NATIONAL AUDIT OFFICE

Tackling congestion by making better use of England's motorways and trunk roads

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL | HC 15 Session 2004-2005 | 26 November 2004

The National Audit Office scrutinises public spending on behalf of Parliament. The Comptroller and Auditor General, Sir John Bourn, is an Officer of the House of Commons. He is the head of the National Audit Office, which employs some 800 staff. He, and the National Audit Office, are totally independent of Government. He certifies the accounts of all Government departments and a wide range of other public sector bodies; and he has statutory authority to report to Parliament on the economy, efficiency and effectiveness with which departments and other bodies have used their resources. Our work saves the taxpayer millions of pounds every year. At least £8 for every £1 spent running the Office.

NATIONAL AUDIT OFFICE

Tackling congestion by making better use of England's motorways and trunk roads

LONDON: The Stationery Office
£10.75

Ordered by the
House of Commons
to be printed on 24 November 2004

This report has been prepared under Section 6 of the National Audit Act 1983 for presentation to the House of Commons in accordance with Section 9 of the Act.

John Bourn
Comptroller and Auditor General
National Audit Office

23 November 2004

The National Audit Office study team consisted of:

Fiona Ashley, Ken Foreman, Sudip Dasgupta and Stewart Lingard, under the direction of Keith Holden

This report can be found on the National Audit Office web site at www.nao.org.uk

For further information about the National Audit Office please contact:

National Audit Office
Press Office
157-197 Buckingham Palace Road
Victoria
London
SW1W 9SP

Tel: 020 7798 7400

Email: enquiries@nao.gsi.gov.uk

CONTENTS




Photographs courtesy of Highways Agency




EXECUTIVE SUMMARY

1 Road traffic congestion frustrates people's travel plans and daily lives. The Highways Agency (the Agency), which is responsible for managing England's strategic network of motorways and trunk roads, has estimated that congestion on the network costs industry and commerce £3 billion a year. Tackling road congestion is a primary objective of the government's *10 Year Plan for Transport*. The government aims to stabilise congestion at 2000 levels by 2010. Yet, neither the Department for Transport (the Department) nor the Highways Agency has comprehensive and reliable data about congestion across the whole of the motorway and trunk road network. The Department is developing new measures to assess traffic delays, their severity and the reliability of journey times. It is committed to having a new set of targets in place by July 2005, including targets for specific roads as well as for the country as a whole, and has awarded a contract to a private sector firm to collect traffic information in support of these targets.

2 The latest available data show that, nationally, congestion levels at certain times of the day improved between 1998 and 2003. Average traffic speeds in the morning peak and to a lesser extent in the off-peak period, for example, rose over the period. They were still lower, however, than they were in 1995. Average traffic speeds, for example, fell by up to six per cent (four miles per hour) depending on the time of day between 1995 and 2003. Speeds have fallen as the volume of traffic has continued to grow – up by 14 per cent on all roads between 1995 and 2002. Around seven per cent of the network suffers heavy congestion at peak times, while a further 13 per cent of the network suffers heavy congestion on at least half the days of the year. The Transport Research Laboratory has estimated that weight of traffic accounts for some 65 per cent of congestion, while accidents and incidents account for 25 per cent, and road works account for 10 per cent.

3 The government is seeking to tackle congestion through a combination of measures intended to increase the capacity, and improve the management, of the network. Measures include new road building and improvement schemes. The Department recently published a report[1] on the feasibility of charging road users for general access to the road network to reduce congestion. Yet, these schemes will take time to deliver. Action is needed in the near term to deal with immediate problems on key routes and at congestion blackspots on the network.

4 The Highways Agency has a programme of work, known as the *Making Better Use (MBU)* programme, intended to bring quick relief from congestion on England's motorway and trunk road network. It spends over £200 million a year on the programme, mostly installing technology on the network or carrying out small scale construction schemes known as Local Network Management Schemes, which include altering the lay out of road junctions and motorway slip roads, introducing free flow lanes at roundabouts and improving junctions between trunk roads and motorways. Since 1998-99, the Agency has spent almost £1.1 billion on the *MBU* programme. Further, in June 2003 the government announced that the Agency would develop its remit beyond building and maintaining the road network and take on greater responsibility for managing traffic as the network operator.

1 Feasibility Study of Road Pricing in the UK: Department for Transport, July 2004.

Expenditure on the key constituent parts of the MBU programme, 2003-04

Main elements	Description	Expenditure (£million)
Technology projects	Systems that support monitoring and operational activities on the network, including: an automated incident detection and warning system, CCTV cameras, a national traffic control centre, and more advanced road side message signs.	107
Local Network Management Schemes	Small scale construction projects costing less than £5 million, aimed at delivering locally targeted improvements quickly including 'pinch point' improvements such as improving layouts of lanes and junctions and signalling at junctions.	106
Research and development	Researching and developing new approaches to traffic management and the management information systems necessary to support the Agency's work.	16[1]
Information technology projects	Information systems to support the programme.	13[1]
Total		242

Source: National Audit Office summary of Highways Agency data

NOTE

1 Expenditure on research and development and business information systems is for the benefit of the Highways Agency as a whole, and not directly or exclusively on measures to tackle road congestion or improve safety.

5 Generally, we found that Local Network Management Schemes have been built to time and budget, while a programme of over 90 schemes at priority action sites designed to bring in improvements quickly is on schedule. Many road user organisations, including the Freight Transport Association, the Intelligent Transport Society (United Kingdom), the Confederation of British Industry, National Express, the Road Haulage Association and the Automobile Association Motoring Trust welcome these types of schemes. In light of these findings, therefore, this report focuses on other measures at the Agency's disposal involving the use of technology to help tackle congestion caused by the weight of traffic, changing driver behaviour and dealing with shocks to the network that cause congestion.

Main conclusions

6 We found that the Agency is improving the information it gives to motorists, as a priority in its strategy for tackling congestion, and is strengthening its ability to deal with the effects of incidents and accidents on the network. Yet, with congestion a pressing problem on much of the strategic road network, we concluded that the Agency:

- has been too risk averse in introducing or testing out measures more readily used abroad, and is behind some of its overseas counterparts in adopting technologies to tackle congestion caused by the weight of traffic on England's motorways and trunk roads;
- has managed its trials of some measures poorly, contributing to their inconclusive results;
- has not installed the most appropriate technology on the most congested motorways resulting in significant disparities between regions of the country; and
- needs to be better prepared for events that cause congestion.

The Agency is behind some overseas counterparts in adopting technologies to tackle congestion caused by weight of traffic

7 Highways authorities in The Netherlands and Germany have for many years been using a range of measures to tackle congestion caused by the weight of traffic on their roads. In contrast, the Highways Agency in England has concentrated on hard engineering solutions to tackle congestion, such as building new roads and widening existing ones. It has been running its *MBU* programme since 1998 and, although annual expenditure on the programme has grown since then from £114 million to £213 million in 2003-04, road maintenance and large road building projects still account for around 85 per cent of the Agency's annual total spending on roads.

8 During the 1990s, the government's emphasis was on building new roads, maintaining the existing ones and improving road safety. The Agency did not have a target to reduce congestion until the government established one in its *10 Year Plan for Transport* in 2000, alongside its target for reducing road casualties. Since then, tackling congestion has become a high priority for the government, as congestion levels have remained high. Since the *MBU* programme started in 1998, however, the Agency has continued to concentrate much of its technology projects on improving road safety and the management of incidents, although fewer accidents also help to reduce the incidence of congestion. Between 1994 and 2003, the number of people killed or seriously injured on England's motorways and trunk roads fell from 4,991 to 4,223.

The Agency has been too risk averse in introducing or testing out measures more readily used abroad

9 The Agency has been slow to introduce new kinds of measures, despite their widespread adoption and reported beneficial impacts in other countries. It has adopted four measures used elsewhere - Tidal Flow, Dedicated Lanes, Ramp Metering and Variable Speed Limits - but only to a very limited extent. The Agency considers that measures used in other countries would operate differently in England and has not been convinced as to the rigour and quality of assessments of measures used abroad.

Measures adopted in other countries to tackle congestion

Tidal Flow involves reversing the direction of traffic in one lane or more on a motorway or trunk road to cope with peaks in traffic volumes. Signals above the carriageway indicate which lanes are in use and the direction of traffic in those lanes. This measure can only be used where it is safe to do so, usually without the traffic being segregated by cones or temporary barriers. It therefore differs from contra-flow, used at roadworks, where lanes might be separated by cones or temporary crash barriers. Tidal flow has been used since the 1970s.

Dedicated Lanes are restricted for use by a specific type of vehicle, such as buses or heavy goods vehicles and can be used on both motorways and trunk roads. High Occupancy Vehicle (HOV) lanes are a form of dedicated lane, intended for vehicles carrying more than one passenger to encourage, for example, commuter car-share schemes. HOV lanes have been widely adopted in the United States since they were introduced in the 1970s.

Ramp Metering involves using traffic signals, similar to traffic lights, to control the rate at which vehicles join a motorway from a slip road. Ramp Metering originated in the United States, where it has been used extensively since the 1970s, while the authorities in The Netherlands and Germany have used Ramp Metering since 1989 and 1995, respectively.

Variable Speed Limits involve adjusting speed limits on motorways depending on traffic volumes in order to improve traffic flow, reduce the number of accidents and thereby reduce congestion. Normal speed limits apply when traffic is free flowing. Speed limits are reduced when traffic volumes reach a predetermined level, with signals above the carriageway indicating either advisory or mandatory speed limits. The authorities in The Netherlands and Germany have used Variable Speed Limits since the 1980s and 1990s, respectively.

Hard Shoulder Running involves temporarily opening the hard shoulder on motorways to traffic during peak periods. Signals above the carriageway indicate when the hard shoulder is open. The authorities in The Netherlands and Germany have used Hard Shoulder Running since 1996 and 1999, respectively.

Dynamic Lanes involve using lights similar to cats' eyes set in the surface of the road to alter the number and width of lanes on a motorway, usually in order to increase the capacity of the road. For example, three lanes of normal width could be changed into four narrower lanes to accommodate more vehicles. Dynamic lanes are a new measure, currently under trial in The Netherlands and Germany.

Source: Highways authorities in The Netherlands, Germany and the United States

10 The Agency has put in place Dedicated Bus Lanes on four stretches of road, including a section of the M4 motorway. Despite the reported success of this scheme in particular, and of Dedicated Lanes in the United States, the Agency has not actively pursued the adoption and wider take up of Dedicated Lanes in England because of considerable opposition from motorists and sections of the media when the M4 bus lane opened in 1999. In July 2004, however, the Department announced that the Agency would be carrying out a motorway trial of High Occupancy Vehicle lanes, a form of dedicated lane, although the Agency has yet to agree with the Department a timetable for implementing them.

11 The highways authority in The Netherlands has used Hard Shoulder Running since 1996, while in Germany successful trials in 1999-2000 led to the wider introduction of Hard Shoulder Running in 2002. By comparison, the Agency does not use Hard Shoulder Running on any of its motorways or trunk roads. The Agency told us that there have for many years been safety concerns, including amongst the police, about how emergency vehicles would arrive at accident sites if Hard Shoulder Running were adopted. Highways authorities in The Netherlands and Germany have addressed safety concerns by introducing reduced speed limits, providing frequent refuge areas for use in an emergency during Hard Shoulder Running, and installing CCTV cameras to scan the hard shoulder before it is opened to traffic and detect any accidents and incidents that might require the lane to remain closed. Research in The Netherlands and Germany found that accident rates have fallen where such measures have been implemented. There have therefore been no insurmountable obstacles to addressing safety concerns associated with the introduction of Hard Shoulder Running. The Agency has recently embarked on a trial of Hard Shoulder Running, in which it will be applying safety features above and beyond those that have been in place for many years in The Netherlands and Germany.

12 The Agency has run, and is still running, a small number of trials of various measures to identify the characteristics and conditions where a measure is effective at a particular trial site and to make a business case for adopting that measure elsewhere. Yet the very small number of trials has limited the Agency's ability to find trial sites with the right characteristics and conditions for success. The Agency is conscious of the need to control the risks to safety that might be associated with running trials of particular measures. In our view, it needs to adopt a more expansive approach to risk management, more in proportion with the risks involved. Better managed risk taking would involve carrying out more trials at more sites to increase their chances of success, whilst also managing any safety risks involved.

The Agency has managed two of its three trials poorly, contributing to inconclusive results

13 The Agency has not issued any guidance on identifying, designing and delivering trials, nor established any standards on how long trials should take or how much they should cost. We found that some trials were not managed well. Managers were too focused on ensuring that the technology worked, for example, and did not give sufficient consideration to the trials' overall aim of developing a business case.

14 The Agency has over-spent its budgets for its trials of Ramp Metering and Variable Speed Limits by 80 per cent (£3.2 million) and 12 per cent (£1.2 million) respectively. The initial results of the one year trial of Variable Speed Limits indicated savings in journey times, smoother flowing traffic and a fall in the number of accidents. On the basis of these findings, the Agency converted the trial into a permanent facility in 1997. Variable Speed Limits have generally been popular with road users who have reported perceived benefits, including less congestion and less stressful journeys. Yet the Agency could not prove a business case to use the measure elsewhere. Conditions at the site of the Variable Speed Limits trial were not stable before or during the trial, or in the period of extended monitoring that followed it. Traffic volumes changed and the Agency introduced new technology and new lighting and widened the motorway at both ends of the trial site, preventing it from establishing properly controlled and reliable "before and after" data to assess the measure's impact. Without reliable data, the Agency could not prove a business case to use the measure elsewhere. As a result, in 2002 the Agency extended the Variable Speed Limits trial, at a further budgeted cost of £3.9 million, to cover an additional eight kilometres of the M25, where conditions were expected to be more stable, in order to collect sufficient before and after data to prepare a business case. The Freight Transport Association told us that they were frustrated that the success of Variable Speed Limits has not led to their greater use.

The Agency is improving the information it gives to motorists

15 Motorway and trunk road users told us that they were dissatisfied with the quality of on-road information provided to motorists. Information was not up-to-date and did not enable drivers to consider alternative routes when their existing routes or planned routes were congested. Drivers often want information before they join motorways but only a few sections of trunk roads are served by information signs. The Agency has made the provision of better information for road users a priority in its strategy for tackling congestion. It expects its new £160 million national Traffic Control Centre in Birmingham, allied with the implementation of new message signalling technology, to improve the quality of information it provides to drivers. The Centre was due to open and providing some services by March 2004, before becoming fully operational by the end of December 2004. It actually started operations five months early, in November 2003, but the Agency now does not expect it to be fully operational until July 2005. The Agency is also now recruiting to a new post of Director of Information, responsible for devising an information strategy and policy, and managing the provision of information to motorists.

The Agency has not installed the most appropriate technology on the most congested roads

16 A key problem affecting the quality of on-road information provided to motorists is the prevalence of old technology across the network. The Agency has installed its most sophisticated technology - the Motorway Incident Detection and Automatic Signalling (MIDAS) system and second and third generation electronic message signs - along the M1 and M6 and around the major conurbations in the North and Midlands, where there are some of the most congested motorways in England. It has not installed the systems on many equally heavily congested motorways in the South East, however, such as sections of the M25 and the radial motorway links connected to it, partly because of uncertainty over future widening works.

17 In 2001, the Agency recognised that some of the most congested roads in the South East lacked any of the latest technologies warranted by the weight of traffic they carried each day. To address the disparity between the regions within the resources available, the Agency started to install some additional first generation electronic message signs to be followed at a later date by the more sophisticated third generation signs. This approach was not appropriate for motorways in the South East. We calculated that the approach would cost up to £64 million more than if the Agency installed the appropriate third generation signs progressively as resources allowed. The Agency has discontinued implementing first generation signs in the South East and now plans to implement third generation signs instead. It had already spent more than £16 million installing 39 first generation signs along some 43 kilometres of motorways in the South East. Most of the equipment can still be used when the Agency comes to implement third generation signs, although some £690,000 of expenditure to date would be abortive and the Agency will have to upgrade 23 of these signs, at an extra cost of some £2.4 million, in due course. The disparity in the provision of technology between regions will take several years to address because the Agency's resources are limited, there is a lead time in installing the technology and planned widening of the M25 might bring further delay.

The Agency needs to be better prepared for events that cause congestion

18 Major sporting and entertainment events can cause congestion on roads leading to and from venues. The Agency has no influence over the number, location or timing of events it has to deal with each year, nor the number of people or vehicles attending them. It prepares for those events it knows about, but in some cases has not been aware that events have been planned. In the case of a major one-off entertainment event, the Licensing Act 2003 requires promoters to apply to the local authority for a licence to hold the event. The Agency is not statutorily consulted in this process and the promoters of events do not routinely notify it after a licence for an event has been granted. The Agency has therefore been less well informed about, and less well prepared to deal with, the congestion caused by these events. During the preparation of the Licensing Act 2003 the Agency had not been aware of the opportunity to become a body which has to be consulted and is now considering making a case to become one. In the meantime, it continues to rely on informal arrangements between its area teams and local licensing authorities.

The Agency is strengthening its ability to deal with the effects of incidents and accidents on the network

19 Adverse weather conditions, especially in winter, can cause incidents and accidents leading to major congestion problems. After a breakdown of the Agency's winter maintenance procedures during a period of adverse weather conditions in January 2003, the Agency has taken a range of measures to reduce the risk of such incidents happening again. One of the key problems was the lack of strategically placed hardened central reservation crossovers or barriers that could be quickly dismantled to provide escape routes onto the opposite carriageway. The Agency has identified around 2,200 crossovers built for maintenance purposes and has installed additional demountable barriers or built new crossover points at a further six sites. A more systematic review is required of where such escape routes should be sited, however, based on an analysis of the strategic points around the network where traffic conditions and the history of incidents and accidents warrant crossovers to be built to relieve congestion following incidents and accidents.

20 Major accidents can also cause significant congestion, and clearing roads after they have taken place can be a significant challenge. The Agency does not have any targets for clearing roads within a certain space of time after the emergency services have completed their work. It is taking over from the police many of their responsibilities for clearing motorways after incidents and accidents, establishing a uniformed motorway patrol service of its own. It expects the project to cost £73 million to set up, and have annual running costs of some £58 million. In return, the Agency has estimated that the measures will result in a 17 per cent reduction in motorway congestion caused by incidents, producing economic benefits valued at £67 million a year and releasing £20 million worth of police officers' time to their core activities of fighting crime. The Agency expects that, on average, its new measures will cut by five minutes the time taken to clear motorways after an incident lasting 45 minutes.

21 The project is a major challenge for the Agency. Few highways authorities in other countries have transferred police traffic management powers to civilian traffic officers. It has to recruit and train 1,500 new staff, nearly doubling the number of its employees from 1,800 to 3,300, procure and deploy 100 vehicles, establish a network of depots and offices for its new teams of traffic officers, and develop clearly defined joint working arrangements with the police. The Agency is carefully managing the associated risks, taking over police responsibilities in stages. It started an initial service in the Midlands in April 2004 and expects to have services available on the whole of the motorway network by September 2006.

22 Traffic sometimes has to be diverted from the strategic road network on to local authority roads, or vice versa. Local roads do not always have the capacity to accommodate diverted motorway traffic. The police and the Agency generally try to avoid diverting traffic where this is the case. The Agency has formal procedures agreed with local authorities for putting diversions in place for some of its roads, though not all. In our survey of local authorities in 2003, local authorities considered that the Agency had a patchy record of working with them to identify and agree alternative routes to manage traffic. One third considered either that they did not have any pre-planned diversion routes agreed with the Agency or had diversion arrangements that did not work well. Some 40 per cent of local authorities who replied to our survey considered that unplanned diversions off motorways and trunk roads have caused disruption and congestion on local authority roads, because the diversions have not always taken account of the capacity of the local road network. As a result, local authorities have been reluctant to discuss alternative routes with the Agency. The Agency's Area Offices are now working with local authorities to identify potential diversions off main routes.

RECOMMENDATIONS

Exploiting more fully the measures at the Agency's disposal

i The Agency should adopt a more expansive approach to testing out the range of measures at its disposal, carrying out more trials at more sites to increase its chances of success, whilst managing the risks involved.

ii The Agency should improve the design, management and delivery of its trials of measures, along the lines suggested in this report.

iii Before implementing any new measures, the Agency should seek to convince users about the benefits they would bring to them, as a means of gaining public acceptance.

Giving motorists the information they need

iv The Agency needs to improve the nature of the information it gives to motorists through its road-side signalling systems. It should provide information on:

- the length of traffic jams and how long it is expected to take to clear them;
- expected journey times to key locations; and
- what motorists should consider doing to minimise or avoid delay, including through the use of other alternative routes to help drivers bypass congestion.

v The Agency should provide relevant information to drivers as they approach junctions to join motorways, to allow them to consider other routes, as well as on the motorways themselves.

Targeting the most appropriate technology at the most congested roads

vi Through its Technology Strategy Steering Group, the Agency should assess the scope to release resources from planned technology projects outside the south east, in order to help redress the regional disparity in the provision of technology, and put in place a clear plan of action for installing the appropriate technology by specified dates.




Being better prepared for major events

vii The Agency should establish a database of major events that have an impact on motorway and trunk road traffic, containing information about numbers of people expected to attend, associated traffic volumes and roads affected, as well as about any measures taken and delays caused by previous events. The Agency should make the database available to staff in its regional and local offices, to allow them to learn lessons from each other and become better prepared for future events.

viii In consultation with the Department for Transport, the Agency should make the case to the Department for Culture, Media and Sport for the Agency to become a body which has to be consulted in the licensing of major events, to support its new traffic management responsibilities.

ix In the meantime, the Agency should establish formal agreements by which local authorities provide the Agency's relevant local and regional offices with complete, timely and accurate information about events that they have licensed, to allow Agency staff to prepare and plan for those events in consultation with all of the relevant parties.

Being better at dealing with incidents and accidents

x The Agency should carry out a systematic review of where crossovers between carriageways should be sited around the network, and build such facilities into central reservations in order to allow vehicles to pass onto the opposite carriageway as a means of clearing roads more quickly after an incident or accident.

xi The Agency should set targets, dependent on the severity of incidents and accidents, for clearing a road after the emergency services have completed their work and released it to the Agency.

xii The Agency should agree pre-planned diversion routes with all English local authorities and Scottish and Welsh local authorities bordering England, to be activated where there is a major disruption on the motorway and trunk road network affecting local authority roads, and vice versa.

PART ONE
Introduction

1.1 Road traffic congestion[2] causes delay and frustrates people's travel plans and daily lives. The Highways Agency (the Agency) has estimated that congestion on the network costs industry and commerce £3 billion a year. Tackling road congestion is a primary objective of the government's *10 Year Plan for Transport*. In July 2000, the government forecast that congestion on motorways and trunk roads would increase by 28 per cent between 2000 and 2010 unless action were taken to tackle it. It expected to achieve a five per cent reduction in congestion by 2010 if the planned resources were invested in the strategic network. In December 2002, however, data showed that projections for traffic growth, and the level of congestion, had been understated. The government revised its projections, forecasting an increase in congestion of between 52 and 67 per cent by 2010 if no action were taken, and set a new target to stabilise congestion at 2000 levels by 2010.

1.2 In April 2004, however, the Department for Transport (the Department) told the Committee of Public Accounts that the revised target was itself unsatisfactory and that the government would not meet it because the target was based on inadequate information. The Department and the Highways Agency do not have comprehensive and reliable data about congestion across the whole of the motorway and trunk road network.

1.3 The Department is developing new measures of congestion that better capture what matters to road users, assessing traffic delays, their severity and the reliability of journey times. The Department is committed to putting in place a more robust set of targets by July 2005, including targets for specific roads in addition to targets for the country as a whole. The targets will be supported by information derived from several sources, including electronic sensors known as "loops"[3] buried in the road, journey time information available from the commercial firm Trafficmaster and satellite navigation systems fitted to private and commercial vehicles. The Department has awarded a contract to a private sector firm to supply data from satellite navigation systems.

The Department has let a contract to collect information from vehicles' satellite navigation systems to identify the pattern and location of congestion

In February 2004, the Department entered into an agreement with ITIS Ltd to collect data from satellite navigation systems fitted in over 50,000 private and commercial vehicles. Collection of the data started in February 2004, although information previously recorded, dating back to 2001, will also be made available to the Department. The contract is worth £1.25 million in the first year of the agreement and £1 million in the following two years. The information will enable detailed reports to be produced on the pattern and location of congestion; identify congestion hotspots; and show the impact of measures to tackle congestion problems. The information will be provided to the Highways Agency and also made available, free of charge, to local authorities.

1.4 The information that has been available has been collected from different sources, such as the loops and Automatic Number Plate Recognition cameras.[4] Neither of these sources covers the whole network or has used the same method for measuring congestion, making national aggregation difficult. The latest data[5] that are available show that, nationally, average speeds at certain times of the day improved between 1998 and 2003. Average traffic speeds in the morning peak and to a lesser extent in the off-peak period, for example, rose over the period. They were still lower, however, than they were in 1995. For example, although average traffic speeds on motorways and trunk roads remained steady at around 55 miles per hour in the off-peak period, average speeds fell between 1995 and 2003:

- by five per cent in the morning peak period, from around 53 miles per hour to 50 miles per hour; and
- by six per cent in the evening peak period, from around 55 miles per hour to 51 miles per hour.

2 Until recently, the Department for Transport measured congestion by comparing the actual time a journey takes with the theoretical time it should take if vehicles were able to travel at, or close to, the maximum speed for which the road is designed.
3 "Loops" are rectangular coils of wire buried in the road surface and connected to roadside electronic sensors. Sensors detect vehicles passing over a loop, count them, and send the data to a central location. Vehicle speed can be measured by installing two loops in each lane.
4 Vehicle speeds can be calculated as vehicles pass these cameras located at set distances along a road.
5 National Statistics: Transport Statistics Bulletin: *Traffic Speeds on English Trunk Roads: 2003.*

1.5 Average speeds since 1995 fell the most on motorways. In the evening peak period, for example, speeds fell by more than 10 per cent, from around 65 miles per hour in 1995 to less than 58 miles per hour in 2003, adding 11 minutes to the time taken to complete a 100 mile journey. Average speeds have fallen as the volume of traffic has continued to grow. Between 1995 and 2002, traffic volumes grew on all roads by 14 per cent[6] and on motorways alone by 26 per cent.

1.6 Around seven per cent (some 665 kilometres) of the 9,500 kilometres of motorways and trunk roads in England suffers heavy congestion at peak times and occasionally at non-peak times. A further 13 per cent (1,235 kilometres) of the network suffers heavy congestion on at least half the days of the year. The Transport Research Laboratory has estimated that weight of traffic accounts for most congestion – some 65 per cent – while accidents and incidents account for 25 per cent, and road works account for 10 per cent. We examined the measures adopted by the Agency to minimise the impact of roadworks in our March 2003 report on *Maintaining England's Motorways and Trunk Roads* (HC 431, 2002-03).

The government is tackling congestion through a range of measures

1.7 Road congestion is difficult to address and might be seen to be a symptom of a dynamic and successful market economy. It is influenced by a variety of factors, such as people's attitudes towards car use, changes in land use such as the growth of out-of-town shopping centres, and public transport, as well as the actual availability of alternative means of transport such as trains and buses. There is a close link between transport and economic growth and the government has recognised that the underlying growth in traffic is likely to continue, driven by long-term trends of increasing wealth, rising car ownership, demographic changes and a real-terms reduction in the cost of motoring.[7] The latest data available show that, between 1992 and 2002,[8] the number of registered vehicles in Great Britain increased on average by some two per cent a year. By 2002, there were 30.6 million registered vehicles on Britain's roads.

1.8 The government is seeking to tackle congestion through a combination of measures intended to increase the capacity, and improve the management, of the network. The strategy for motorways and trunk roads includes:

- speeding up the delivery of new road schemes, where the elapsed time between conception and delivery has been as long as 16 years;
- implementing a major programme of targeted improvement schemes, such as widening of, and junction improvements at, bottlenecks on existing roads;
- bringing about a shift from road to other forms of transport, mainly rail for both passengers and freight transport;
- managing road incidents and accidents better; and
- promoting quality public transport alternatives.

1.9 Charging road users for general access to motorways and trunk roads to reduce congestion is not currently government policy, although tolls are used on some key roads on the network such as the Dartford Crossing on the M25 and the privately-run M6 Toll near Birmingham. The M6 Toll was built as an alternative to the heavily congested M6 through the West Midlands. In the first three months after the M6 Toll opened in December 2003, the Agency found that traffic volumes fell by around 10 per cent on the M6, accompanied by reduced traffic delays and improved journey time reliability. Tolls have primarily been used as a means to pay for the construction and operation of the roads, however, rather than as a means of tackling congestion.

1.10 The Transport Act 2000 allows local authorities to implement congestion charging schemes in urban areas, although only the Greater London Authority has introduced such a scheme on a major scale (there is a small scheme in the City of Durham). In July 2004, the Department for Transport published a report[9] on the feasibility of a national road pricing scheme for general access to the road network, covering both the Agency's motorways and trunk roads and local authority roads. The report concluded that road pricing could play a part in reducing congestion, alongside other measures, and that it would be technically feasible in the next 10 to 15 years. The Department intends to undertake further research into road pricing and how it might work, including consideration of what would make road pricing acceptable to motorists.

6 *Transport Statistics Great Britain:* Department for Transport, 2003.
7 *Managing our roads:* Department for Transport, 2003.
8 *Transport Statistics Great Britain:* Department for Transport, 2003.
9 *Feasibility Study of Road Pricing in the UK:* Department for Transport, July 2004.

The Highways Agency has a programme of activities intended to make better use of the existing motorway and trunk road network

1.11 As an Executive Agency of the Department for Transport, the Agency is responsible for implementing government policy in the provision, maintenance and management of the strategic road network in England. While new road building and improvement schemes and a shift from road to other forms of transport will take time to deliver, action is needed in the near term to deal with immediate problems of congestion on key routes and at congestion blackspots on the network. The Highways Agency has a programme of work, known as the *Making Better Use (MBU)* programme. Projects within the programme can have one or more of the following objectives:

- to bring quick relief from congestion;
- to improve safety;
- to improve the environment, such as by reducing noise levels;
- to improve accessibility for cyclists, pedestrians and people with disabilities; and
- to improve integration with other forms of transport.

1.12 **Figure 1** shows that the programme consists of two principal elements:

- Technology projects, such as an automated incident detection system (Motorway Incident Detection and Automatic Signalling - MIDAS), which uses sensors buried in the road surface to detect when traffic has been slowed or stopped by an accident (or some other problem on the motorway carriageway) and provides messages to drivers on electronic road-side signs; and
- Local Network Management Schemes, which may involve altering the layout of a road by painting new lane markings; adding traffic lights to a junction; replacing a cross-roads with a roundabout; or re-building slip roads, improving access to a motorway or trunk road. These schemes cost from a few thousand pounds up to a maximum of £5 million.

1 Expenditure on the key constituent parts of the *MBU* programme, 2003-04

Technology projects and Local Network Management Schemes are the principal elements of the Highways Agency's *MBU* programme.

Main elements	Description	Expenditure (£million)
Technology projects	Systems that support monitoring and operational activities on the network, including: an automated incident detection and warning system, CCTV cameras, a national traffic control centre, and more advanced road side message signs.	107
Local Network Management Schemes	Small scale construction projects costing less than £5 million, aimed at delivering locally targeted improvements quickly including 'pinch point' improvements such as improving layouts of lanes and junctions and signalling at junctions.	106
Research and development	Research and development projects to support all aspects of the Agency's work, including the MBU programme.	16[1]
Business Information systems	Information systems to support all aspects of the Agency's work, including the MBU programme.	13[1]
Total		242

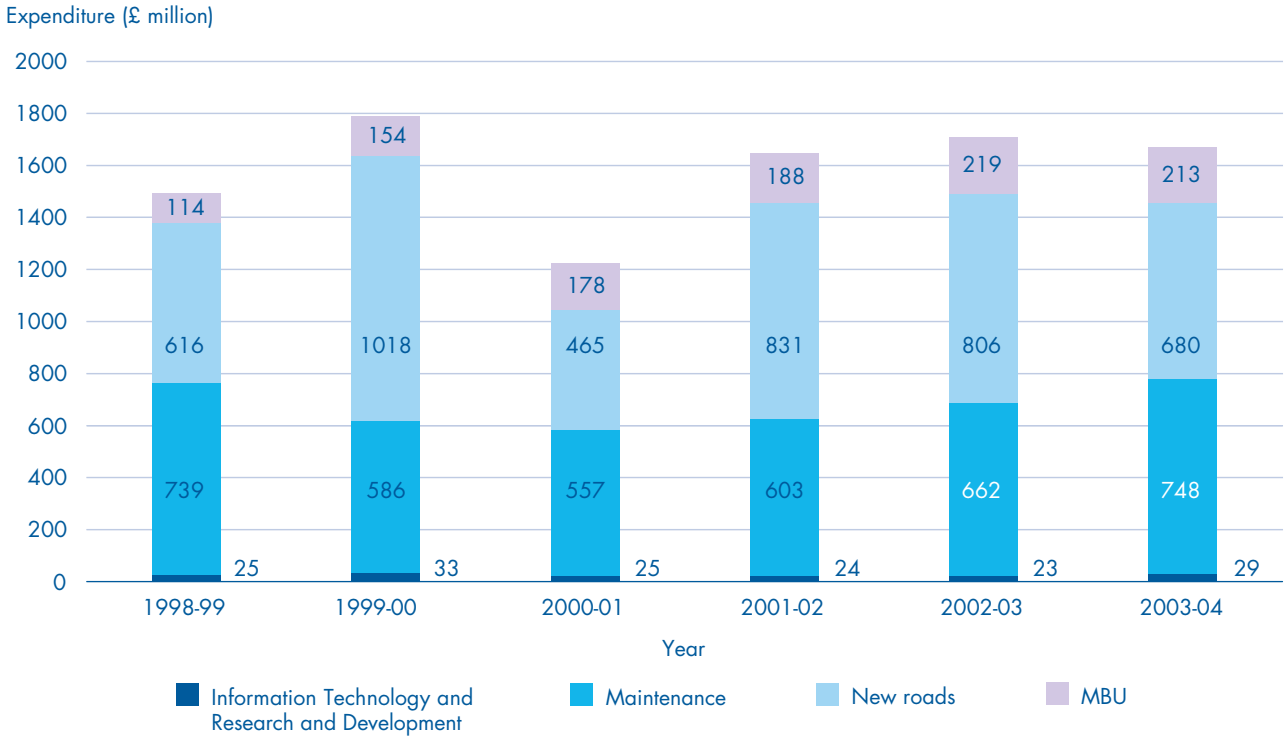
Source: National Audit Office summary of Highways Agency data

NOTE

1 Expenditure on research and development and business information systems is for the benefit of the Highways Agency as a whole, and not directly or exclusively on measures to tackle road congestion or improve safety.

2 Highways Agency expenditure on the MBU programme, compared with spending on road maintenance and new road building, 1998-99 to 2003-04

Although the Agency's spending is dominated by road maintenance and road building projects, expenditure on the MBU programme has grown since the programme started in 1998-99.



Source: National Audit Office summary of Highways Agency financial information

1.13 The *MBU* programme is on-going and open-ended, responding to changes in traffic volumes and congestion on different parts of the network, with no pre-determined date for its completion. Although road maintenance and large road-building projects account for around 85 per cent of the Agency's annual total spending on roads, expenditure on the *MBU* programme has grown from £114 million in 1998-99, when the programme began, to £213 million in 2003-04 **(Figure 2)**. The Agency spent nearly £1.1 billion on the programme in the six years to March 2004.

1.14 The Agency is also taking steps to improve its management of the network, including dealing with incidents, accidents and adverse weather conditions, which should help in its efforts to tackle congestion. In June 2003, the government announced that the Agency would develop its remit beyond building and maintaining the road network, by taking over from the police many of their responsibilities for clearing motorways after incidents and accidents and establishing a motorway patrol service of its own.

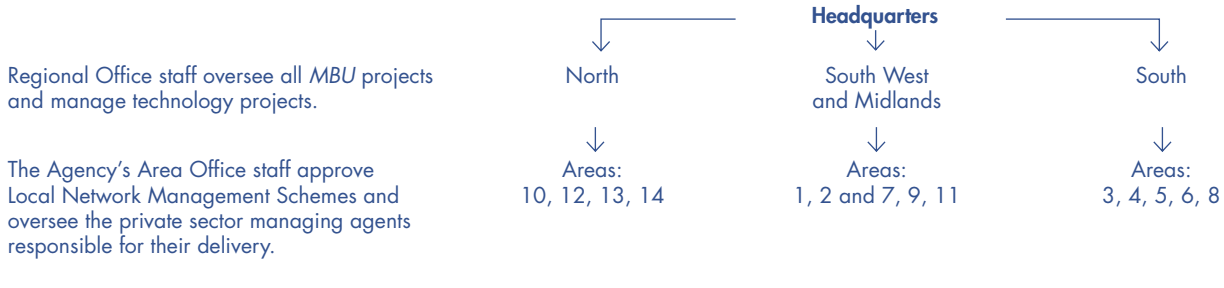
The Agency manages the *MBU* programme through regional and area offices, while delivery is contracted out to agents

1.15 The Agency oversees the *MBU* programme from its headquarters in London, and manages it through seven Regional Offices grouped into three Regions. Within the seven Regional Offices there are 14 Area Teams **(Figure 3)**:

- Staff in the Agency's headquarters identify major technology schemes across England as a whole, while staff in the Regions appraise them and manage their implementation. Consultants design technology schemes, while contractors deliver them.

3 The Highways Agency's organisational structure for managing and delivering the *MBU* programme

The Agency manages and delivers the *MBU* programme through its Headquarters, and through three Regional and 14 Area Offices.



Source: Highways Agency and National Audit Office

- Staff in Area Offices approve which Local Network Management Schemes should go ahead, fund them and oversee their delivery. Private sector managing agents, overseen by Area Teams, are responsible for the identification, appraisal, design and delivery of projects within their designated geographical areas. The Agency awards contracts to managing agents after competitive tender, appointing them for a fixed period of up to five years. The Agency can terminate their contracts if they do not meet agreed performance targets.

What we examined

1.16 Generally, we found that Local Network Management Schemes have been built to time and budget, while a programme of schemes designed to bring in improvements at 92 priority action sites is on schedule. Many road user organisations, including the Freight Transport Association, the Intelligent Transport Society (Unirted Kingdom), the Confederation of British Industry, National Express, the Road Haulage Association and the Automobile Association Motoring Trust welcome these types of schemes.

In the light of these findings, therefore, this report focuses on the other key aspects of the Agency's activities to tackle congestion, examining whether the Agency:

- is exploiting all of the measures at its disposal to tackle congestion caused by the weight of traffic on England's roads (Part 2 of this report);
- has given sufficient attention to influencing driver behaviour, as a means of tackling congestion (Part 3); and
- is dealing effectively with shocks to the network that cause congestion (Part 4).

1.17 As part of our study, we visited The Netherlands and Germany, countries which suffer from similar congestion problems to England, to obtain comparative information on how they tackle congestion. Our study visit to The Netherlands included a visit to the Transport Research Centre in Rotterdam and the National Traffic Control Centre at Utrecht. Our visit to Germany included a visit to the Federal Highways Research Institute near Cologne and the Traffic Control Centre, in Frankfurt. A full list of our methods is at the Appendix.

PART TWO

The Agency has made little use of measures used abroad

2.1 This Part of the report examines whether the Agency has exploited the full range of measures at its disposal to tackle congestion caused by the weight of traffic on England's motorways and trunk roads. To inform our work, we visited The Netherlands and Germany in October 2003 accompanied by officials from the Highways Agency and carried out additional research on other countries to ascertain the measures - usually involving technology - that their national and state transport authorities use to tackle congestion. We compared our findings against the range of technology measures adopted by the Highways Agency in England specifically designed to tackle congestion caused by weight of traffic. Further information about our international comparisons work is at the Appendix.

The Agency is behind some overseas counterparts in adopting measures to tackle congestion caused by weight of traffic

2.2 We found that highways authorities in The Netherlands and Germany used a variety of technology measures[10] to tackle congestion **(Figure 4)**, although neither country used all of the measures and the extent of usage of any measure varied between the two countries. Two of the measures, Dedicated Lanes and Ramp Metering, are also used extensively in the United States. Highways authorities abroad have not put measures in place across the whole of their motorway and trunk road networks, but have been selective in adopting measures on particular stretches of roads, such as the approaches to junctions where their use need not be on many kilometres of road in order to be effective. For example, Tidal Flow is generally used over short distances where travel patterns vary by time of day, such as during a rush hour when traffic travels into, and then out of, a city centre. Under a Tidal Flow scheme on the bridge over Auckland harbour in New Zealand, for example, the direction of traffic is changed to deal with the daily fluctuations in traffic flow into and out of the city.

4 Measures adopted in other countries to tackle congestion

Highways authorities in The Netherlands, Germany and the United States use a variety of measures to tackle congestion.

Tidal Flow involves reversing the direction of traffic in one lane or more on a motorway or trunk road to cope with peaks in traffic volumes. Signals above the carriageway indicate which lanes are in use and the direction of traffic in those lanes. This measure can only be used where it is safe to do so, usually without the traffic being segregated by cones or temporary barriers. It therefore differs from contra-flow, used at roadworks, where lanes might be separated by cones or temporary crash barriers. Tidal flow schemes have been used since the 1970s.

Dedicated Lanes are restricted for use by a specific type of vehicle, such as buses or heavy goods vehicles, and can be used on both motorways and trunk roads. High Occupancy Vehicle (HOV) lanes are a form of dedicated lane, intended for vehicles carrying more than one passenger to encourage, for example, commuter car-share schemes. HOV lanes have been widely adopted in the United States since they were introduced in the 1970s.

Ramp Metering involves using traffic signals, similar to traffic lights, to control the rate at which vehicles join a motorway from a slip road. Ramp Metering originated in the United States, where it has been used extensively since the 1970s, while the authorities in The Netherlands and Germany have used Ramp Metering since 1989 and 1995, respectively.

Variable Speed Limits involve adjusting speed limits on motorways depending on traffic volumes in order to improve traffic flow, reduce the number of accidents and thereby reduce congestion. Normal speed limits apply when traffic is free flowing. Speed limits are reduced when traffic volumes reach a predetermined level, with signals above the carriageway indicating either advisory or mandatory speed limits. The authorities in The Netherlands and Germany have used Variable Speed Limits since the 1980s and 1990s, respectively.

Hard Shoulder Running involves temporarily opening the hard shoulder on motorways to traffic during peak periods. Signals above the carriageway indicate when the hard shoulder is open. The authorities in The Netherlands and Germany have used Hard Shoulder Running since 1996 and 1999, respectively.

Dynamic Lanes involve using lights similar to cats' eyes set in the surface of the road to alter the number and width of lanes on a motorway, usually in order to increase the capacity of the road. For example, three lanes of normal width could be changed into four narrower lanes to accommodate more vehicles. Dynamic lanes are a new measure, currently under trial in the Netherlands and Germany.

Source: Highways authorities in The Netherlands, Germany and the United States

10 The Glossary describes the various measures in more detail.

2.3 By comparison, in England the Highways Agency:

- has adopted four of the six measures used in other countries, but only to a very limited extent;
- has carried out trials of two measures, but the Agency has managed them poorly and they have been inconclusive; and
- has no proposals to adopt one of the measures currently under trial in other countries, or to run trials of it in this country.

We asked the Agency why it was behind some of its overseas counterparts in adopting measures to tackle congestion caused by weight of traffic.

The Agency has concentrated its technology projects on improving road safety

2.4 As the operator of England's strategic motorway and trunk road network, the Agency aims to:

- make best use of the existing infrastructure by implementing traffic management, network control and other measures;
- reduce congestion and increase the reliability of journey times; and
- improve road safety and contribute to the government's road safety strategy.

2.5 During the 1990s, the government's emphasis was on building new roads, maintaining the existing ones and improving road safety. For the first six years after it was set up in 1994, the Agency did not have a target to reduce congestion. Its priority for traffic management was improving road safety until the government issued its *10 Year Plan for Transport* in 2000, which set the Agency the target to reduce congestion by five per cent, alongside its target to reduce by one third the number of road casualties, by 2010. Between 1994 and 2003, the number of people killed or seriously injured on England's motorways and trunk roads fell from 4,991 to 4,223.

2.6 Since then, however, tackling road congestion has become a high priority for the government, as congestion levels have remained high. Congestion reduction features among the Public Sector Agreement (PSA) targets that the Prime Minister's Delivery Unit has been focusing on since 2002. Since the *MBU* programme started in 1998, however, the Agency has continued to concentrate much of its technology projects on improving road safety and managing incidents by installing the MIDAS system (paragraph 1.12), supported by CCTV cameras to help identify incidents and manage response. Although fewer accidents help to reduce the incidence of congestion, the primary aim of MIDAS is to improve road safety and its installation has absorbed most of the Agency's investment in technology schemes.

The Agency considers that measures used in other countries would operate differently and that driver behaviour is different in England

2.7 The Agency told us that it would operate some measures differently in England compared with other countries and that the differences have to be tested. Highways authorities in the United States, for example, allow a backlog of traffic on a motorway slip road to build up as a means of keeping existing vehicles flowing freely on a motorway even if the backlog results in congestion on local roads, a practice that the Agency considers would be unacceptable in England. In such circumstances, the Agency would suspend Ramp Metering before such conditions developed. The Agency also told us that it has been concerned that traffic conditions and driver behaviour in England differ from those in other countries, which would affect the success of measures to tackle congestion.

The Agency has not been convinced as to the rigour and quality of assessments of measures used in other countries

2.8 The Agency considers that it is well informed about developments in other countries. It is, for example, a member of CENTRICO, a western European project concerned with cross border co-ordination and implementation of transport technology. One of CENTRICO's objectives is to exchange information about the implementation of new traffic management techniques. Staff from the Agency have also visited, for example, The Netherlands on several occasions to examine their schemes for tackling congestion. The Agency has evaluated schemes in other countries. In 1998, the Agency evaluated Ramp Metering in the United States and The Netherlands and on several occasions in the 1990s reviewed Variable Speed Limits in Germany. In 2001, the Agency reviewed the use of Tidal Flow, Ramp Metering, Dedicated Lanes and Hard Shoulder Running abroad compared with their use in England. The Agency has not been convinced, however, as to the rigour and quality of the assessments carried out in other countries. Hence, despite the measures' widespread adoption and reported beneficial impacts in other countries, the Agency has not consistently sought to implement similar measures in England, although it has been running trials of some measures and is planning to run trials of others.

The Agency has adopted to a very limited extent four measures used in other countries

2.9 The Agency has adopted Tidal Flow, Dedicated Lanes, Ramp Metering and Variable Speed Limits but in each case only to a very limited extent. It introduced the first three measures without trials, while its adoption of Variable Speed Limits came out of a trial on one stretch of motorway.

The Agency operates Tidal Flow measures on two roads on the network

2.10 The Agency operates Tidal Flow schemes on two roads – on the Bascule Bridge on the A12 near Lowestoft and on 400 metres of the Saltash Tunnel on the A38 in Cornwall.[11] The Bascule Bridge scheme was installed in the mid-1980s and the Saltash Tunnel scheme started in 1988, both before the Agency was set up in 1994.

2.11 In 1990, consultants commissioned by the-then Department of Transport assessed the potential to operate Tidal Flow on the whole of the M25, but found that the M25 did not offer sufficient differences in directional flow for Tidal Flow to be effective on that motorway. The consultants noted that the opportunities to use Tidal Flow were generally best suited to urban routes with heavy traffic flows into and out of city centres during morning and evening peak periods. The Agency has recently assessed Tidal Flow on a section of the M42, with similar results to those for the M25. In keeping the network under review, the Agency has not identified any other congested locations where traffic flows are highly directional and therefore suitable for Tidal Flow measures.

Tidal Flow schemes are more common abroad

National and state highways authorities in The Netherlands and Germany, as well as in the United States, Canada, Australia, New Zealand and France to varying extents, have implemented Tidal Flow schemes to deal with congestion on some of their motorways and trunk roads. In The Netherlands, Tidal Flow schemes covering some 22 kilometres of motorways are either in place or under construction. In Germany, Tidal Flow schemes include a 12 kilometre section of an autobahn near Hanover.

The Agency operates Dedicated Lanes at four locations on the network and until very recently has been reluctant to extend their use

2.12 The Agency has put in place Dedicated Bus Lanes on four different stretches of road: a section of motorway from the M4 to Heathrow airport; six kilometres of the M4 motorway; sections of the A40 near Oxford; and the A52 near Nottingham. The Agency spent £1.9 million setting up the six kilometre M4 scheme, and has run it since 1999. When it introduced the scheme, the Agency also reduced the maximum speed limit to 50 miles per hour on that part of the M4. Research carried out in 2000-01 showed that the bus lane had reduced journey times in peak periods by three and a half minutes for buses and by one minute for cars, saving some 1,150 person hours each weekday valued at £750,000 a year. Off-peak journey times for cars and buses increased by about one minute, partly because of the lower speed limit. There has, however, been an estimated 20 per cent reduction in the number of accidents, and journey times are now more predictable than in the past.

2.13 High Occupancy Vehicle (HOV) lanes are a form of dedicated lane. HOV lanes have become widely adopted in the United States since they were introduced in the 1970s. There are over 125 HOV projects in 30 US cities[12], covering over 2,500 lane-miles and carrying more than 3 million commuters a day. Most HOV lanes were created either by widening existing roads or during the building of new ones. The number of projects in the US is expected to double in the next 25 years.

Motorways in The Netherlands have lanes dedicated to heavy goods vehicles

Around 12 kilometres of roads in The Netherlands are specifically dedicated to heavy goods vehicles. In addition, on more than 80 per cent (1,650 kilometres) of the motorway network, heavy goods vehicles are prohibited from overtaking any other traffic - making the inside lane in effect a dedicated lorry lane. Research in The Netherlands has reported that heavy goods vehicle lanes have increased road capacity by 16 per cent while the prohibition on heavy goods vehicles overtaking has increased capacity by four per cent, helping to tackle congestion.

11 Local authorities also run tidal flow schemes, such as the Blackwall Tunnel in London, which is operated by Transport for London.
12 Although the majority of HOV lanes are on radial routes into cities, there are many examples on inter-state routes akin to England's motorways.

2.14 Despite the reported success of the M4 bus lane in particular, and of HOV lanes in the United States, the Agency has not actively pursued the adoption and wider take up of these types of Dedicated Lanes in England.[13] Although the Agency consulted drivers and local stakeholders about the M4 scheme, through leaflets to drivers and briefings for bus companies before and after the scheme was implemented, there was considerable public opposition from motorists and sections of the media when the scheme opened in 1999. In 2001, consultants prepared draft guidelines on how the Agency might develop and implement HOV lanes. The Agency considered putting HOV lanes on the A102(M) in South East London and on the M32 near Bristol, and a Heavy Goods Vehicle lane on the M62 between Manchester and Leeds. The unpopularity of the M4 bus lane with motorists, however, discouraged the adoption of any dedicated lanes at other sites beyond the A40 and A52 schemes.

2.15 More recently, a separate programme of 21 Multi-Modal Studies[14] commissioned by the Department recommended a range of measures to address problems identified on key parts of the strategic road network, including HOV, bus and freight dedicated lanes on certain routes. The Agency is considering how to take the recommendations forward. In May 2004, the Agency also evaluated eight potential sites for HOV lanes, and in July 2004 the Department announced that the Agency would be carrying out a motorway trial of HOV lanes in England. The Agency has yet to agree a timetable with the Department.

2.16 Highways authorities in other countries have experienced public resistance to innovative schemes, which might require considerable consultation to gain user acceptance. In the United States, specialist public relations consultants have been employed to help persuade motorists of the benefits of proposed new schemes. Highways authorities in the United States have considerable guidance on how to market a new scheme; by comparison, the Highways Agency has none.

Winning over public opinion is a major consideration in the implementation of road schemes in The Netherlands

The Dutch national highways authority introduced a high occupancy car lane in 1993 that led to reduced congestion during peak hours. Following pressure from the media and the public, however, the authority withdrew the scheme. The national highways authority has recognised the importance of consulting with road users to influence their acceptance of potentially unattractive measures and now uses publicity and information to secure stakeholders' acceptance of measures before they are introduced. A report "Roads to Reliability" in 2002 found that a targeted communications strategy aimed at road users is likely to be more successful than using the mass media, such as television.

The Agency has adopted Ramp Metering and mandatory Variable Speed Limits at a small number of sites, but has not extended their use elsewhere on the network

2.17 Highways authorities in the United States and Europe have adopted Ramp Metering and Variable Speed Limits widely over the past 20 to 30 years. Research carried out in The Netherlands has reported that Ramp Metering and Variable Speed Limits both increase the traffic flow by four and five per cent respectively, helping to tackle congestion. In Germany, the reported benefits of Variable Speed Limits, where there had previously been no speed limits, include smoother traffic flow at higher speeds (up to 20 kilometres an hour faster), increasing the volume of traffic that roads can accommodate, and a 30 per cent reduction in the number of accidents.

13 There are two local authority run HOV lanes, one along the A647 in Leeds and one near Bristol on the A4174. The Leeds scheme was designed to relieve congestion on a two kilometre stretch of road where journey times took typically 10 minutes during the morning peak. An evaluation of the Leeds scheme in 1999 found that in the morning peak there were time savings of four minutes for HOVs and a reduction of 1.5 minutes for non-HOVs.

14 The Department set up Multi-Modal Studies in 1999. Study teams reported between December 2000 and February 2004.

Ramp Metering and Variable Speed Limits are commonly used overseas

Highways authorities in the United States were the first to introduce Ramp Metering, in the 1970s, and now operate it at more than 3,000 sites across the country. Highways authorities in The Netherlands use Ramp Metering at over 40 sites and have plans to adopt the measure at a further 24 sites. In Germany, Ramp Metering is in use at some 30 sites. On motorways around cities, such as Madrid in Spain, Ramp Metering is an integral part of managing traffic flows.

Variable Speed Limits are common in other European countries including: The Netherlands; Germany; France; Spain; Sweden; and Denmark. Highways authorities in The Netherlands operate mandatory Variable Speed Limits on half of the country's 2,000 kilometres of motorways. Variable Speed Limits are also used in Germany on about 850 kilometres of motorways, although the extent varies from state to state. In the state of Hessen, for example, there are some 90 kilometres of autobahn covered by Variable Speed Limits – some 10 per cent of the State's motorway network.

2.18 The Agency has at one time operated Ramp Metering at six sites on the M6, although the number is now down to four, and mandatory Variable Speed Limits on 30 kilometres of the western section of the M25. In addition the MIDAS system (paragraph 1.12) provides advisory speeds to drivers on nearly 30 per cent of the motorway network. The-then Department of Transport introduced Ramp Metering in 1985 to address specific traffic problems at specific locations on the M6. It took the opportunity to evaluate whether the measure might be used elsewhere, however, as if it were a trial. Ramp Metering brought about reductions in journey times of up to 20 minutes during peak hours at one site and lesser reductions at other sites.

2.19 The sites were unrepresentative of traffic flows on most other parts of the network, however, as they sustained very high volumes of traffic throughout the day with only a discernible peak during the morning. They also had similar physical characteristics, providing no indication as to whether Ramp Metering was suitable for other sites with different characteristics. The Ramp Metering equipment and operating systems would also require significant development work before there could be wider application of Ramp Metering elsewhere on the network. The Department considered that the results were unlikely to be replicated and was not prepared to fund implementation of Ramp Metering elsewhere on the network. It stopped evaluating the results in 1987 but left the equipment in operation until the end of the equipment's life, in 1999. After installing new equipment, however, the Agency resumed Ramp Metering in 2001 at four of the original six sites on the M6 because it considered that the measure worked at those locations.

2.20 In 1995, the Agency set up a one year trial of Variable Speed Limits on 22 kilometres of the M25. The initial results of the trial indicated savings in journey times, smoother flowing traffic and a fall in the number of accidents. On the basis of these findings, the Agency converted the trial into a permanent facility in 1997. Variable Speed Limits have generally been popular with road users who have reported perceived benefits, including less congestion and less stressful journeys. The Freight Transport Association told us that they were frustrated that the success of Variable Speed Limits has not led to their greater use.

The Agency has carried out further trials of Ramp Metering and Variable Speed Limits, but has managed them poorly with inconclusive results

2.21 Whilst running Ramp Metering on the M6 and Variable Speed Limits on the M25 as permanent features, the Agency has also carried out further trials of these measures on the M3 and M27, and M25, respectively with the aim of determining whether these measures could be used elsewhere on the network. We found that the Agency has not managed the trials well and that this has contributed to some trials' inconclusive results. Further, the Agency has been attempting, without much success, to develop business cases for adopting the measures more widely. We are not convinced that the Agency's approach for doing so is the right one.

The Agency has not managed its trials well, contributing to their inconclusive results

2.22 Although it has prepared guidance on how to monitor and evaluate trials, the Agency has not issued any guidance on identifying, designing and delivering them. Nor has it established any standards on how long trials should take or how much they should cost.

2.23 The Agency has employed consultants to undertake much of the design, data collection and evaluation of trials. We found that:

- some managers were too focused on ensuring that the trial technology worked without also considering the trials' overall aim to develop a business case;
- the objectives of trials were not clearly specified from the outset. We found that the objectives for the first M25 Variable Speed Limits trial did not set out how long the trial should take, how much it should cost, or whether a business case for using the measure elsewhere on the network would be developed. In case of the M3 and M27 trials and M6 Ramp Metering schemes there were no objectives about how the results of the trials and schemes were to be used to prepare a business case; and
- on the M27 Ramp Metering trial, the Agency did not have direct access to the work of sub-contracted consultants responsible for monitoring the trial and was therefore unable to monitor or assess the work properly during the course of the trials, and therefore did not appreciate any difficulties until the end of the trial, at which point it was too late to rectify problems without extending the trial at additional expense.

2.24 The national highways authority in The Netherlands has conducted more, quicker and less costly trials than the Agency, which have contributed to the wider implementation of measures across the Dutch network. The Dutch authorities told us that they complete trials in 12 to 18 months and that they collect three months of "before and after" data for evaluation purposes. From our review of the Agency's trials and of trials practices in other countries, we identified several areas where there is scope for the Agency to improve its design, management and delivery of trials **(Figure 5)**.

2.25 The Agency has over-spent its budget for the trial of Ramp Metering and its first trial of Variable Speed Limits by 80 per cent (£3.2 million) and 12 per cent (£1.2 million) respectively **(Figure 6)**.

5 NAO best practice guide for designing, managing and delivering trials of measures to tackle congestion

There are several areas in which the Agency could improve the design, management and delivery of its trials of measures to tackle congestion.

In designing a trial, the Agency should:

- take account of trials carried out in other countries, systematically assessing the results of any evaluation or research on those trials' results and any lessons to be learned in adopting the measure under trial;
- set clear objectives for the trial, with a clear budget and timescale. Trials should have a finite life with a fixed end date. Two years, for example, would allow for two annual cycles of traffic flows and any seasonal variations.

In establishing a trial, the Agency should:

- select sites that will not be affected by any other planned changes, such as the introduction of other forms of technology not under trial or changes in road layout, that would compromise the evaluation of the trial;
- collect sufficient and reliable traffic-related data before the trial begins; and
- put in place procedures to collect sufficient and relevant traffic-related data during the course of the trial that are consistent with the data collected before the trial started.

In managing a trial, the Agency should:

- monitor the progress and results of the trial on a regular basis; and
- evaluate the results of the trial, including the impact of the measure itself and the design, management and delivery of the trial. The evaluation should include an assessment of: the factors contributing to or detracting from the trial's success, including the characteristics of the trial sites such as traffic volumes and patterns, in order to identify lessons for future trials; and of whether the measure should be adopted elsewhere on the network and, if so, under what conditions.

Source: National Audit Office

6 Comparison of plans against actual expenditure and lifetimes for trials of Ramp Metering and Variable Speed Limits

The Agency over-spent its budget in two of its three trials.

Measure under trial and first year of operation	Budget	Spend to date[1]	Planned lifetime of trial	Actual lifetime (to date if ongoing)
M25 Variable Speed Limits, junctions 10 to 15 (1995)	£10.0 million	£11.2 million	1 year[2]	1 year
M3 and M27 Ramp Metering (2000)	£4.0 million	£7.2 million	3 years	4 years
Extension of trial of M25 Variable Speed Limits to cover junctions 15 to 16 (2002)	£3.9 million	£2.9 million	2 years[2]	2 years
Total	£17.9 million	£21.3 million		

Source: National Audit Office summary of Highways Agency data

NOTES

1 Figures have not been audited.

2 The equipment was installed to have a 15 year life.

2.26 Learning from the Department's experience of Ramp Metering on the M6 (paragraph 2.19), the Agency selected slip roads with characteristics that were as varied as possible for its Ramp Metering trials on the M3 and M27. Starting in 2000, the Agency intended these trials to conclude on whether Ramp Metering could be installed more widely on the network. Research on the M3 and M27 trials, however, has shown that reductions in journey times have not been sufficient to justify the use of Ramp Metering at those locations. The Agency switched off the Ramp Metering signals on the M3 and M27 in March 2004. The results of these trials, combined with on-going monitoring of Ramp Metering on the M6, however, have enabled the Agency to identify up to 100 sites where Ramp Metering might be appropriate, although each may require more detailed local analysis.

2.27 The results of the Agency's initial trial of Variable Speed Limits on the M25, which ran from 1995 to 1996, indicated that the measure was effective at the trial site. The Agency therefore continued to operate Variable Speed Limits as a permanent feature at the site, whilst monitoring their impact to confirm and more accurately quantify the benefits beyond the 12-month trial period. Monitoring of the scheme by the Transport Research Laboratory in 2000 found that accident results were inconsistent between different stretches of the motorway, increasing on one stretch but falling on another. The latest study by the Transport Research Laboratory in 2002, however, concluded that Variable Speed Limits reduced accidents involving injury by between 10 and 20 per cent.

2.28 The trial and the subsequent monitoring did not provide conclusive evidence of the measure's benefits, however, to allow the Agency to make a business case for using Variable Speed Limits elsewhere on the network. Conditions at the site were not stable before or during the period of the trial and of the extended monitoring. Traffic volumes changed and the Agency introduced new technology and new lighting and widened the motorway at both ends of the trial site, preventing it from establishing properly controlled and reliable "before and after" data to assess the measure's impact. Without reliable data, the Agency could not prove a business case to use the measure elsewhere.

2.29 As a result, in 2002 the Agency extended the Variable Speed Limits trial, at a further budgeted cost of £3.9 million, to cover an additional eight kilometres of the M25 site, where conditions were expected to be more stable, in order to collect sufficient before and after data to prepare a business case. In October 2004 consultants monitoring the trial extension reported that there had been little change in journey times during peak periods and small increases during off-peak periods, although overall journey time reliability had improved. Accidents involving injuries had been reduced by 10 per cent. The consultants developed a generic framework, which the Agency is now applying to identify sites where Variable Speed Limits are likely to be cost effective, including sections of the M25 and M42.

The Agency's approach to proving that a measure should be implemented more widely might not be the right one

2.30 In undertaking its trials, the Agency aims to identify the characteristics and conditions where a measure is effective at the particular trial sites and to make a business case for adopting that measure elsewhere. Yet, the Agency's approach of running very few trials limits its ability to find trial sites with the right characteristics and conditions for success. The Agency is conscious of the need to control the risks to safety that might be associated with running trials of particular measures. In our view, against the background of the need to manage the safety risks involved, the Agency needs to adopt a more expansive approach to risk management more in proportion with the risks involved, carrying out more trials at more sites to increase their chances of success.

The Agency is only now putting in place trials of Hard Shoulder Running

2.31 In The Netherlands, the highways authority has used Hard Shoulder Running during peak periods since 1996. The measure is currently operated at 15 locations over short stretches of motorway, mainly around junctions, covering some 35 kilometres of motorway. Research in The Netherlands has reported that on two-lane motorways Hard Shoulder Running has increased road capacity by 36 per cent, helping to tackle congestion. In Germany, successful trials in 1999-2000 led to the wider introduction of Hard Shoulder Running in 2002. The measure is now in operation over some 60 kilometres of motorways. By comparison, the Agency does not use Hard Shoulder Running on any of its motorways or trunk roads, other than as a temporary measure at roadworks.

2.32 The Agency told us that there have for many years been safety concerns about the introduction of Hard Shoulder Running in England, including amongst the police. The Automobile Association Motoring Trust, the Royal Automobile Club (RAC plc) and the Parliamentary Advisory Council for Transport Safety[15] expressed concerns to us about how quickly emergency vehicles would arrive at accident sites if Hard Shoulder Running were adopted. Many organisations, however, including the Freight Transport Association, support the use of the hard shoulder and would like the Agency to implement Hard Shoulder Running on the most congested parts of the network as a key priority.

Highways authorities in The Netherlands and Germany have used Hard Shoulder Running since 1996 and 1999, respectively

Following a six week consultation period with drivers, the highways authority in The Netherlands identified Hard Shoulder Running as a priority area for improvement and has launched a £305 million project to install a further 480 kilometres (covering a further 10 per cent of its network) of Hard Shoulder Running by 2006.

Both the Dutch and the German authorities have found that the additional motorway capacity provided by allowing traffic to use the hard shoulder has significantly reduced congestion at peak times. They have also found that Hard Shoulder Running is cheaper, and has less impact on the environment, than widening the road.

2.33 In The Netherlands and Germany, refuge areas are provided at intervals of between 500 and 1,000 metres for use in an emergency during Hard Shoulder Running, and CCTV cameras scan the hard shoulder before it is opened to traffic and detect any accidents and incidents that might require the lane to remain closed. Research in The Netherlands and Germany found that accident rates have fallen where such measures have been implemented alongside reduced speed limits. For example, in The Netherlands the accident rate has halved on those stretches of motorway where Hard Shoulder Running and lower speed limits have been introduced. A 2002 survey found that, although 10 per cent of Dutch road users perceived a reduction in safety following the introduction of Hard Shoulder Running, 40 per cent considered that the roads were safer as a result of Hard Shoulder Running.

2.34 Overseas experience therefore suggests that there have been no insurmountable obstacles to addressing safety concerns associated with the introduction of Hard Shoulder Running. Indeed, the Agency has recently embarked on a trial of Hard Shoulder Running in which it will be applying safety features similar to those that have been in place for many years in The Netherlands and Germany. In May 2003, the Agency started the construction work necessary to set up a trial of Hard Shoulder Running as part of a larger project, known as Active Traffic Management (ATM), on the M42. The Agency intends to address safety concerns about the use of Hard Shoulder Running during the trial through a range of measures, including:

15 A registered charity whose aim is to advise and inform members of the House of Commons and the House of Lords on air, rail and road safety issues.

- reducing the speed limit to 50mph when Hard Shoulder Running is operational;
- opening the hard shoulder to traffic only after one of the Agency's patrol vehicles has driven along it to check for debris and other safety hazards;
- providing refuge areas every 500 metres along the carriageway for broken down vehicles and use in an emergency;
- using extensive CCTV coverage to monitor the hard shoulder, and closing it immediately any problem is identified; and
- the installation of MIDAS at closer intervals (100 metres) than standard, to provide faster detection of incidents.

The Agency considers that this package of safety measures goes beyond those adopted for Hard Shoulder Running abroad. Further, part of the trial involves developing a fully automated system for controlling how and when Hard Shoulder Running should be switched on and switched off safely.

2.35 In the ATM project, the Agency will be combining Hard Shoulder Running with a variety of other technologies and measures, including Variable Speed Limits and Ramp Metering. In testing several technologies and measures together, the Agency will be aiming to find out how flexible it can be in its response to congestion problems, using different permutations in response to different circumstances. For the project to be a success, the Agency will need to manage a variety of risks associated with the design, management and delivery of trials, drawing on the NAO's best practice guide (Figure 5).

Highways authorities in other countries are running trials of Dynamic Lanes, but the Agency has no plans to follow suit

2.36 Highways authorities in Germany and The Netherlands are carrying out trials of Dynamic Lanes. In a pilot project in the State of Hessen, Germany, for example, the highways authority is able to divide into two the inside lane nearest the exit slip road, by moving the position of the cats' eyes set in the surface of the road that provide the demarcation between lanes, creating an additional 'through lane' past the junction and helping to relieve congestion on the motorway in the approach to the junction. The Dutch and the Germans have experienced problems with the reliability of the technology, which they are currently trying to address. They do, however, intend to continue with the trials in due course. The Agency is keeping a watching brief on the progress of the trial, but has no plans to run similar trials in England.

PART THREE

The Agency is giving more attention to influencing driver behaviour

3.1 In addition to making physical changes in the layout and use of motorways and trunk roads and implementing new technology to facilitate and support smarter use of the existing road space, attention needs to be given to the human factors that contribute to congestion. This Part examines the Agency's efforts to influence two of the human factors involved:

- driver behaviour, including drivers' choice of particular routes, which might exacerbate problems caused by the weight of traffic on those routes; and
- the concentration of journeys during peak periods, contributing to heavy traffic volumes at those times.

The quality of road-side information given to drivers during their journeys has been poor

3.2 The reliability of expected journey times is important for commercial firms involved in transporting goods around the country. The Freight Transport Association told us that there was a significant potential cost saving to industry as a whole through the provision of better, real time information to help commercial road users improve the routing and scheduling of their vehicles, allowing drivers to take alternative routes to avoid congestion. The results of the latest biennial national road users' survey indicate that motorists' satisfaction levels with the information on the Agency's message signs are good, although these signs cover only about 30 per cent of the motorway network and a few stretches of trunk road.

3.3 Motorway and trunk road user groups that we consulted, however, such as the Road Haulage Association, were dissatisfied with the quality of on-road information provided to motorists. They pointed out that the information was not up-to-date, and did not enable road users to consider alternative routes when their existing or planned routes were congested. For example, electronic signs on the M25 carrying messages such as *"Accident M40 North"* are of limited assistance to motorists as they provide no indication of how long it will take to clear the scene of the accident and the resultant tailbacks, or of what motorists should do to minimise or avoid delay – whether, for example, to join the M40 or take an alternative route and, if so, which one. Motorists also want to know how long it will take them to get to their destination, but the Agency does not currently provide such information on the range of electronic message signs located around the network.

3.4 The Agency, as manager of the network, is responsible for installing the road-side equipment and signals to provide the information that drivers need. The police, through a network of Police Control Offices, have operated the signals. The police have monitored road conditions mainly by using their patrols and CCTV cameras.

Highways authorities in The Netherlands, Germany, Japan and France provide motorists with real-time information about journey times and congestion

In **the Netherlands**, on-road "Dynamic Route Information Panels" provide information on the length of traffic jams on two or three alternative routes. After the highways authority introduced the Panels on the Amsterdam ring road in the late 1990s, research found that the level of congestion on the ring road fell by up to 25 per cent. The Dutch highways authority is now upgrading the information on the Panels to include information about estimated journey times.

In **Germany,** many strategic junctions of autobahns have electronic signs providing recommended routes to help drivers bypass congestion. These signs display a standard bypass arrow symbol indicating alternative routes to take. If an autobahn is congested or closed for any reason, alternative routes are posted to guide traffic around the closure. On sections without electronic signs, the police warn motorists of traffic jams ahead by using signs mounted on police cars parked along the hard shoulder.

In **Japan,** the highways authority informs motorists of incidents or severe congestion before they join motorways and once they are on the motorways by means of information displayed on Variable Message Signs. These Signs give predicted journey times for using the motorways and for other national route alternatives. Some Signs show a simplified network map showing levels of congestion using a colour coding system, although they do not give any direct advice on which alternative routes to select, leaving motorists to make their own decisions based on the information provided.

In **France,** there have been on-road variable message signs around the Paris ring road (Paris Boulevard Périphérique) since 1994. The highways authority has extended the system to other parts of the motorway network. The signs give real time information about congestion, road closures and journey times. The Paris system scores very highly with motorists, achieving approval ratings of over 80 per cent in satisfaction surveys. Some 79 per cent of motorists say that they change their itinerary as a result of the messages.

The Agency expects its new Traffic Control Centre to improve further the information it can give to motorists

3.5 In addition to old technology affecting the quality of on-road information that the Agency can provide to motorists, collecting good quality data that can then be posted on message signs also presents a problem. The Agency has made the provision of better information for road users a priority in its strategy for tackling congestion. In March 2001, the Agency awarded a £160 million, 10-year Public Private Partnership contract to Traffic Information Services Limited to design, build, finance, and operate a new National Traffic Control Centre in Birmingham. It is also now recruiting to a new post of Director of Information, responsible for devising an information strategy and policy, and managing the provision of information to motorists.

3.6 One of the Traffic Control Centre's main functions will be to provide drivers with up-to-date information through variable message signs located around the network. The Agency expects the Centre to reduce congestion on the motorway network by five to six per cent over the 10 year contract, reducing traffic delays and securing journey time savings valued at some £160 million. When fully in service, the Centre will be the first in the world to cover an entire country and will be supported by seven regional centres managing traffic in their respective regions. The Centre was due to be open and providing some services by March 2004, before becoming fully operational by the end of December 2004. It actually started operations five months early, in November 2003 but the Agency now does not expect it to be fully operational until July 2005.

The Agency is upgrading the information technology on much of the motorway network

3.7 A key problem affecting the quality of on-road information that the Agency can provide to motorists is the prevalence of old technology across the network. Two of the most significant technology projects implemented by the Agency over the last five years have been MIDAS (paragraph 1.12) and Mark 2 and Mark 3 electronic variable message signs. Some 70 per cent of the motorway network is still served by the first generation (Mark 1) electronic message signs, which were first introduced in the late 1960s. There are few variable message signs on the Agency's other roads. The Agency considers that Mark 1 signs are appropriate for motorways that handle up to 60,000 vehicles a day. Mark 1 signs are limited in the range of information they can display, however, and are usually confined to displaying information about blocked lanes, fog, and advisory speed limits. These signs cannot display messages, such as how long drivers will have to wait in queues, or suggest alternative routes, or display up-to-date information about current traffic conditions. They are also expensive to maintain, because the lanes adjacent to the central reservation of motorways have to be closed to gain access to them.

In Japan, the government is subsidising the installation of satellite navigation systems in vehicles to help tackle congestion

In Japan, the government has been subsidising the cost of installing satellite navigation systems in vehicles to help drivers avoid congestion by providing them with information about congestion, route guidance and travel times during their journeys. Motorists contribute £2,000 to the cost of installing the equipment, but then receive traffic information, route guidance and information about travel times free of charge. The Japanese Vehicle Information and Communication System Centre expects the technology to reduce congestion by 10 per cent once it is installed in 10 million vehicles. The latest available data show that, by 2002, some two million vehicles had been fitted with the necessary equipment.

3.8 The Agency has developed improved signals for motorways that handle more than 60,000 vehicles a day. These variable message signs display text messages on gantries above the motorway. They can display text messages, be updated to reflect traffic conditions in 'real time' and are easier to maintain because they do not require lanes to be closed to service them. In 2000, the Agency set itself a target to install variable message signs at all strategic points[16] on the network by March 2005, although it did not specify how many strategic points there were or their location. By September 2004, the Agency had installed a total of 450 variable message signs at strategic points before junctions, and over 1,600 signs between junctions, on the network. In October 2004, the Agency announced that it would be running a trial to test the extent to which driver behaviour changes in response to messages urging better lane discipline on motorways.

16 Points on the network where information could be given to drivers to suggest diversion routes if there is congestion or a problem on the road ahead. Most points are located before junctions.

The Agency has not installed the most appropriate technology on the most congested motorways

3.9 The Agency's guidance advises that MIDAS is justified where traffic volumes exceed 15,000 vehicles a day for each lane of motorway (some 90,000 vehicles a day in both directions on a three lane motorway). The Agency has installed the system mainly on motorways around the major conurbations in the North and the Midlands and along the M1 and M6. Of the 583 kilometres of motorway covered by MIDAS in the three years 2001- 2004, for example, 80 per cent was in the North and Midlands, compared with only 20 per cent in the South East **(Figure 7)**. Although the North and Midlands regions do have some of the most congested motorways in England, the Agency has not installed MIDAS on many of the equally heavily congested motorways in the South East, such as most of the M25 and some of the radial motorway links to it, where traffic volumes regularly exceed 120,000 vehicles a day.

3.10 Further, 76 per cent of the variable message signs installed by the Agency have been in the North and the Midlands **(Figure 8)**. The Agency has installed variable message signs on only part of the M25 motorway and of the radial motorways leading to it, even though every section of the M25 carries on average more than 60,000 vehicles a day, the Agency's key threshold for installing such signs. The Agency has installed a small number of these signs in the South West region because few stretches of that region's motorways carry enough vehicles to justify them.

3.11 The Agency has made limited provision of MIDAS and variable message signs on the M25, partly because of uncertainty over future widening works. In January 1998, the Agency had plans to widen three sections of the M25. In July 1998, however, it withdrew two of these schemes as the government announced a Multi-Modal study of the M25. Following publication of results of the study in 2003, the Department announced major widening schemes on six sections of the M25. The Agency has now scheduled these schemes to start in 2005 for completion in 2013.

7 Kilometres of motorway covered by the installation of MIDAS systems, by region, between 2001 and 2004

In the last three years, the Agency has installed MIDAS to cover four times as much motorway by kilometre length in the Midlands and the North as in the South East.

Region	Kilometres of motorway covered by MIDAS	Percentage of total
Midlands	244	42
North	225	38
South East	114	20
South West	0	0
Total	583	100

Source: National Audit Office summary of Highways Agency data

8 Number of variable message signs installed by region

The Agency has installed more than twice as many variable message signs in the North, and nearly 100 more in the Midlands, than in the South East.

Region	Number of signs installed	Percentage of total
North	985	48
Midlands	574	28
South East	484	23
South West	22	1
Total	2065	100

Source: National Audit Office summary of Highways Agency data

The Agency started to install inappropriate technology in the South East region before changing its mind

3.12 In 2001, the Agency began to recognise the disparity in the provision of technology between the South East region and the North and Midlands regions, and that some of the most congested motorways in the South East lacked any of the latest technology warranted to improve safety and reduce congestion. In order to close the significant gap between the regions and maximise coverage of the South East motorway network with some form of MIDAS and variable message signs within the available resources, the Agency adopted a strategy comprised of two phases. The first phase was to last up to five years and involve the installation of some additional Mark 1 signs on central reservations, halving the usual three kilometre intervals between signs, as part of a £54 million project. Phase two would begin at a later date, probably after 2006 but dependent on the available resources, and would involve replacing the Mark 1 signs with more up-to-date, third generation variable message signs as used elsewhere on the motorway network where MIDAS had been installed.

3.13 The implementation of Mark 1 signs would allow the Agency to cover some of the key sections of motorways in the South East with a signalling system, where previously there was none. By comparison, to keep within the resources allocated to the South East, the Agency calculated that implementation of the more expensive but higher specification third generation variable message signs would have to be confined to the M25, M4 and a limited section of the M1. A Technology Strategy Steering Group, set up in February 2003 to prioritise resources for technology projects nationally and address the recognised disparity between regions, considered that a two phase strategy was appropriate only in very exceptional short-term circumstances.

3.14 During the course of our examination in June 2003, we expressed our concerns to the Agency about the strategy:

- the installation of additional Mark 1 signs was not generally appropriate for motorways in the South East. Mark 1 signs are suitable for motorways handling fewer than 60,000 vehicles a day. Key motorways in the South East, such as the M3, M20 and M23, carry more than this number of vehicles each day. There are no stretches of the M25, for example, where the average annual daily traffic flow is less than 90,000 vehicles. The more sophisticated Mark 3 signs are the most appropriate for carrying such high volumes of traffic;
- we calculated that the two stage approach would cost up to £64 million more than if the Agency installed third generation variable message signs progressively, as resources allowed; and
- resources might not necessarily be available to install third generation variable message signs in the second phase of the project beyond 2006, with the risk that the South East region would be left with inappropriate technology.

3.15 In August 2003, the Technology Strategy Steering Group noted that the Agency was continuing to implement its two stage approach in the South East. Acknowledging our concerns, the Group recommended that the installation of Mark 1 signs be discontinued and that variable message signs be implemented instead. By then, the Agency had already spent more than £16 million installing 39 Mark 1 signs along some 43 kilometres of motorways in the South East. Most of the equipment can still be used when the Agency comes to install the more sophisticated third generation signs, although some £690,000 of the Agency's expenditure to date would be abortive. In due course, the Agency will have to upgrade 23 of these signs, at an extra cost of some £2.4 million (at 2004 prices). The Agency has discontinued the implementation of Mark 1 signs and has put in place plans to implement third generation variable message signs instead.

3.16 The Agency is working to ensure future technology schemes are implemented on the basis of greatest need nationally. The disparity in the provision of technology between regions will take several years to address, however, because the Agency's resources are limited, there is a lead time in installing the technology and the planned widening of the M25 might delay the introduction of the technology. The Agency is currently assessing the resources at its disposal and therefore the speed at which it can deploy the new technology.

The Agency has been considering ways of encouraging motorists to plan their journeys for off-peak periods

3.17 The Agency's internet website helps motorists identify times when specific roads are likely to be less congested. The Agency's new traffic forecaster service, for example, which provides up-to-date information about congestion across the network, started operations in June 2004. Many commercial firms also take advantage of the traffic information services on offer from private sector firms, such as Traffic*master*, which use their own bridge-mounted and roadside sensor equipment to provide information on congestion to drivers.

3.18 Since October 2002, however, the Agency has been exploring the opportunities for more systematic travel planning to help reduce congestion. It has been discussing with companies and organisations the potential to reduce car usage amongst commuters during peak periods, for example, by encouraging greater use of public transport, car sharing and flexible work patterns. The Agency has also considered encouraging the tourism and leisure industry to provide information to its customers about planning their journeys to avoid congestion, such as on routes to the South West and the Lake District. The Agency is also working with the freight industry to change the times of day that high volumes of freight traffic travel on congested routes. This work is in its infancy, however, and the Agency does not yet have any firm plans in place to take the work forward. The Agency has identified candidate companies to work with but no travel plans are currently in place that can be evaluated for their success.

PART FOUR

The Agency is improving how it deals with shocks to the network

4.1 Parts 2 and 3 examined the measures adopted by the Agency to deal with congestion caused by the weight of traffic on England's motorways and trunk roads. This Part of the report examines how well the Agency deals with major events, such as sporting events, music concerts, disruption of the rail network, bad weather and incidents and accidents, which act as shocks to the network and cause congestion.

The Agency needs to be better prepared for events

4.2 Major sporting and entertainment events can generate considerable levels of additional traffic, causing congestion on roads leading to and from the venues and resulting in significant delays to all road users in the area, not only those attending the events. Disruption of the rail network, due to rail accidents or major engineering work, can also have an impact on the road network, especially around London, as people have to use other means of transport such as cars, buses or coaches, for their journeys. Such events place additional burdens on key parts of the road network, exacerbating the often already heavy weight of traffic on England's roads.

4.3 The Agency has no influence over the number, location or timing of events it has to deal with each year, nor the number of people or vehicles attending them. Most major sporting and entertainment events take place near local authority roads and the police and the relevant local authority have shared responsibility for managing traffic around their sites. The Agency has a direct interest in knowing about events in advance, however, so that it can plan for managing their impact on the rest of the strategic road network.

The Agency prepares for major events that it knows about, but has not always been able to minimise disruption and congestion

4.4 A key factor in the Agency's ability to manage the effect of traffic generated by events is whether the Agency has prior notice of the events. For major annual events, such as the British Grand Prix at Silverstone, the Agency has developed an annual traffic management plan in consultation with the owners of the site, the event manager, the local authorities and local police forces. The Agency meets with the other organisations involved throughout the year to discuss the plan, meeting more frequently in the period leading up to the event. Despite such preparations, however, the Agency has not always been able to prevent considerable traffic disruption caused by some major events.

There has been significant traffic disruption at some major events

Around the site of an open air pop music concert in Hertfordshire in August 2003

Over the course of three days in August 2003, Robbie Williams attracted some 370,000 people to an open air pop music concert at Knebworth House in Hertfordshire, resulting in significant disruption to the A1(M), other roads on the network and nearby Stevenage town centre despite prior planning by organisations involved, including the Agency. Traffic around the venue, particularly on the afternoon of the first show, became gridlocked, affecting both concert goers and regular traffic. Some motorists reported being stuck for up to nine hours and some concert goers said that they were unable to reach the venue before the concert had finished later that evening. The Agency, promoters and the police did not fully clear the A1(M) until the following day.

On roads near to the British Motorcycle Grand Prix at Donington Park in July 2004

Over the course of a three day period in July 2004 over 130,000 people attended the British Motorcycle Grand Prix at Donington Park in Derbyshire. On the three days there were significant traffic queues on the M1, A42, A453 and A50 and surrounding villages. Some people took over five hours to get away from the area after the meeting. About 60 people missed their flights at Nottingham East Midlands Airport because they were stuck in traffic. Other flights were delayed to allow passengers extra time to get to the terminals.

4.5 The Agency is seeking to learn lessons and establish best practice in preparing for and dealing with future events. For example, a review carried out after the August 2003 open air pop music concert in Hertfordshire drew out lessons to be learnt, where:

- consultants appointed by the Agency to model expected traffic patterns and volumes on local roads under-estimated the impact that the additional traffic would have;
- road signs and directions to and from the event car parks were inadequate and unhelpful; and
- car parking arrangements at the site could not cope with the volume of vehicles arriving, resulting in queues backing up onto the road network.

4.6 The Agency could go further, however, by being more systematic in its recording of events, the preparations made for them, and its evaluations after events have finished. For example, a database of events that have a major impact on motorway and trunk road traffic, containing information about numbers of people expected to attend, associated traffic volumes and roads affected and any measures taken, as well as information about delays and other problems caused by previous events, would help the Agency in its preparations.

The Agency is ill-informed to deal with one-off events

4.7 Promoters of events or local authorities do not routinely notify the Agency after a licence for an event has been granted. The Agency knew nothing about a major pop music concert at Stockwood Park in Luton (close to junction 10a of the M1 that was expected to attract some 40,000 people) on the same weekend as the Robbie Williams concerts at Knebworth House until one of its officials heard a local radio announcement just two weeks before the event was due to take place. The Agency has therefore been less well informed about, and less well prepared to deal with, the congestion caused by these types of event.

4.8 Under the Licensing Act 2003, which comes into force in November 2005, the promoter of a major one-off entertainment event will be required to apply to the local licensing authority, usually the local authority, for a licence to hold the event. The promoter will be required to copy the application to responsible authorities such as the local police force and the local fire authority, and to advertise the event to interested parties such as local residents and businesses. If neither the responsible authorities nor the interested parties object to the application, the licensing authority will be obliged to issue the licence. The Agency is not, however, a responsible authority in this process.

4.9 During the preparation of the Licensing Act 2003, the Agency had not been aware of the opportunity to become a body which has to be consulted. It had not therefore put forward a case to become one in the licensing of a major event. In September 2004, the Department for Culture, Media and Sport, which is responsible for the licensing legislation, started consultations on draft Regulations to be made under the 2003 Act, including whether new bodies should be prescribed as responsible authorities. The Agency is now considering making a case to become a responsible authority, in support of its new traffic management responsibilities. In the meantime, it continues to rely on informal arrangements between its area teams and local licensing authorities.

The Agency has taken measures to improve its ability to deal with the effects of bad weather on the road network

4.10 Adverse weather conditions, especially in winter, can cause incidents and accidents leading to major congestion problems. Motorway and trunk road maintenance in the winter involves precautionary salting of roads to prevent their icing over. In our March 2003 report on *Maintaining England's Motorways and Trunk Roads* (HC431, 2002-03), we highlighted the breakdown of the Agency's procedures during a period of adverse weather in January 2003. The result was substantial disruption to parts of the network as roads iced up and vehicles were involved in accidents. In its July 2003 report on *Maintaining England's Motorways and Trunk Roads* (HC 556, 2002-03), the Committee of Public Accounts concluded that the Agency needed to put more robust winter maintenance and emergency response procedures in place to prevent a similar situation ever happening again.

4.11 The Agency carried out two reviews in February 2003, the first looking at its winter maintenance procedures and the performance of its managing agents responsible for maintaining the roads affected, and the second examining the wider handling of the incident, particularly the relationships between the various organisations involved in dealing with the incident and communication with motorists. The Agency has since taken a range of measures to reduce the risk of such incidents occurring **(Figure 9)**.

9 The Agency's actions to strengthen its winter maintenance procedures and its ability to manage emergencies

After the substantial disruption to parts of the network in January 2003, the Agency has taken a range of measures intended to reduce the risk of such an incident happening again.

The Agency has appointed a National Traffic Director as the single person with responsibility for managing traffic and incidents on the strategic road network, supported by three regional traffic directors.

The Agency has established new winter maintenance standards and procedures.

The Agency has put in place new protocols and lists of key contacts for dealing with emergencies.

The Agency is preparing contingency plans, setting out roles and responsibilities of Agency staff in the event of an emergency.

Source: Highways Agency

4.12 As a result, the Agency was better prepared for the adverse weather conditions of January 2004. No major routes had to be closed because of the weather. Although broken down vehicles and difficult driving conditions caused delays on the M1, M11 and M25, in particular, the Automobile Association Motoring Trust reported that the Agency could have done little more to tackle congestion caused by the exceptional weather.

4.13 One of the key observations arising from the Agency's February 2003 reviews was the lack of exit routes to facilitate the evacuation of vehicles from the stretch of the M11 motorway affected by the incident. There were no strategically placed hardened central reservation crossovers or barriers that could be quickly dismantled to provide escape routes onto the opposite carriageway. The Agency told us that it had identified around 2,200 crossovers already in existence that could be used as turnaround points to relieve congestion following an incident and that it has installed additional demountable barriers or built new crossover points at a further six sites on the network. The Agency now needs to carry out a systematic review of where escape routes should be sited, based on an analysis of the strategic points around the network where traffic conditions and the history of incidents and accidents warrant crossovers to be built to relieve congestion following incidents and accidents.

Major incidents and accidents have caused significant congestion

4.14 Clearing roads after an incident or an accident can be a significant challenge, depending on the nature of the incident or accident, its location, the time of day or year when it takes place, and the range of organisations involved in responding to it **(Figure 10)**. Minor incidents and accidents might, for example, affect only one lane of a carriageway and not require the whole road to be closed. An accident resulting in a fatal or serious injury, however, can involve the complete closure of a road for a significant period of time while emergency services attend to casualties and the police investigate the causes of the accident.

10 Services that might be called to attend an incident

A variety of emergency services, with differing roles and responsibilities, may attend an incident.

The police

Primarily responsible for the accident scene (unless a fire or hazardous materials dictate that the fire service should be in charge), traffic management and diversions, and crime investigation.

The fire service

Primarily responsible for the accident scene if fire or hazardous chemicals are involved, otherwise responsible for freeing any trapped motorists and helping the police clear the scene.

The ambulance service

Primarily responsible for treating casualties at the scene or removing them to hospital.

The Highways Agency

Primarily responsible for planning co-ordination of the work of its maintenance contractors with that of the police.

The Agency's maintenance contractors and incident response units

Responsible for clearing debris and repairing any damage caused by the accident to the carriageway, crash barriers and road signs.

Vehicle recovery organisations

Responsible for removing damaged or broken down vehicles from the motorway.

Specialist recovery organisations

Responsible for hazardous chemical and other types of material recovery.

Environment Agency

Monitoring any potential environmental impacts such as chemical spills.

Source: Highways Agency

The Automobile Association Motoring Trust (AA) found that the average time taken to clear major incidents increased significantly between 1997 and 2000

The AA analysed its records on the 250,000 worst incidents on motorways and trunk roads, over the period 1997 to 2000, to establish the average time taken to clear them and for traffic flows to return to normal. The AA found that the average duration of the incidents and the time taken for traffic to return to normal increased from one and a half hours to two hours over the period.

The AA has not repeated the exercise on more recent data, but in 2003 reported that there were on average six major incidents a month in which traffic was gridlocked for more than three hours.

4.15 Neither the Agency, nor any of the other organisations involved in responding to incidents, has any targets for clearing incidents within a certain space of time. The Agency has little control over the time taken to clear an incident before the road has been released to it by the police. In the case of a major accident, for example, the scene has to be made safe by the fire service, the ambulance service has to remove casualties and the police have to complete any criminal investigation before the road can be released. The Agency could, however, have targets depending on the severity of the incident for the period of time it takes to clear a road after its release.

4.16 The Agency collects information on the number and nature of incidents and accidents on its road network and the actual time taken to clear them, but recognises that it needs to collect the information in electronic form to aid its analysis. When the Agency needs personal injury accident data, usually as part of the appraisal of a proposed road scheme, it relies on information collected by the police and collated by the Department for Transport. Police forces have not collected non-injury accident data in a consistent way, however, making aggregation of such data difficult. Organisations such as the Automobile Association Motoring Trust consider that the Agency could do considerably more to manage incidents and accidents. It took too long to clear accidents, which was of real concern to drivers who were already affected by unpredictable journey times.

4.17 Motoring organisations such as the Automobile Association Motoring Trust and the RAC plc have maintained some incident data, including the length of time taken to clear an incident and the period of time before traffic returned to normal. A July 2002 study for the Highways Agency indicates that more than 97 per cent of incidents and accidents are minor and do not cause lengthy delays, but that the impact on congestion of the remaining three per cent can be significant and costly to those involved in traffic jams. The media reported an accident on the M25 in February 2004, for example, which took over 24 hours to clear and for the traffic to return to normal. The Agency estimated that, with 1,000 heavy goods vehicles stuck in the traffic jam, the incident cost the freight industry some £3 million.

Several factors have caused delay and ineffective response to incidents and accidents

4.18 In July 2002, consultants appointed by the Agency evaluated how well incidents on England's motorways and trunk roads were managed. As part of the review they identified the key causes of delay in responding to incidents and accidents and in clearing roads for traffic **(Figure 11)**. One of the consultants' key findings was lack of clarity in the roles and responsibilities of the different organisations involved in clearing incidents. The police currently have overall responsibility for dealing with and clearing incidents and attend all except the most minor. The priorities of the police are, however, to ensure public safety, aid rescue of injured parties and investigate incidents for possible crimes. Although they endeavour to respond to incidents quickly, speed of clearance is not their primary consideration.

11 Key causes of delay in responding to incidents and accidents

A range of factors causes delay in responding to incidents and accidents.

Unclear roles and responsibilities

Many organisations can be involved in responding to an incident or accident, but their respective roles and responsibilities lacked clarity and there were no national guidelines or procedures for incident management.

Problems in pinpointing the location of an incident

Motorists' increasing use of mobile phones, displacing the use of roadside emergency telephones, and their difficulty in providing accurate information about the location of incidents has caused delay and diverted emergency services to the wrong location in some cases.

The nearest emergency service not necessarily attending an incident

The proximity of emergency services, such as fire, police and ambulance stations, to the location of an incident does not necessarily result in those stations' crews responding to that incident. Emergency services respond to incidents within their geographical boundaries, even if another station is nearer.

The unavailability of personnel

Personnel other than from one of the emergency services can take longer to respond during out of office hours because they might be on standby at home rather than at their depots.

Problems gaining access to the site

Emergency and non-emergency services can use the hard shoulder of motorways, unless it is itself blocked as a result of an incident. Otherwise, they have to work their way through the traffic to reach the incident or accident site. Non-emergency service vehicles are not equipped with blue lights, and their drivers do not generally undergo emergency driver training, hindering their ability to reach incidents quickly.

Poor road-side information for drivers

Poor information for drivers means that they do not avoid incidents and the associated congestion.

Lack of specialist equipment

It can take a long time to clear incidents involving heavy goods vehicles because specialist equipment needed to lift the vehicle or its load might be many miles from the scene.

Source: National Audit Office summary of consultants' report

The Agency is taking over from the police many of their responsibilities for clearing motorways after incidents and accidents

4.19 From November 2002 to June 2003, the Agency and the Association of Chief Police Officers carried out a joint review of emergency and incident response, in recognition that the Agency wanted a greater role in managing the network and the police wanted to focus more on their core activities in fighting crime. In June 2003, the Agency launched a project to take a more active role in traffic management on the motorway network, to reduce the time taken to clear roads after an incident and reduce congestion. Such a change would, at the same time, release police resources for other duties. The project involves the Agency:

- developing a network of seven regional control centres, operated jointly by the Agency and the police, taking over much of the traffic monitoring and control currently performed by 29 police control offices;
- establishing a uniformed motorway patrol service to take on many traffic management tasks currently undertaken by the police; and
- putting additional resources into its existing incident support units.[17]

4.20 In its outline business case for the project in May 2003, the Agency announced that these changes would cost an estimated £44 million to put in place, and some £38 million a year to run. It estimated that, in return, the measures would result in a 17 per cent reduction in motorway congestion caused by incidents, producing economic benefits valued at £67 million a year. At the same time, these measures would release the equivalent of 540 full time police officers from traffic management to their core activities of fighting crime, valued at some £20 million a year. The Agency expected that, on average, these measures would cut by five minutes the time taken to clear motorways after an incident lasting 45 minutes.

17 Incident support units: rapid response teams employed by some of the Highways Agency's maintenance contractors. The units attend accidents and incidents and make any repairs as quickly as possible to enable traffic to return to normal, reducing the impact the problem has on causing congestion.

Traffic officers in the United States have improved incident management

In some parts of the United States, traffic officers have been employed for many years and have reduced both police time at accidents and the time taken to clear incidents. In addition, formal operating protocols for managing incidents have resulted in better co-operation between the various organisations involved in responding to an incident. Philadelphia's Traffic and Incident Management System, for example, has reduced the number of incidents on the city's freeways by 40 per cent and has reduced freeway closure times by 55 per cent. On the Gowanus/Prospect Expressway in Brooklyn, New York, the average time to clear up all types of incidents has fallen from one and a half hours to half an hour.

4.21 Few highways authorities in other countries have transferred police traffic management powers to civilian traffic officers. In most other countries the police have the main responsibility for dealing with incidents and accidents on motorways. The Agency is also planning to use its new traffic officers to start collecting accident statistics, which it will then use to improve its understanding of the causes of accidents and the best methods of clearing them.

4.22 In October 2003, the Agency finalised its business case for the project, which provided new cost estimates based on a more detailed knowledge of what the project would entail. The Agency estimated that the project would cost:

- £73 million to put in place, the increase since its estimates of May 2003 due primarily to extra technology (£3 million), the need to recruit and train 600 more traffic officers and control staff than originally envisaged (£10 million), the need for additional offices and premises for those extra staff (£9 million), and additional uniforms (£3 million); and
- some £58 million a year to run, the increase since its estimates of May 2003 due mainly to higher salary costs (£17 million), additional vehicle running costs (£2 million), and higher building lease and maintenance costs (£1 million).

4.23 The Agency has included few of its trunk roads within the scope of the project, partly because they are a less controlled environment than motorways in which to work. Motorways are better served by CCTV cameras and incident detection technology, while all motorways also have hard shoulders. The Agency also considers that motorways are generally busier than trunk roads and that they would provide a better return on its investment in its new traffic management arrangements.

4.24 The project is a major challenge for the Agency and the Agency is carefully managing the associated risks. It recognises the need to adapt to the significant changes that will be involved in moving from an almost exclusively office-based organisation working normal office hours to an organisation that also has a significant corps of staff responsible for providing on road services, including emergency response, 24 hours a day. The Agency has to manage the recruitment and training of 1,500 new staff, which will nearly double the number of its employees from 1,800 to 3,300 once the project is complete, procure and deploy 100 vehicles and establish the network of depots and offices needed by its new teams of traffic officers, and gain the confidence and acceptance of its role by local police forces and develop clearly defined joint working arrangements with them. In light of these significant demands, the Agency considers that introduction of the new measures in stages will give it time to identify and act on lessons learnt before it puts the full service into place.

4.25 The Agency started an initial service in the West Midlands in April 2004 but the powers of the Agency's traffic officers were initially limited. Until October 2004, when the Traffic Management Act 2004 became law, the Agency's traffic officers could not stop, direct, or divert traffic. The Agency plans to provide a full service in the West Midlands by March 2005 and expects to have services available on other key routes, such as the M25, by July 2005. Until traffic officers are fully trained, however, the police will continue to carry out some functions. The remainder of the motorway network should be covered by September 2006, by which time the Agency expects to have some 1,200 traffic officers and 300 Regional Control Centre staff in place to manage the network.

The Agency is giving more attention to the impact of diversions on local authority, and its own, roads

4.26 The Agency makes plans for two types of diversion – strategic, and tactical. Strategic diversions generally only involve the Agency's road network and not local authority managed roads. The National Traffic Control Centre (NTCC) has prepared strategic diversions ready to be activated for any road on the strategic network.

4.27 The NTCC is also working with local authorities to provide information to motorists about problems on local authority roads. An example would be where a local authority advises the NTCC about delays on roads leading to a city centre. The NTCC could provide information on message signs on nearby motorways to alert drivers so that they could use alternative routes. The Agency expects this exercise to be completed by November 2005.

4.28 Tactical diversions involve diverting traffic from the strategic road network onto local authority roads, or vice versa. Local roads do not always have the capacity to accommodate diverted motorway traffic. The police and the Agency generally try to avoid diverting traffic where this is the case, although this is not always possible with longer duration incidents.

4.29 Some 40 per cent of local authorities who replied to our survey considered that unplanned diversions off motorways and trunk roads have caused disruption and congestion on local authority roads. They considered that diversions from motorways, for example, have not always taken account of the capacity of the local road network. As a result, local authorities have been reluctant to discuss alternative routes with the Agency. The Automobile Association Motoring Trust considered that the Agency has had problems with diversion routes, caused by inadequate signing and poor emergency traffic management.

4.30 The Agency has formal procedures agreed with local authorities for putting diversions in place for some of its roads, though not all. In responding to our survey in 2003, local authorities considered that the Agency had a patchy record of working with them to identify and agree alternative routes to manage traffic. Although two thirds of authorities considered that they had pre-planned diversions that worked satisfactorily, one third either did not have any pre-planned routes or had arrangements that did not work well. The Agency's Area Offices are now working with local authorities to identify potential diversions off main routes.

APPENDIX

Study methodology

International comparisons

We examined published information and information provided by the Agency on the extent to which technological and other measures are used to relieve congestion in other countries, especially European countries, the United States, Japan, Australia, and New Zealand.

We visited highways authorities in The Netherlands and Germany to obtain more information on measures used to combat congestion in those countries. The Netherlands and Germany were chosen because their major roads have similar levels of congestion to English roads. Staff from the Highways Agency joined our visits.

In The Netherlands, we visited:

- the Transport Research Centre in Rotterdam; and
- the National Traffic Control Centre for The Netherlands, located in Utrecht.

In Germany, we visited:

- the Federal Highways Research Institute in Cologne and
- the traffic control centre for the state of Hessen, located in Frankfurt.

In each country, we examined:

- their strategies for tackling congestion;
- the types of technological measure used and the extent to which the authorities have implemented them;
- how the authorities carry out trials of innovative measures;
- the extent to which their authorities consult with motorists and other stakeholders about the introduction of new measures; and
- how new measures are evaluated and, if successful, implemented more widely across their network.

Examination of technology measures used by the Agency to tackle congestion

We examined the extent to which the Agency has considered, tested by way of trials and implemented a range of technology measures (see Glossary for description) designed to tackle congestion including:

- dedicated lanes, including high occupancy vehicle lanes;
- dynamic lanes;
- hard shoulder running;
- ramp metering;
- tidal flow schemes; and
- variable speed limits.

In particular, we examined:

- the extent to which the Agency uses the measures;
- the Agency's conduct of trials of new measures and the extent to which the Agency has rolled them out; and
- the impact of measures in tackling congestion.

For each measure, we examined the Agency's files and interviewed key personnel.

Examination of information provided to drivers

We examined the quality of road-side information given to drivers by:

- consulting with major road user groups such as motoring organisations and the haulage industry to establish their views on the quality of information;
- referring to surveys of drivers' views carried out by the Agency;
- reviewing the Agency's work to establish a new National Traffic Control Centre in Birmingham; and
- examining the Agency's major technology projects.

Technology projects are systems that support monitoring and operational activities on the network. In 2003-04 the Agency spent £107 million on technology projects. We examined two of the Agency's major technology projects – the Motorway Incident Detection and Automatic Signalling System (MIDAS) and Variable Message Signs – designed to reduce the number of accidents and tackle congestion. We interviewed key personnel at the Agency and examined relevant documents to establish:

- the Agency's coverage of the network by the major projects;
- whether the Agency has targeted the most congested roads; and
- whether the Agency's projects have been delivered quickly, on time and to budget.

For each project, we examined the Agency's files and interviewed key personnel.

Examination of how the Agency manages the network

We examined how well the Agency responds to major events, such as sporting events; and incidents and accidents. We interviewed key personnel at the Agency and examined relevant documents to establish how well the Agency:

- manages major events to reduce congestion;
- deals with the effects of bad weather; and
- deals with, and clears, incidents and accidents.

Our work involved:

- examination of the Agency's role in four major events: the British Grand Prix at Silverstone (2003 and 2004); a music concert at Knebworth House (2003); and the British Motorcycle Grand Prix at Donington Park (2004) and at other events generally;
- reviewing the actions taken by the Agency in response to our report on *Maintaining England's Motorways and Trunk Roads* (HC 431, 2002-03) and the Committee of Public Accounts, report on *Maintaining England's Motorways and Trunk Roads* (HC 556, 2002-03); and
- reviewing a major project which is giving the Agency a greater role in managing the network and the Agency taking over responsibilities from the police. The project involves the introduction of traffic officers on motorways employed by the Agency.

Survey of local authorities

Local authorities are responsible for managing their own trunk roads outside the strategic network. Congestion on the Agency's network can have a significant impact on local traffic management and vice versa. We surveyed 101 local authorities of which 53 replied (53 per cent). We ascertained their views on how well the Agency works with local authorities to tackle congestion, such as the operation of diversions onto local authority roads.

Consultation with stakeholders

We consulted with various organisations with an interest, or active involvement, in tackling congestion on England's roads and invited their comments on:

- how well the Agency manages the network, including its response to incidents and accidents;
- the measures taken by the Agency to tackle congestion; and
- other measures that could be adopted.

We consulted with 23 organisations:

Motoring organisations

Automobile Association Motoring Trust (AA)
Institute of Advanced Motorists
Royal Automobile Club Foundation for Motoring Limited
Royal Automobile Club (RAC) plc

Road haulage and coach operators

National Express Coaches
The Freight Transport Association
The Road Haulage Association Limited
TNT Express

Regional Development Agencies

Advantage West Midlands
East of England Regional Development Agency
East Midlands Regional Development Agency
Northwest Regional Development Agency
One NorthEast
Yorkshire Forward

Other organisations

Confederation of British Industry
Countryside Agency
Institute of Directors
Institution of Civil Engineers
Intelligent Transport Society for the United Kingdom
Parliamentary Advisory Council for Transport Safety
Trafficmaster plc
Transport 2000
Transport Research Institute, Napier University

Examination of Local Network Management Schemes

Local Network Management Schemes are small scale construction projects costing less than £5 million aimed at delivering locally targeted improvements quickly, such as improving layouts of lanes and junctions and signalling at junctions. In 2003-04 the Agency spent £106 million on Local Network Management Schemes. We examined a sample of schemes in three Agency areas: the M25 Sphere, West Midlands and Yorkshire/Humberside. We also examined the Agency's programme of "priority action sites". The programme comprises 92 Local Network Management Schemes which are expected to be delivered quickly.

For the areas selected, we interviewed key personnel at the Agency and examined relevant documents to establish:

- how schemes with congestion-reducing objectives were identified and prioritised in the local network management scheme programme;
- whether schemes have been delivered quickly on time and to budget; and
- how well the schemes were implemented.

GLOSSARY

Active Traffic Management – A pilot scheme on the M42 that the Agency is running to reduce congestion without the need to widen the existing road. The pilot combines a number of existing and new traffic measures using technology to maximise their overall benefits. The scheme includes: Hard Shoulder Running; Ramp Metering; Variable Speed Limits; automatic queue detection; Closed Circuit Television Cameras; Variable Message Signs and digital enforcement equipment.

Automatic Number Plate Recognition cameras – Road-side cameras used to monitor traffic, detect incidents and collect data by identifying individual number plates from camera images.

Controlled motorways – Sections of motorway where the Agency uses Variable Speed Limits and an automatic incident detection system (MIDAS) to improve traffic flow during peak periods. The Highways Agency is running a trial of controlled motorways on a western section of the M25.

Dedicated Lanes – Sections of a carriageway where access is restricted to certain types of vehicle, such as buses, to speed their journeys. Dedicated Lanes also encourage drivers to use public transport as an alternative to their cars. Proper use of the lane is enforced using traffic cameras. The M4 bus lane is an example of a Dedicated Lane (see also High Occupancy Vehicle lanes).

Dynamic Lanes – A measure that aims to reduce congestion by increasing the number of lanes on the carriageway during peak periods with the use of lights, similar to cats' eyes, set in the road. For example, three 'normal' width lanes can be changed into four narrow ones. Traffic officers monitoring the road from a control centre would decide when an alternative lane layout would be appropriate. The measure is under trial in The Netherlands and Germany.

Hard Shoulder Running – A measure that aims to increase road capacity by allowing traffic to use the hard shoulder on motorways, under controlled conditions, during peak periods or to by-pass accidents and incidents. Signals over the carriageway indicate when the hard shoulder is in operation as a running lane (using a red cross to indicate when the lane is closed). Emergency refuge areas are built at 500-1000 metre intervals so that road users in difficulty have a place of safety to wait for help. The measure is used in The Netherlands, Germany and other countries but not in England. The Agency will be running a trial of hard shoulder running as part of its Active Traffic Management project on the M42.

High Occupancy Vehicle lanes – High occupancy vehicle lanes are a form of Dedicated Lane, intended for vehicles carrying more than one passenger. Widely used in the United States but not in Europe. Not used in England but will be trialled by the Agency over the next few years.

In-vehicle technology – Equipment installed in vehicles, based on satellite navigation, which provides up-to-date traffic information, advance warning of congestion ahead and alternative routes to avoid traffic queues.

Local Network Management Schemes – Agency projects costing less than £5 million which deliver small improvements quickly. Schemes can have one or more of five objectives: reducing congestion; improving safety; benefiting the environment; improving roads for non-motorised traffic such as cycle lanes; and encouraging greater use of public transport. Congestion schemes include improvements to road junctions and motorway slip roads and better synchronisation of traffic signals.

Loops – Loops are rectangular coils of wire buried in the road surface and connected to roadside sensors. Sensors detect vehicles passing over a loop, count them and send the data to a central location. Vehicle speed can be measured by installing two loops in each lane.

Managing agents – Private sector contractors appointed by the Agency who are responsible for identifying, designing and building new projects (such as local network management schemes). They are also responsible for managing the maintenance of the network on behalf of the Agency.

Motorway Incident Detection and Automatic Signalling (MIDAS) – A safety system which provides on-road advance warning to drivers of queuing or slow moving traffic ahead. Incident detection is particularly important to protect vehicles at the back of a queue after an accident, often the site of accidents when vehicles approach stationary traffic at high speed. The system uses electronic sensors in the road (loops) to detect slow moving traffic. Variable message signs ahead of the incident are then automatically set to warn drivers to reduce their speeds.

National Traffic Control Centre – A national service located in Birmingham which is being set up by the Agency to collect, analyse and disseminate traffic information to the public and road users, for example about accidents, traffic flow and journey times. Information is collected through loops and CCTV cameras and disseminated to drivers through Variable Message Signs. The Centre co-ordinates the response to accidents and incidents by traffic officers, the police and other organisations. The Centre is run by a private sector contractor and is supported by seven regional centres. It is expected to be fully operational from July 2005.

Ramp Metering – A measure which controls the rate at which vehicles join a motorway from the 'on ramp' (slip road) using traffic signals. Ramp Metering allows traffic to join the main carriageway at a measured or "metered" rate and aims to delay the onset and / or duration of flow breakdown that leads to congestion and might lead to accidents. The Agency operates Ramp Metering at four sites on the M6.

Tidal Flow – A measure which involves reversing the direction of traffic in one or more lanes of a carriageway to cope with morning and evening peaks in demand. Signals above the carriageway indicate to drivers which lanes to use. The Agency uses this measure on two stretches of road in England.

Traffic officers – The Agency's traffic officers are a new uniformed motorway patrol service with powers to take action and do whatever is necessary – as soon as possible – to get traffic moving. They work in close cooperation with the police, road-side assistance and recovery organisations and ensure that local diversion routes are opened up quickly and that timely and accurate information is relayed to drivers about incidents and accidents. The Agency is recruiting, training and deploying some 1,200 traffic officers over a two year period, 2004-2006.

Variable Message Signs – The Agency uses Variable Message Signs to display up-to-date information and advice to drivers. They are positioned at the side of the road, or on gantries above the carriageway. Information provided could include advisory or mandatory speed limits; whether there are queues ahead and how long drivers might have to wait; alternative routes and diversions; and bad weather warnings.

Variable Speed Limits – A measure which involves adjusting speed limits on motorways according to traffic volumes in order to improve traffic flow, thereby reducing the number of accidents and congestion. Speed limits are reduced when traffic volumes reach a predetermined level. Normal speed limits apply when vehicle volumes allow traffic to flow freely. Signals above the carriageway indicate either advisory or mandatory speed limits. The Agency operates Variable Speed Limits on the western section of the M25.