the start up costs of charging, which would be recovered as revenue from charges rises over time. Vehicle owners would also need to buy a smart card compatible with the GPS receiver, which might cost about £5-10.

Although there are many uncertainties about precise technology, cost and timing something on these lines sounds very promising.

Collaboration with manufacturers and other countries. GPS navigation devices can now be bought on many new cars but they are not designed for road charging. We recommend the Government initiates collaboration with manufacturers of vehicles and charging equipment and also with the EU (as with 'Powering Future Vehicles'). The aim would be universal fitting of some form of charging and/or identification equipment on all new vehicles, perhaps helped by a whole vehicle type approval under the auspices of the UN ECE. Approval might not require a complete device, but could oblige manufacturers to provide a standard socket for the charging unit or to include a wiring 'bus' which makes it easier to add new features and would cut installation costs too.

This initiative would be aimed at reducing delays and costs, after a decision to introduce charging had been taken, by agreeing minimum standards and perhaps standardisation. It would require a political lead and might be announced with the proposed programme of exploratory work.

Presentation
The exploratory work would feed into presentation and draw on several positive elements in this outline.

Some of these points might be included in a Government Pledge on Road Charges.

Pledge on national road charges

1. The aim of charges will be to reduce congestion. So they will vary by time and place and there will be no charge on most roads.

2. The level of charges will be based on estimates of the cost which an extra trip imposes on others ('marginal external costs' which are mainly congestion). Targets may be published by politicians for reducing delays, journey time, or variability.

3. Charges will be set in a transparent and evidence-based way by technical experts and/or be set or approved by a regulator.

4. Charges will be changed at intervals, upwards if congestion is higher than the target and downwards if it is lower.

5. National revenue needs will not be a criterion for charges.

6. Loss of charge revenue will be ignored when investment proposals for easing bottlenecks are assessed.

7. Revenue from national charges will go to the government. It will be used partly for extra spending and partly for reducing road taxes, probably fuel duty, which will benefit users of uncongested roads.

8. Privacy will be protected unless a vehicle using a charged road has no means of payment.

Congestion in the longer term
Wide extension of congestion charging on the inter-urban network and, through LA schemes, on major urban roads, will not by itself be a final solution. It is likely that the pressures making for congestion will build up again. Congestion charging to manage demand will be an essential new strand of transport policy and the level of charges will probably need to be raised over time to match the increasing value put on time saving (and perhaps even beyond that). Without charging, increasingly strict and burdensome regulation of road use (or even car ownership) may be introduced to deal with mounting congestion.

Other strands of policy will include improving public transport and investment in infrastructure, based on transparent decisions and financed by part of the congestion charges revenue.

Conclusions
The Government has argued that the 10 Year Transport Plan will allow road congestion to fall slightly, implying that it is manageable without new policy decisions. We believe there will be mounting congestion on the roads in coming decades, certainly after 2010 if not before.

A passive response would carry a heavy economic cost for business, households and the economy as a whole. The cost of congestion is likely to rise faster than GDP by about 4% a year.

It is feasible to reduce this growth, provided that the need to manage demand with widespread road charges is accepted.

Fuel duty can be seen as a form of road charging. But it cannot be differentiated enough by time and place to deal with congestion efficiently. Since the escalator was suspended, fuel duty no longer restrains the growth of traffic caused by economic growth. Parking controls remain essential. LAs have new powers to tax private non-residential parking, and there is considerable scope for widening the focus of Park & Ride schemes. Despite this, taxes and parking policy will not be enough.

The case for road charging, based on marginal social costs, has been made since the Smeed report in 1964. It is widely accepted in principle by business and by the EU. Like CfIT, we believe that differentiated charging is the key to managing demand and that the UK should aim to be capable of introducing it by 2010 as an essential new strand of transport policy.

The larger the level of road capacity and the higher the rate of fuel tax, the lower the level of charges required for a given congestion outcome. But we do not believe that road capacity or fuel duty can be moved enough to avoid the need for charging. Other things being equal, the initial level of charges will need to be higher, the longer the delay before they are introduced.

Devising an acceptable and effective scheme for widespread charging challenges the capacity of any government for analysis, implementation and long term political decisions. No such scheme is yet in operation in any OECD country. Several EU countries plan to introduce distance-related charges for lorries. But they are not aimed at congestion. Only Holland has proposed charging, initially undifferentiated, for cars as well as lorries.

Recommendations

Although we do not have answers to all the issues, we recommend that:

- The Government's starting point should be recognition that congestion will become an acute problem after 2010 if not before. By themselves the LAs' new charging powers are unlikely to be a sufficient addition to traditional policies; and the Government may have overestimated the impact of the whole 10 Year Plan on congestion.
- If the Government does not wish to commit itself to targeted national road charging now, it should say that road charging is a sufficiently promising option to justify an urgent programme of exploratory work, covering difficulties as well as advantages. A timetable should be announced for completion not later than the end of 2003.
- The content of the work programme should include the issues listed in the chapter; the policy questions about the basis for charges and their objective, the use of the proceeds; implementation, including timescale review of roles of central, regional and local government, content of legislation and the choice of technology and collaboration with manufacturers and EU countries.
- A Ministerial statement on these points could bring out the element of trial and error in LAs' schemes for congestion charging and the need to treat errors as the source of lessons for corrective action (e.g. revising the initial charge level or charging area) and for new or extended LA schemes; and announce that DTLR would favour LA investment proposals whose benefits would be enhanced by sound local congestion schemes; or that it would match the revenue from approved LA charging schemes pound for pound; and confirm the need for 'interoperability' between LA and other charging schemes.

Subject to the proposed exploratory work, our recommendations are that a national targeted scheme for charges would be most likely to be acceptable if:

- They were not based on national revenue needs but on congestion costs and objectives in an evidence-based and transparent way (though there could also be local charges of other types). A regulator of charges may also be needed.
- Charges could go down (as well as up) if actual congestion were lower (or higher) than objectives; bills are calculated using information from a GPS or equivalent system and the options for payment include a smart card. The technology would need to be flexible enough to cope with errors in the design of schemes and with unforeseen diversion. The system would in due course apply to all vehicles. Some delay to get this flexibility could be accepted, though fortunately its cost would be lower than originally estimated. Privacy would be protected unless a vehicle had no means of payment.

- The proceeds of charges were used partly on spending to tackle congestion in hot spots, to make alternative routes, times or modes of transport better or cheaper and to help the socially excluded with their transport problems; and partly, when charge proceeds build up sufficiently, on reducing fuel duty which will give net benefits to those who use uncongested roads, notably those who live in the country.
- If differentiated charging were in the end to prove unacceptable, it is likely that increasingly strict and burdensome regulation of road use (or even of car ownership) would have to be introduced. The nature of this alternative to charging should be put across to motorists.

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13 Influencing demand


[SPACE 1]
THE MOVING GALLERY

14 Public acceptability

- 83% of motorists would find it very difficult to adjust to a lifestyle without the car
- Historically motorists have opposed congestion charging or tolls
- Today most would find road tolls acceptable if there were equivalent reductions in fuel duty or as part of a package of better roads, public transport and traffic management
- Only 22% of drivers believe that tax on fuel is a better way of restraining traffic than a charge or toll for using congested roads
- 60% believe that it would be fair to tax motorist according to the amount of time they spend on congested roads
- 51% of motorists would like to see money from tolls spent on better roads and road maintenance

14 Public acceptability

For any package of polices to work they must have public backing. Therefore public acceptability is vital to the political process. Past surveys have indicated that the motorist has been reluctant or indeed hostile to the introduction of road tolls or congestion charging. Indeed in the past such policies have been dubbed a 'poll tax on wheels'. However, as congestion worsens there are signs that the motorist is becoming more amenable to change.

The motorist is often portrayed as a subspecies belted into his or her car 24 hours a day. In fact the average motorist spends less than 1 hour per day in their car. However, the motorist is not just a motorist. Motorists are concerned about the environment, safety, walking, cycling and provision of public transport. Environmentalists are often motorists. Motorists are often environmentalists. Motorists have children so are concerned about air quality, road safety and school buses.

As discussed elsewhere car ownership is lower in the UK than most European countries but is set to rise further. Previous work for the RAC Foundation has identified high car dependence in the UK.[1] However, for many people the word dependence does not accurately describe their perception of how car use helps them to resolve constraints of managing with young children, heavy shopping, or fear of crime. Rather they see cars as providing independence with advantages of privacy, enjoyment of control, real financial savings (and some illusory ones) and indeed pleasure in performing active driving tasks. In general terms the research found at one end of the scale a minority of journeys, about 20%, which must be made by car. At the other end some 20% of car journeys could quite easily be made by other means. In between there are a whole host of journeys normally cheaper, quicker, safer or more convenient if made by car.

General attitude towards the car

Figure 14.1 shows that the vast majority of motorists would find it very difficult to adjust their lifestyle to being without a car.

Car dependence is only one side of the equation. What does the average motorist think of public transport? Does the average motorist use public transport? Various sources show the reality that many motorists never use public transport.

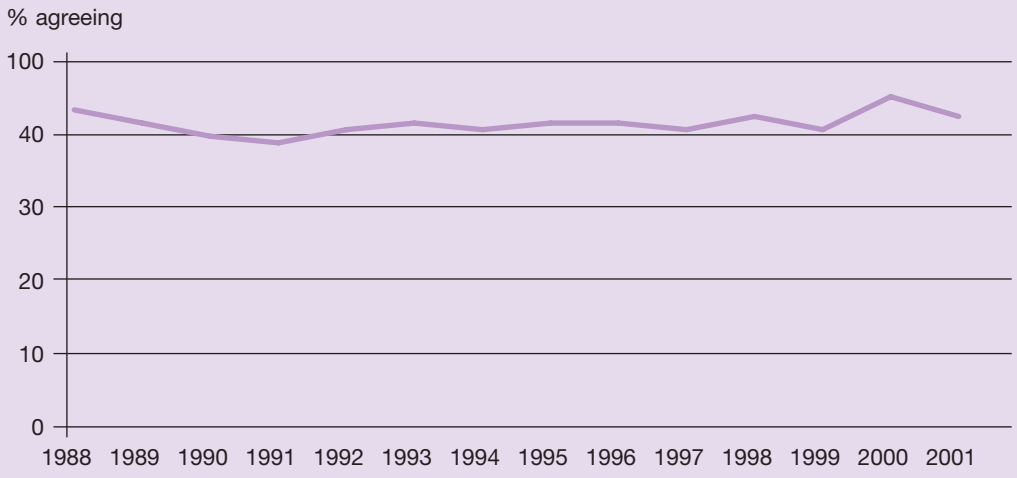
85% of passenger travel is by car and taxi.

Only 8% travel by public transport (outside London).

85% of motorists never use buses or coaches.

75% of motorists never use rail or underground.

Figure 14.1
I would find it very difficult to adjust my lifestyle to being without a car



Source RAC Reports on Motoring

Figure 14.2 on the use of public transport, shows a peak in September 1997 soon after Labour came to power when 46% agreed that they would use their car less if public transport were better. This was perhaps a sign of optimism that things could only get better. Unfortunately, this optimism had diminished by 2001 to 36% after Hatfield and other problems on the railways.

Motorists estimate that the sheer volume of traffic is the biggest cause of congestion (60%), followed by roadworks (18%) and poor quality public transport (10%) which means that more people have to use their cars.

The main contributors to congestion and how motorists try to overcome congestion are:

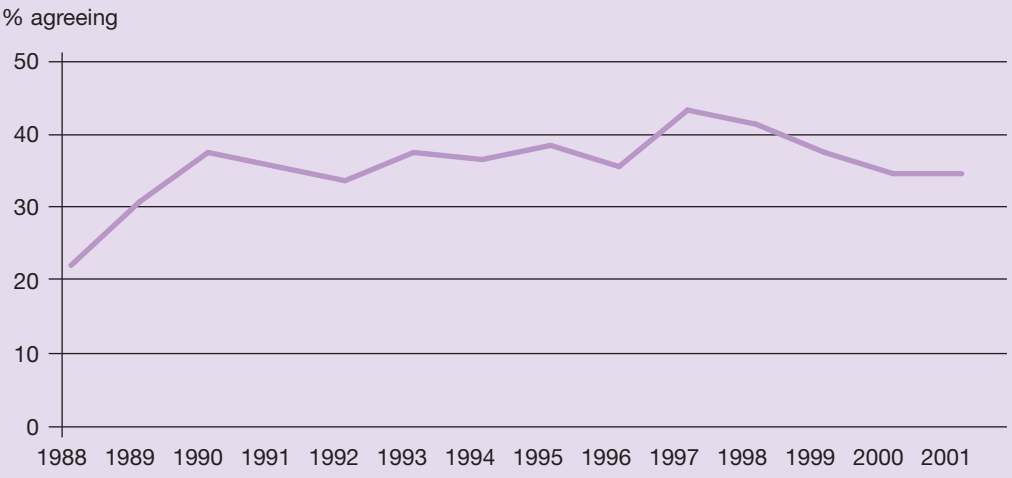
Main contributors to congestion:

- parents doing school run – 27%
- commuters – 17%
- lorry/van drivers – 8%
- old/young/company car drivers – 11%
- all of these – 28%
- none of these – 7%.

How do you personally overcome congestion?

- do not – put up with it – 29%
- leave more time – 24%
- choose different route – 22%
- change time – 18%
- give up the journey – 3%
- use public transport – 2%
- use other mode – 4%
- it's not a problem – 17%.

Figure 14.2
I would use my car less if public transport were better



Source RAC Reports on Motoring

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How could you change the way you use your car to reduce congestion?

- could use train or bus more – 22%
- could walk more – 22%
- reduce/combine journeys – 19%
- could get/offer lifts – 16%
- could use cycle/motorcycle more – 6%
- don't know – 30%.

Source RAC Reports on Motoring[2]

Motorists realise that congestion is a problem but when asked how they overcome it only 2% mentioned using public transport, only one in ten used 'an alternative to their car' and only one in five felt that they could use a bus or a train more.

As a result of the general reluctance of the motoring public to utilize public transport further we decided to carry out some opinion surveys to access public acceptability to the broad packages of measures which were emerging from our work. We needed to ascertain what levels of support there would be for road and public transport improvements, as well as attitudes towards congestion charging.

We commissioned NOP Automotive to survey 500 principal drivers in a Motorbus survey between the 8-10 March 2002.

Results from NOP Automotive Survey: CARS IN THE FUTURE

Figure 14.4
In the future would you be willing to pay tolls to drive in city centres?

	YES	NO
UK	43%	55%
Scotland	36%	62%
London	39%	61%
age 17-24	31%	69%
age 65+	47%	50%
social class AB	58%	40%
social class C2	38%	62%

Motorists were also asked if they would be willing to pay tolls to drive on motorways and the results were similar with 43% agreeing and 57% disagreeing. Again there was less support from young drivers and more support from AB social class.

Figure 14.5
In the future would you be willing to pay tolls to drive on all roads?

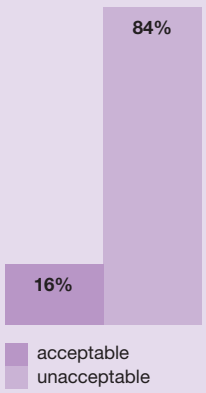


Figure 14.6
How acceptable would road tolls be to you if there were equivalent reductions in tax disc fees?

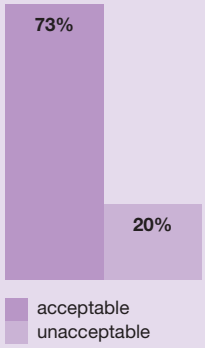
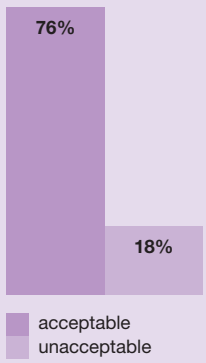


Figure 14.7
How acceptable would road tolls be to you if there were equivalent reductions in fuel duty?



So whereas motorists were fairly equally divided over city centre or motorway tolls there was overwhelming opposition to tolls on all roads.

In the survey we also put forward a number of propositions whereby charging was part of an overall package which gave the motorist some tangible benefits. Respondents were much more likely to favour charging if part of a package. Support for the package approach was significantly high across all age groups and social classes.

So if the motorist received a reduction in Vehicle Excise Duty (VED) equivalent to the amount levied in tolls, then 73% find it acceptable and 20% unacceptable. There were regional differences with the lowest support of 59% in Yorkshire and generally higher than average support in the south where congestion tends to be worse.

When offering a tax reduction to the motorist in part compensating for road charges drivers tended to favour a fuel duty reduction. In the NOP survey this is the most favoured option with 76% finding it acceptable and just 18% unacceptable. This measure tended to be far more acceptable to the young (87%), social class C2 (79%) and with very little difference between males and females. Interesting this proposal received 87% support from those living in East Anglia, possibly because with the exception of a short section of the M11 there are no motorways and therefore people assumed that there would be fewer tolls. In past polls for the RAC Foundation we found a distinct north-south divide in acceptance of tolls with those in the south more likely to accept charging. With this package approach tolls received 77% support in Scotland, 78% in the northwest, 71% in the northeast and 62% in Yorkshire. So with the exception of Yorkshire levels of support ran at over 70% in the north.

We then tested other combinations of measures to deduce acceptability.

'How acceptable would road tolls be to you, if the following were to happen?' (Figures 14.9 - 14.12)

These options show that there is still majority support for road tolls even without equivalent reductions in motoring taxes as long as the motorist is convinced that the money is going to be spent on improved transport provision. (Figure 14.8)

Figure 14.8
Which is the top priority for spending the money generated from the tolls?

Road maintenance	19%
Better roads e.g. road widening and bypasses	32%
Public transport	34%
Public services	12%

There were no great variations in how the money should be spent between different age groups or different social classes although younger drivers tended to be more supportive of public transport improvements. Overall if maintenance and better roads are combined this shows a level of 51% support for road improvements.

Figure 14.9
How acceptable would road tolls be to you if there were equivalent reductions in public transport fares?

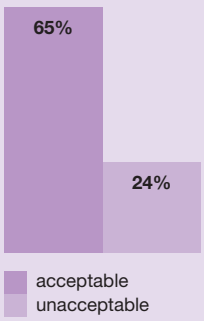


Figure 14.10
How acceptable would road tolls be to you if the level of tolls were set in accordance with level of congestion?

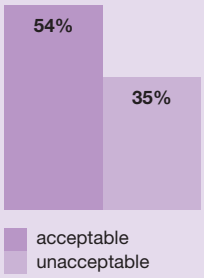


Figure 14.11
How acceptable would road tolls be to you if roads were improved to guarantee better journey times?

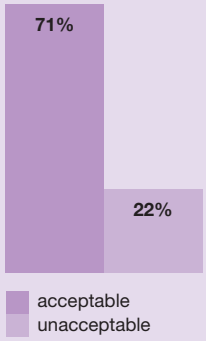
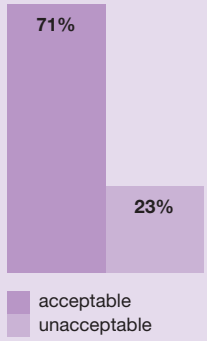


Figure 14.12
How acceptable would road tolls be to you as part of a package of better roads, public transport and traffic management?



14 Public acceptability

General findings

60% felt it would be fairer if motorists paid tax according to amount of time they drive in congestion rather than tax on fuel and tax disc. The only exception to this were company car drivers where only 49% felt this would be fairer possibly because their fuel and tax disc is paid by the company.

Only 22% argue that tax on petrol is a better way of restraining traffic than a charge or toll for using congested roads. 69% disagree with the concept of the fuel duty escalator.

58% think that if charges are introduced for using congested roads there should be concessions for those on low incomes.

52% think that the use of satellites to monitor the location of cars is an infringement of personal liberty.

55% think it is unlikely that there will be a reliable train service by 2020.

By 2020 49% think half the population will work from home.

By 2020 44% think it is likely or very likely that cars joining the motorway will be automatically linked up into a moving line of traffic with the distance between each vehicle controlled electronically.

By 2020 70% think it will be likely or very likely that most cars will run on electricity or environmentally friendly fuels.

39% think will have to pay to book a slot on the motorway.

By 2050 73% expect to see charges in all major towns

71% tolls on motorways

31% on all roads

43% expect the driving age to be raised to 21.

By 2050 44% expect the car to be powered by fuel cell technology which produces no harmful emissions

44% expect the majority of cars to be hybrid (electric/petrol)

10% petrol/diesel.

By 2050 75% do not expect the car to be main means of transport in towns

43% do not expect the car to be the main means of transport in suburbs

17% do not expect the car to be the main means of transport in rural areas.

By 2050 53% of motorists do not think that people would give up their cars even if we had the best train and public transport system in the world.

Conclusions and recommendations

There have been various false dawns when motorists claimed that they would use their cars less if public transport were better. As many as 46% claimed this in 1997 but after Hatfield and other problems on the railways this optimism dropped to 36% by 2001.

Part of our task was to come up with a package of measures which would be acceptable to the motorist, and indeed the general population. In the past motorists have opposed congestion charging. An NOP Automotive survey for the RAC Foundation in 1999 found that 75% of motorists thought it unfair to charge to drive into towns and cities.

Even when motorists were told that the charges would go back into improving transport 48% still thought it unfair with more opposition in the north of the country.

Our 2002 survey showed that if the charging package includes a reduction in fuel duty support for tolling jumps to 76%. Even if other taxes are not reduced but tolls are introduced as a package of better roads, public transport and traffic management, then 71% find this acceptable. Hence we argue that if the package includes charges set at a reasonable level combined with transport infrastructure improvements and a reduction in fuel duty then this package would be acceptable to three quarters of motorists.

However, history has shown us that the Government must play fair with the motorist if it is to maintain their support. Hence, this package approach will only be acceptable if the benefits to the motorist are made clear, and the reduction in fuel duty and road charges fair and transparent. The public will need to experience actual improvements to the transport infrastructure, including the removal of bottlenecks, before tolls are introduced. The reduction of fuel duty in line with the tolls should be set by independent technical experts to an agreed formula rather than by the Treasury.

We recommend that the Government takes forward ‘Motoring towards 2050’ as the catalyst to building public understanding and support for the broad package of measures which will be needed to avoid transport chaos in the future. Our evidence suggests that the motorist is more likely to accept radical changes in transport policy than most politicians envisage. The public and political debate over the future of transport needs to start now.

Reference

1 *Car Dependence* A report for the RAC Foundation November 1995

2 Lex and RAC Reports on Motoring 1989-2002

14 Public acceptability

Motoring towards 2050

Conclusions

The problem

Over the past 50 years a steady rise in income has given us more freedom and choice in where we live, where we study, where we work and how we want to spend our leisure time. One of the major contributors to our freedom has been the mobility provided by the motor car. However, we are now at a critical point where the resulting congestion and damage to the environment could threaten our mobility. How we can balance the increasing demand for mobility based on rising prosperity with a responsible attitude to the problems that it brings?

Transport policy

Britain's transport policy in the last 50 years has achieved some targets, such as the building of the basic motorway network, but there has been insufficient investment in either in roads or rail to provide a sound infrastructure for the future. This has been a mixture of restricted government spending and a short term approach without a clear vision, although we have some disadvantages in transport planning such as high population densities in the south east, long established settlement patterns and many historic buildings and streets. Not only have successive governments failed to provide sufficient capacity, they have also failed to predict how the shortfall in capacity will be met and not controlled demand accordingly.

The present Government has taken a longer term view with its 10 Year Plan for transport but there are concerns over the speed of implementation. Our conclusion is that we need to take an even longer view to ensure we have the transport system which will continue to support the growth of the economy and mobility for the population. But the long term starts today and the problems have to be addressed with a sense of urgency now.

The prospects

The demand for travel grows with growing prosperity. It will increase further as people make more journeys for more purposes and over longer distances. The car will increase its dominance with more people having driving licences and owning cars, especially among the elderly, and the increasing number of young people, particularly women, learning to drive. When people have cars they will use them to make the journeys they need or want to make. So the problems arising from traffic growth – congestion and pollution – will be more urgent.

Demand forecasts

The growth in car vehicle kilometres has been lower in the last decade and we can expect a further slowing down as car ownership approaches saturation. Even on a conservative estimate we can see latent demand for car vehicle kilometres rising nearly a half by 2031 and possibly by another third by 2050.

This is based on forecasts of GB car ownership which would be no higher in 2031 than some other European countries today. Travel demand will be moderated by congestion which will cause people to abandon car journeys, change destination or switch modes. If no action is taken, the rise in actual demand by 2031 would be cut back to 33% while average journey times would increase by around 2%: such an average implies, of course, that some journey times would increase by much more while many may not change at all.

Very roughly, the additional capacity required to accommodate all latent demand in 2031, and thus prevent the deterioration in average speeds which would otherwise occur, is of the order of four to five times the annual rate of investment envisaged in the 10 Year Plan, sustained over the whole 30 year period. Alternatively, to keep the demand at its present levels would require motoring charges or tax to be five times the current level of fuel duty, an annual increase of 6% every year. The same forecasts predict no change in bus use and a doubling of passenger rail transport over 30 years, which is a slower rate than the current SRA forecast of a 50% increase over ten years. All these forecasts are subject to wide ranges and therefore policies will need to be adjusted to actual demand.

Motoring and the environment

While we expect that the basic functionality of the car will not change over the period, changes in materials and engineering will mean that future generations of cars will be far safer, easier to drive, quieter, capable of meeting different user needs and be readily recyclable.

The most encouraging outcome of our enquiry is that emissions of toxic pollutants and CO_2 could be largely eliminated by technology already available although not yet exploited on a commercial scale, such as hybrid and fuel cell propulsion. Zero emissions could only be achieved by using low carbon fuel sources of electricity such as renewables or nuclear energy. Concerted measures – involving industry, government and infra-structure providers – will be needed to bring these new technology cars to market rapidly.

In the intervening period, the existing regulatory, fiscal and planning measures will still be required to ensure that climate change and air quality targets are met (particularly in city centre hot-spots) but the need for these will diminish as older, more polluting vehicles are eliminated by natural replacement, retrofit or scrappage programmes.

Other impacts of vehicles, such as noise and physical severance will remain, and may be exacerbated by increasing vehicle numbers, but these too can be significantly mitigated by technology and planning.

Freight

Trucks and buses will benefit from the same technological improvements as cars and their environmental disadvantage against trains will be greatly reduced. The freight industry has made huge strides in improving efficiency and further gains will be harder to achieve although increased night time deliveries could reduce the impact of trucks on road capacity. Overall the impact of trucks on congestion is going to be much smaller than that of cars in most circumstances.

Cycling, walking and motorcycling

Cycling and walking can play a valuable role in terms of improving the health of the nation and can reduce the need for short car journeys, especially in urban areas, although this is not going to have a significant impact on total travel patterns or congestion. Motorcycles reduce congestion and are easier to park where they replace car journeys but at the expense of safety and noise.

New modes of transport

New travel options such as car clubs for sharing cars, light weight monorail pods such as ULTra or on-demand taxis will develop slowly and will have limited impact on travel although it is possible that over the next 50 years a revolutionary idea, not yet conceived, will make a more significant change although the past 100 years suggests this is unlikely.

Planning

The range of choices about car use and the distances over which they are used have grown greatly. We should use planning to reduce the need to use cars but that it is unlikely to reduce overall demand significantly, and then only over a long period. It is essential to start to develop an adequate strategic framework for locational policy. There are particular problems in the south east and inter-related national and regional policies are required to address this. At the same time we need to do more to empower local communities to respond to the effects of the car in their neighbourhoods.

Policy options

Limiting traffic growth through congestion

As noted above, providing no incremental road capacity and no specific means of restraint other than congestion itself, would lead to a 21% increase in journey times overall by 2031 which translates into much larger increases on some journeys and unreliability which will worsen more quickly. This is clearly inconsistent with providing personal mobility and is economically and environmentally undesirable. There is evidence that drivers adapt to congestion by changing their routes or times but this will become progressively more difficult as congestion spreads across time and space. This is the implicit policy of the past two decades and the adverse effects on traffic congestion can be seen on many major roads throughout the country.

Limiting car ownership

We have to recognise that if road pricing and increasing capacity do not reduce congestion sufficiently some restriction may be needed on car ownership since it is the main engine behind traffic growth but we cannot expect car ownership to reduce without severe and unacceptable restrictions on personal liberty. This would have highly undesirable consequences as it would restrict those in the lower income brackets who are often dependent on cars for employment, the young, and those families with more than one earner. In a free society, it is an unpalatable fallback if all else fails. Governments should be able to do better than this.

Public transport

A decent and adequate public transport system should be an essential part of a civilised town or city just systems for water supply or power. Interchanges between modes, including car and public transport (park and ride), are part of the essential package. Buses are likely to be the preferred option in urban areas because of their flexibility and low investment but they do require priority on a good road network.

In rural areas the main problems are for those without access to cars. Scheduled public transport using large buses is often ineffective and would be better replaced by small buses or on-demand services such as shared taxis or dial-a-ride services.

Rail usage must be increased to help where it makes social or economic sense for high volume inter-urban and commuting travel. Because rail carries only a small share of total travel outside London, even a doubling of demand will not significantly reduce road traffic. Similar conclusions apply to freight and it can be argued that most rail freight severely reduces the capacity of the rail network to provide passenger services and should not be encouraged. After 2010 there will be few economical ways of expanding the railway system. New routes would lead to the same objections as for new road building. Moreover the environmental case for shifting traffic from road to rail will have largely disappeared.

Inter-urban roads

Road investment is an essential component of any package. Making full allowances for the economic environmental and social costs, a higher rate of road investment – both software and hardware is justified We need a framework for the future road programme and we also have to recognise that improvements to local roads will need to match the expanded the strategic roads programme.

Technology and traffic management to get the most out of our existing system could add 10-15% to existing capacity. This includes both techniques already available such as ramp metering, and narrow lanes etc and new techniques linking in-car technology with traffic management, so that intelligent roads can communicate with drivers to minimise delays. Eventually, automatic guidance may be possible, which would improve safety as well as capacity. Britain is at the forefront of telematics technology in Europe and the government should make the most of it.

The 10 Year Plan road investment programme will help to catch up on under-investment over the past 20 years but the rate of implementation must be increased or there is a high chance of not completing the programme on time. If there were no increase in the rate of investment at the end of the 10 Year Plan, congestion would rapidly worsen after 2010.

Projecting the current 10 Year Plan road improvement programme forward each decade by widening in existing corridors, where feasible, and building bypasses of towns and villages suffering heavy environmental damage would increase the capacity of the strategic network. A third possibility would be a substantially larger programme designed to prevent congestion on the network rising above the present levels. This would require 40-50% additional capacity but would be extremely costly.

We also suggest a number of improvements to the road building process itself:

- higher environmental standards of design, including tunnels, noise improvements and works to fit roads into the landscape
- more generous compensation for people affected
- faster statutory procedures to reduce uncertainty and blight.

Sensibly planned and carried out, the land-take and intrusion of such a programme over 50 years would be small.

Demand management

It seems unlikely that road capacity will increase as fast as latent travel demand and therefore congestion will continue to rise. For this reason we believe that demand management has an important part to play in the overall strategy. The current fuel duties are inefficient and unfair and would be better replaced, at least in part, by road charges which influence motorists directly at the place and time of congestion. However it is essential that they are sensibly implemented, that there are adequate safeguards and that the money raised is used to help finance worthwhile transport objectives. The amount of charge would depend on local conditions.

We conclude that charges for journeys should be determined technically by reference to congestion objectives: if congestion goes down, the charge would be reduced. Fuel duty should be reduced at the same time. Where the congestion charge on a stretch of inter-urban road is persistently higher than the average for the area, that would be prima facie evidence that road improvement is desirable. Since there is little scope for building new roads in urban areas, local congestion charging schemes are acceptable in principle provided that there are adequate public transport alternatives for people priced off the roads. The revenue raised should go partly on improving congestion hot spots and alternative transport modes to help people priced off roads or who cannot use a car either because of disability or lack of means; and partly as receipts built up, to reduce fuel duty.

Our calculations suggest that in 2010 congestion charges would be needed on 10% of the strategic road network and not at all times of the day. Many inter-urban road users and country-dwellers will benefit from the improved infrastructure and lower fuel duty and they will not be subject to congestion charges.

Congestion charging in London seems inevitable although this should be part of the national scheme but set with local parameters. In the short-run Londoners should gain from better bus services but investment in new and improved underground rail routes will still be required. Restraint on cars will be unavoidable in many urban areas, but the combinations of road and public transport provision should vary from place to place as should the means of traffic restraint selected.

Public acceptability

Historically, motorists have been strongly against charges as they feel they already contribute enough through fuel duty, VED and VAT. However, opposition to road charging appears to be lessening especially where there are corresponding reductions in fuel duty or other motoring charges.

What is to be done

Looking forward over the next 50 years, we must recognise the reality of the current situation and start our planning now for an environment where the car remains the main source of personal mobility but adjust our approach to changing our lifestyle to overcome some of the problems the car causes. There is no silver bullet solution - we must use every tool, weapon and idea in a coordinated manner to tackle them in a way which is fair and just and makes economic, social and environmental sense for all.

We must:

- make fuller and more effective use of all the assets we have in transport – roads and public transport
- push public transport to make its maximum contribution to the travel problem but only as far as is economically and socially justified
- exploit technology to the full – to make transport safer and more environmentally acceptable
- use information technology to enhance the knowledge and capabilities of drivers and transport operators
- develop ways to help people to be less dependent on transport systems
- use spatial planning to reduce the need for travel without interfering with basic freedoms and to redistribute demand particularly away from the crowded south east
- reduce the intrusion of the car on existing residential communities
- invest in roads to deal with existing congestion problems and to meet changing demand, but make new efforts to build roads in ways which cause the least possible damage to the environment
- manage demand through various methods, including road pricing, parking controls and fuel duties.

Overall, it is for the government to decide the balance of priorities and the allocation of resources.

We must take a long term view but we must start now.

Recommendations

This chapter sets out our principal recommendations. Fuller statements of all our detailed recommendations are included in the individual chapters.

Our proposals are intended to be a package. It may not solve, but we believe it does at least address, the complex of problems which surround the future of motoring in this country, and vitally affect the majority of citizens for whose daily lives cars are important. It is not an à la carte menu from which the reader may choose some items and reject others. If our report stimulates debate which leads to better packages than ours, we shall have achieved our goal.

Transport planning and investment (chapters 1, 2, 10, 12)

Major change in transport takes a long time, whether building infrastructure, or influencing people's behaviour. So the Government is right to publish a 10 Year Plan and to revise and roll it forward annually. It should periodically – perhaps every five years – look forward a further 20 or 30 years and publish the results to check that:

- programmes and policies are on course
- opportunities are not being missed
- people have a chance to discuss the big questions which affect their lives acutely.

The Government should similarly set a 10 year framework for local authority planning but periodically require them, too, to look further ahead.

The Government should commit substantial and sustained investment to the transport system, both roads and public transport, to overcome the damage done by decades of under-investment which have resulted in massive congestion and serious problems of renewal on large parts of the road and rail networks.

The Government should implement its commitment that the appraisal of policy options and investment proposals in terms of their costs and benefits will be at the heart of decision-making; and it should publish the returns expected from major rail and road schemes so that the reasoning underlying its priorities is transparent. Appraisals should take account of the latest assessments of the environmental effects of road and rail transport, which will change as technological improvements reduce the environmental impact of transport.

The Government should urgently commission a comprehensive review of the costs of safety measures across all modes of transport, with a view to establishing whether current policies deliver best value for money.

Vehicles and the environment (chapters 3 and 5)

To maintain current progress in reducing the impact of motor vehicle emissions on air quality and climate change, the Government should, in concert with other European governments, roll forward the targets in the present strategies beyond 2010, with new measures to achieve them selected on the basis of careful cost-benefit assessment of options, both within sectors and between transport and other sectors.

Because the potential benefits from switching from propulsion by fossil fuels to new zero-emission vehicles are so large and widespread, the Government should give the highest priority to achieving a smooth and efficient transition from the old energy world to low carbon technologies. We strongly support its current work with the motor, component and fuel industries, and we recommend that it should develop a fully coordinated strategy for all aspects of the transition, including infrastructure, regulation and incentives to rapid application of the new technology. This work should be done as necessary with international organisations such as UN ECE to ensure consistent standards.

Meanwhile the Government should give the strongest encouragement and support to the use of hybrid vehicles both as a transitional technology and for their intrinsic environmental benefits. Besides fiscal incentives, the Government should consider using other policy instruments for this purpose. This might include specifying a date by which pre-catalyst vehicles should be phased out or upgraded. It might eventually include prohibiting, after a reasonable period of notice, all vehicles other than those with hybrid, fuel cell or Euro-4 technology from entering Low Emission Zones. Such a prohibition should apply to cars, taxis, vans, trucks and buses.

We are confident on present knowledge that the damage to health and the environment of emissions from motor vehicles can over time be dramatically reduced and even eliminated; and we recommend that transport planning should proceed on this basis. But the Government should monitor progress so as to be able to use fiscal or other measures if they are needed to keep on course.

Even with the strong national measures we have proposed, some local pollution hot spots may remain a problem for some years. We recommend that local authorities should use local regulations to mitigate these, particularly the effects of older, more polluting vehicles.

The Government should develop a practical strategy for higher standards in reducing transport noise. Technological improvements will continue to make new vehicles much quieter, but the Government and local authorities should act with urgency in laying quieter road surfaces over local roads as well as the strategic road network whenever resurfacing is required. They should also act to eliminate the bumps and potholes in roads which add greatly to traffic noise. Noise reduction measures should be designed into new roads and major road improvements.

Land-use planning, transport dependence and the quality of life (chapters 4, 7 and 8)

Many changes over the last 50 years have sharpened the problems of congestion and the conflict between the demand for mobility and the desire for a decent quality of life. These problems will become more and more acute, and solutions will become more and more difficult. The development of strategies requires patient analysis, planning and sustained and coordinated action, as much locally as nationally. Such strategies will take time to develop, but action should start now. Specifically, and to start the debate, we recommend that the Government should

- develop a UK Spatial Planning Framework as the basis of locational policy and investment decisions on infrastructure, employment and housing
- work with other EU member states to develop European spatial policy to promote credible regional policies that will help mitigate the growing north-south imbalance in Britain
- take a strategic view of housing pressures in south east England, and in particular consider a new ‘social city’ programme of new towns to show how to manage that demand in ways which make best sense in terms of transport planning
- introduce Territorial Impact Assessment to improve the process of relating transport and infrastructure proposals to spatial strategies, and vice versa
- encourage authorities to deal more comprehensively with the intrusion of cars into communities by such features as Home Zones
- research and develop, possibly with demonstration projects, a range of measures to encourage people to use their cars less – for example, teleworking; travel plans for employers and schools; communal car ownership schemes; and better and safer routes for walkers and cyclists, planned as an integral part of urban fabric. The Government should work closely with local authorities on these ideas, and encourage and give incentives for best practice
- reflect the likely future impact on development strategies of motoring taxes and charges in influencing traffic.

Railways (chapter 10)

The Government and the various agencies involved should speed up to the maximum extent possible the implementation of the investment and other measures in the 10 Year Plan, given the desperate overcrowding on most routes owing to past under-investment and recent traffic growth.

Planning for beyond 2010 should, on present prospects, also expect growing demand. Plans should aim to meet travel needs for which rail is best suited, namely travel to work in the big cities and long-distance business and leisure travel. In the interests of all travellers in London, urgent attention should be given to increasing capacity by building a number of new underground lines.

So that the railways can make the maximum contribution to reducing transport congestion, the Government and the Strategic Rail Authority should review the extent of the actual and potential conflict for scarce track capacity between commuting and long-distance passenger services and between passenger and freight services, and should determine where the balance between them should lie.

Local transport (chapter 11)

The Government should encourage and incentivise local authorities to look further ahead at the likely impact of traffic growth on their transport network, and plan accordingly. In some areas, planning and implementation of major proposals will need to be at a regional or sub-regional level.

Urban authorities should assess for how long parking controls can contain the growth of congestion; consider when it might be necessary to strengthen them by congestion charges; and, if necessary, plan for the orderly introduction of charges and all the accompanying improvements to public transport and roads.

The Government should review the systems of support for the bus industry, to ensure that it better meets transport and environmental objectives and to ensure that operators and local authorities work more closely together. Specifically:

- fuel duty rebate should be replaced by a subsidy related to passengers carried, not fuel used
- there should be more Quality Partnerships between local authorities and bus operators to promote greater identity of objectives, closer working together, and less opportunity for operators to exploit area monopolies.

In many rural areas, the Government should encourage smaller vehicle schemes, often community-based, to replace bus services.

Highway capacity

To deal with severe congestion resulting from under-investment and failures to deliver roads policies in the past, the Government should give high priority to increasing the capacity of the strategic road system by traffic management and, where needed, new construction. The 10 Year Plan has the right approach, but we are concerned that its implementation will be delayed either because schemes are not prepared and pressed forward quickly enough, or because the resources are diverted to other programmes.

The Government should press ahead with work on the application of new technology to road traffic in the form of vehicle to vehicle and road to vehicle communication. This work should cover all aspects, including legal, operational and institutional issues.

New road capacity will need to be provided through widening existing roads, and building bypasses and some new routes after the 10 Year Plan period. Otherwise, congestion will increase steeply, with consequent economic and environmental damage. The Government will need to decide on the right balance between investment in capacity, allowing congestion to grow, and demand management to restrain traffic growth. We recommend that they should explain publicly the reasons for their decisions. On the basis of our work, we recommend: an investment programme at a continuing level at least as great as in the 10 Year Plan. With this level of investment, we estimate that there would be some increase in congestion unless charges rose faster than incomes. If this is right, Governments would probably consider the case for a bigger investment programme.

We recommend a new approach to road design and construction:

- the greatest attention should be given to fitting roads into the environment, with more use of tunnels, cuttings and other measures to avoid severance and damage to surrounding areas
- the Government should ensure that there are enough financial and technical resources to carry out a sustained programme at the required level
- statutory processes should be speeded up so that, without curtailing objectors' rights, delay and uncertainty are minimised
- increased compensation for people whose property is affected.

Clear targets should be set for the performance of the road network in terms of service levels, safety, and environmental effects. An independent body should be created to set and monitor these standards.

It will be essential to make the best use of all the main roads and manage them coherently. So the strategic network should be extended to include some of the principal A roads: it should not be reduced by transferring roads to local authorities.

Influencing demand

The Government should start an urgent programme of exploratory work to be completed not later than the end of 2003, covering:

- the objectives of a congestion charging scheme and the basis of charges
- use of the proceeds
- implementation, including choice of technology, collaboration with manufacturers, and international standards.

Our recommendations on the policies to be adopted are:

- charges should be applied where they are needed to restrain traffic growth and so reduce congestion on roughly the most congested 10% of the strategic road network and
- where local authorities judge them to be necessary as part of a comprehensive plan for the improvement of transport in their area
- charges should be based on congestion costs and targets, set by technical experts in a transparent and evidence-based way
- charges should go down if congestion is reduced, for example by new investment
- the system should in due course apply to all vehicles.

The technology would probably be based on the GPS or some similar system, with payment by smart card; but this is a rapidly developing field, and the decision would need to be taken on the latest assessment and in cooperation with other European countries

The proceeds of charges should be used partly on spending to tackle congestion hot spots, to support public transport, and to develop and support transport for people who for whatever reason had no access to a car. As proceeds build up, they could be applied to reducing fuel duty. This would benefit people using uncongested roads, such as those living in the country.

If local authorities did not come forward with sufficient well-founded schemes for congestion charging in their areas to give confidence that congestion was being tackled in a consistent manner, the Government should consider using incentives or other powers to bring schemes forward.

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Designed by *****langsford
Printed by Moore

The Royal Automobile Club Foundation for Motoring Limited is a charity established to promote the environmental, economic, mobility and safety issues relating to use of motor vehicles.

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