This Annual Report has been prepared by the Impacts Monitoring Group in the Congestion Charging Division of Transport for London.

We wish to thank all of those who have contributed material for this report.

Copies of the report may be obtained from:

London's Transport Museum
Covent Garden
London
WC2E 7BB

Telephone: +44 (0) 20 7379 6344
Email: tarab@ltmuseum.co.uk

The report is available on www.tfl.gov.uk/tfl/cc_monitoring.shtml

Disclaimer

This publication is intended to provide accurate information.
However, Transport for London and the authors accept no liability or responsibility for any errors or omissions or for any damage or loss arising from use of the information provided.

Photographs

ISBN 1-871829-18-6

Introduction

Purpose

This is the first in a series of annual reports describing the measurement of the impacts of congestion charging in and around central London. It describes the monitoring programme, summarises conditions prior to the commencement of charging, and sets out the range of indicators and issues being monitored following the introduction of the scheme.

Both the Mayor and TfL are committed to a comprehensive, 5 year programme of objective monitoring. The programme will assess the key traffic, transport, business, economic, social and environmental impacts of the scheme. It will consolidate information drawn from over 100 specially designed surveys and studies, while making use of already established surveys and data sources.

The monitoring programme will provide much of the information that will enable the Mayor and other interested parties to assess the impacts and implications of congestion charging, and whether adjustments to the scheme should be considered.

Principles

Designing the monitoring programme has inevitably involved prior assumptions and judgements about the nature, scale, timing and location of impacts; based on the anticipated effects set out in TfL's Report to the Mayor of February 2002. However, the programme retains flexibility to adapt to the emerging pattern of effects and stakeholder requirements.

The monitoring programme has been guided by the following principles:

- monitoring should robustly detect and characterise the main expected effects of congestion charging;
- monitoring should enable unexpected or unanticipated effects to be determined;
- monitoring should seek to understand as well as measure;
- monitoring should aim to meet the legitimate needs of all stakeholders for information;
- monitoring should provide Best Value.

Organisation

The monitoring programme consists of over 100 directly-sponsored survey and research activities, designed to investigate specific questions and complement the wealth of existing information gathered by third-parties such as the public transport operators, other official sources and stakeholder groups. Information will also be obtained from the Operational and Traffic Management functions within TfL's Congestion Charging Division.

The work is managed by a team of permanent TfL staff, with independent contractors undertaking most of the main data collection elements. The TfL team are supported by a number of specialist academic and professional external advisers.

Outputs from the monitoring programme

The effects of congestion charging will become apparent over a range of timescales. For example, while changes to traffic patterns might be expected to reach a relatively stable position between 3 and 6 months after charging is introduced, effects on strategic business decisions and the economy of central London would only become apparent over longer periods of perhaps several years.

In recognition of this, outputs from the monitoring programme are planned at the following intervals:

- annual reports, to be produced at approximately 12-month intervals in the Spring of each year, providing a comprehensive summary of the entire monitoring programme. This is the first of these reports, covering conditions prior to the start of charging;
- periodic bulletins, at intervals over the 4 year initial term of the monitoring, focusing on specific topics or (in the short term) early indications of scheme effects;
- technical reports, covering specific areas of the monitoring, and providing interpretative synthesis of emerging effects at a greater level of detail than is possible in Annual Reports – from early 2004 onwards;
- datasets and contractor reports will be made available on request to *bona fide* researchers according to the protocol set out in Appendix 3 of the main report.

Scale and diversity of potential impacts

Traffic impacts – expected to be the most immediate and obvious impacts, as charging will deter some drivers from driving into or through the charging zone. Traffic levels are projected to reduce both inside and outside the zone, producing lower levels of delay and improved journey time reliability. However, on routes around the charging zone there is expected to be some increase in traffic caused by displaced through-traffic (though this will be mitigated by traffic management measures designed to complement congestion charging). Other impacts may include changes in the number of accidents and in the levels of cycling.

Public transport impacts – congestion charging is expected to result in an increase in bus patronage on routes serving the charging zone (to be catered for by increases in bus capacity), and more modest increases on underground and rail services.

Business and economic impacts – congestion charging is likely to make business journeys, especially deliveries, in or near the zone more reliable. Against this some businesses will experience an increase in operational costs due to the charge, and concerns have been raised that small businesses may suffer. Each effect may impact on London's economy, through changes in productivity, accessibility (reflected in property prices) and the relative attractiveness of central London as a place to do business.

Social impacts – the effects of congestion charging on individuals, households and organisations will be difficult to quantify. Changes to travel patterns and any increases in household motoring costs need to be considered in the context of wider changes, such as the job market and the particular experiences of different groups of people, such as emergency service workers or visitors.

Environmental impacts – in terms of visual, noise or atmospheric pollution are expected to be minimal, though concerns have been expressed about the potential for increased air pollution around the boundary of the charging zone.

Overview of the monitoring programme

The monitoring programme is divided into seven sections:

- Congestion
- Traffic patterns
- Public transport
- Travel behaviour and secondary transport effects
- Economic impacts
- Social impacts
- Environment

The introductory chapter of the main report provides an overview of the monitoring activities that underpin the assessment of each of these areas, while the remainder of the report provides further detail of the methodologies and techniques being applied, as well as setting out a selection of available data relating to conditions prior to the start of charging.

The vast range of data-gathering methods being employed enables an extremely detailed picture to be developed over time, and includes a complementary selection of well-established and innovative techniques tailored to each area of monitoring.

These include moving car observer surveys; the use of monitoring and enforcement cameras; a wide range of traffic counts across a variety of areas, sites, screenlines and cordons; various counts of buses and bus passengers, plus data from other public transport providers; trip diaries, a wide range of travel surveys, as well as data from parking providers, the Public Carriage Office, and the London Accident Analysis Unit; business surveys, economic case study work, plus data on a range of key environmental indicators.

In addition, information (including data) generated by the traffic management and scheme operation functions will be drawn on to help understand and characterise the impacts of congestion charging.

To provide a particular focus for the study of boundary-related issues, a case study area has been defined, located adjacent to the Inner Ring Road in the southern part of the Boroughs of Islington and Hackney.

Congestion

Expected impacts of the scheme on congestion

- Transport for London has projected that congestion within the charging zone will reduce by 20 to 30 percent.
- The Inner Ring Road is expected to carry additional orbital traffic, though congestion here is expected to be constrained at or below pre-charging levels by the Real Time Traffic Management system, which will allow traffic signals to be adjusted to manage the flow of vehicles on and approaching the Inner Ring Road;
- Congestion is expected to reduce on radial routes outside the charging zone within inner London. Orbital routes in inner London are expected to experience an increase in traffic though this will be accommodated through adjustments to traffic signals. The net effect is expected to be a modest overall reduction in congestion across inner London;
- In outer London congestion charging is projected to result in a slight reduction in congestion, though this is expected to be too small to measure readily.

Definitions of congestion

Congestion is a consequence of the balance of the capacity of the road network and the intensity of traffic flow. The Department for Transport defines congestion as the average 'excess' or 'lost' travel time experienced by vehicle users on a road network. Excess travel time is the time spent over and above that which would be experienced under 'uncongested' or 'free-flow' conditions. These are best measured in terms of 'travel rates' rather than speeds.

Congestion inside the charging zone

The uncongested network travel rate for the charging zone is 1.9 min/km. In 2002 the average travel rate in the zone was 4.2min/km, which means that traffic inside the zone was experiencing delays or congestion of 2.3 min/km. This compares to an average across large urban areas in England of 0.4 min/km.

Speed distributions in the charging zone

Another way of assessing traffic conditions is in terms of speed distributions, or, in other words, the proportion of time spent driving within various speed bands.

The latest figures show that during charging hours over half of the time spent by vehicles within the charging zone is spent either stationary or at less than 10km/h.

Congestion on the Inner Ring Road

The uncongested network travel rate for the Inner Ring Road is 1.8 min/km. In 2002 the average travel rate on the Inner Ring Road was 3.7 min/km, which means that traffic was experiencing delays or congestion of 1.9 min/km.

Speed distributions on the Inner Ring Road

The latest data shows a similar pattern as the charging zone, with about half of the time spent by vehicles on the Inner Ring Road being spent either stationary or at less than 10km/h.

Congestion on main roads in inner London

The uncongested network travel rate for main roads in inner London is 1.5 min/km. In 2002 the average travel rate on these roads was 2.8 min/km, which means that traffic was experiencing delays or congestion of 1.3 min/km.

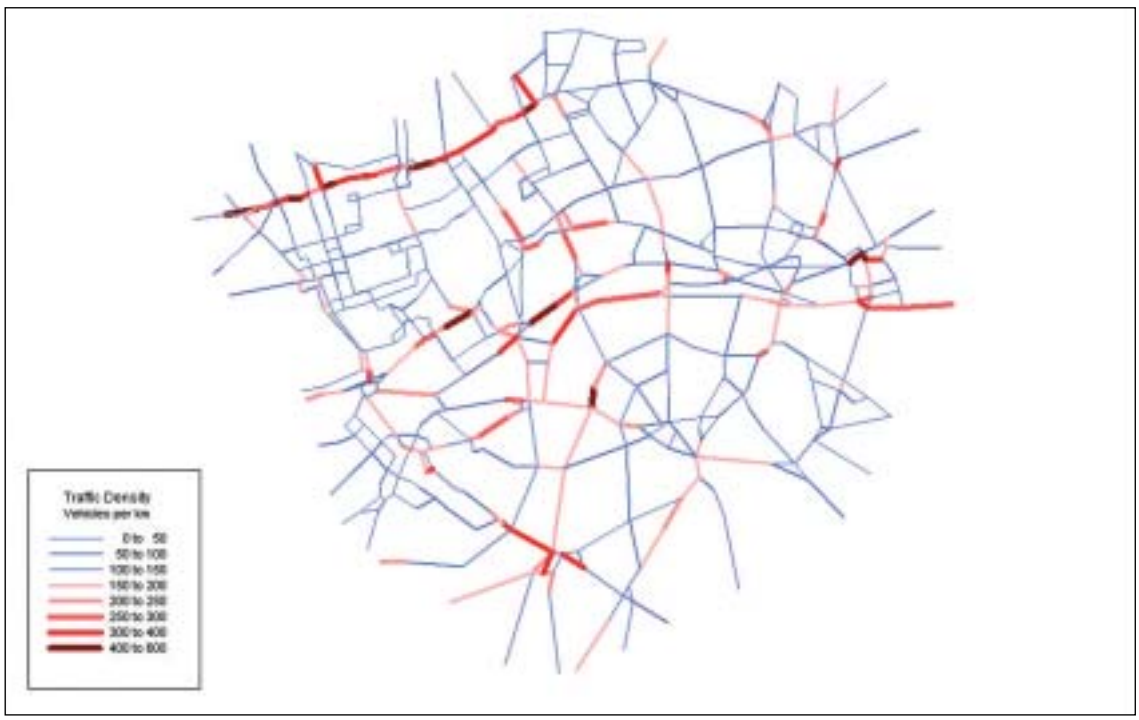
Congestion on main roads in outer London

The uncongested network travel rate for main roads in outer London is 1.2 min/km. In 2002 the average travel rate on these roads was 1.8 min/km, which means that traffic was experiencing delays or congestion of 0.6 min/km.

Traffic density

While the information above provides average indications of the level of flow on particular kinds of roads in broad geographical areas, the data gathered by TfL can also be used to show how the average 'crowding' of vehicles varies across the network. The traffic density map below shows the number of vehicles per kilometre using each particular part of the central London road network during the morning peak (averaged January – August 2002).

AM peak traffic density map for the charging zone and surrounding area, January to August 2002.



Traffic patterns

Expected traffic impacts

- Transport for London has projected that congestion charging will reduce the volume of traffic (excluding pedal and motorcycles) within the charging zone during its hours of operation by some 10 to 15 percent.
- This is expected to lead to an increase in traffic on the Inner Ring Road, and some increase in orbital traffic in inner London, as some drivers choose routes to divert around the charging zone boundary.
- Traffic is expected to reduce on radial approaches to the charging zone, reflecting the anticipated reduction in traffic travelling to the zone.
- Other changes are expected, such as drivers changing the time of their trips to avoid the charging hours; as well as changes to the composition of traffic as different kinds of vehicle are deterred or attracted into the charging zone in response to both the charge itself and the changing traffic conditions that result.

Monitoring traffic volumes

The monitoring programme involves a wide range of traffic counting techniques to monitor the volume of traffic in and around the charging zone. This work includes area-based counts within the charging zone; cordon-based counts at the zone boundary and just outside the Inner Ring Road; counts on the Inner Ring Road itself and on specific sites on local roads in the charging zone and across inner London; and screenline-based counts at various locations to capture changes in orbital traffic.

This programme will be supplemented by counts related to specific issues or incidents, and will take regard of additional relevant information emerging from counting programmes commissioned by other organisations.

Recent traffic trends

- There is a long-term trend of slowly-declining traffic within the charging zone, largely accounted for by a reduction in the numbers of cars, which have fallen by up to one-third over the past 15 years since 1986.
- Between 2000 and 2002 traffic levels within the charging zone fell more sharply; by 7 percent for all traffic and by 9 percent for vehicles potentially subject to the congestion charge.
- A total of 1.5 million vehicle-kilometres are driven within the charging zone during charging hours on a typical weekday, based on 2002 data. The equivalent figure is 1.3 million if pedal cycles and motorcycles (which are not subject to the charge) are excluded.
- A total of 0.6 million vehicle-kilometres are driven on the Inner Ring Road during charging hours on a typical weekday, based on 2002 data.
- 388,000 vehicle trips are made into the charging zone (and 377,000 vehicle trips are made out) during charging hours on a typical weekday, based on 2002 data. Not all of these vehicles would be subject to the congestion charge, and it should be noted that these figures include multiple crossings by the same vehicles.

- In contrast to the charging zone, the long-term trend of increasing traffic continues when Greater London is considered as a whole, with 7 percent more traffic crossing into Greater London in 2001 as compared to 1989.

The data underpinning this analysis reflects a substantial amount of survey work implemented during 2002 specifically for the purpose of monitoring conditions before the start of charging. Although the monitoring programme has made use of longer-established pre-existing data where relevant, it is worth noting that because the new surveys commenced recently they cannot in themselves provide a picture of long-term trends in traffic.

It is therefore important to be aware that 2002 was characterised by an unusual amount of disruption to the road network in central London. This means that measurements taken during 2002 may not be wholly representative of 'settled' conditions before charging and hence a longer perspective on pre-charging traffic conditions is considered when possible.

Public transport

Expected public transport impacts

Congestion charging is expected to result in a small net increase in public transport patronage of 1 to 2 percent. The net effect is expected to reflect both car-users shifting to public transport as well as some shift between public transport modes, such as from rail and Underground to bus. Once new travel patterns have settled, buses are expected to take the bulk of the net modal shift from car, with only a marginal net impact expected on rail and tube.

Recent levels of public transport patronage and projected increases are shown below:

Key indicators of public transport patronage 2002, with TfL projected increases following implementation of charging.

	07:00-10:00 Passengers	07:00-18:30 Passengers	Projected Passenger Increase 07:00-10:00
Bus passengers entering charging zone (Autumn 2002)	76,000	193,000	Up to 15,000
LUL passengers exiting stations in and around charging zone (Spring 2002)	547,000	1,322,000	Up to 5,000
National Rail passengers arriving at stations in and around charging zone (Spring 2002)	451,000	564,000*	

* Rail passengers departing stations in and around the charging zone. Includes double counting of National Rail and the Underground.

Other key public transport indicators

- During 2002, average bus journey speeds in the charging zone remained broadly unchanged on previous years at 11km/h. Average journey speeds in January 2003 were slightly faster than any period in 2002 at 11.6 km/h.
- Scheduled bus kilometres increased by 10 percent to 6.9 million kilometres per 4-week period on routes operating on the Inner Ring Road and within the charging zone between January 2002 and January 2003.
- The amount of mileage scheduled but not operated that was apportioned to traffic delays on routes serving the charging zone increased in 2002 compared to the year before, even after the normal seasonal variation is taken into account. This is most likely due to a higher than normal volume of roadworks. In January 2003 this improved on routes inside the charging zone over and above that expected due to seasonality.

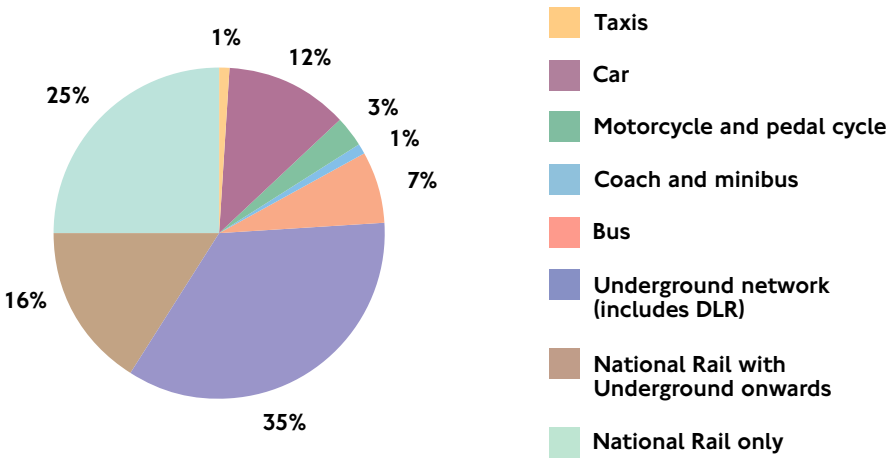
Travel behaviour and secondary transport effects

The monitoring programme also seeks to determine the impact of congestion charging on aspects of wider travel behaviour in London, and important secondary impacts such as road traffic accidents, parking, and pedestrian activity.

Method of travel

A total of almost 1.1 million people entered central London (a description wider than the charging zone) between 07:00 and 10:00 on a typical weekday in 2001. The diagram below shows the proportion of this total that used particular modes of travel.

Mode shares for people entering central London, 07:00 to 10:00, 2001.



The modal share shown above represents a number of changes on previous years. In comparison with 2000, the figures for 2001 show a 1 percent decline in total volumes of people entering central London. Between 2000 and 2001, the use of personal (rather than public) transport fell sharply by 9 percent. Car usage dropped by 11 percent, while bicycle trips increased by 4 percent. Public transport saw an overall increase of 0.1 percent, with a 10 percent increase in bus use being offset by decreasing net Underground usage and decreasing coach usage.

Taxis

- 24,400 licensed taxi drivers and 20,500 licensed taxi vehicles were operating in London in April 2002.
- 57,500 licensed taxi movement crossed into the future charging zone during charging hours, based on averaged 2002 data this includes multiple crossings by the same vehicle both with passengers and without.

Motorcycles

- 28,000 motorcycle movements crossed into the future charging zone during charging hours based on 2002 data. This reflects steady growth in motorcycle usage over recent years.

Pedal cycles

- 16,000 pedal cycle movements crossed into the future charging zone during charging hours (based on 2002 data). This reflects significant growth in cycle usage in central London (with overall usage almost doubling over the past 15 years).

Accidents involving personal injury

- 2,336 road traffic accidents resulting in personal injury were reported in the future charging zone in 2002.
- Between 2001 and 2002 there was a 20 percent reduction in the number of accidents within the charging zone occurring between the hours of 07:00 and 19:00.

Business and economic impacts

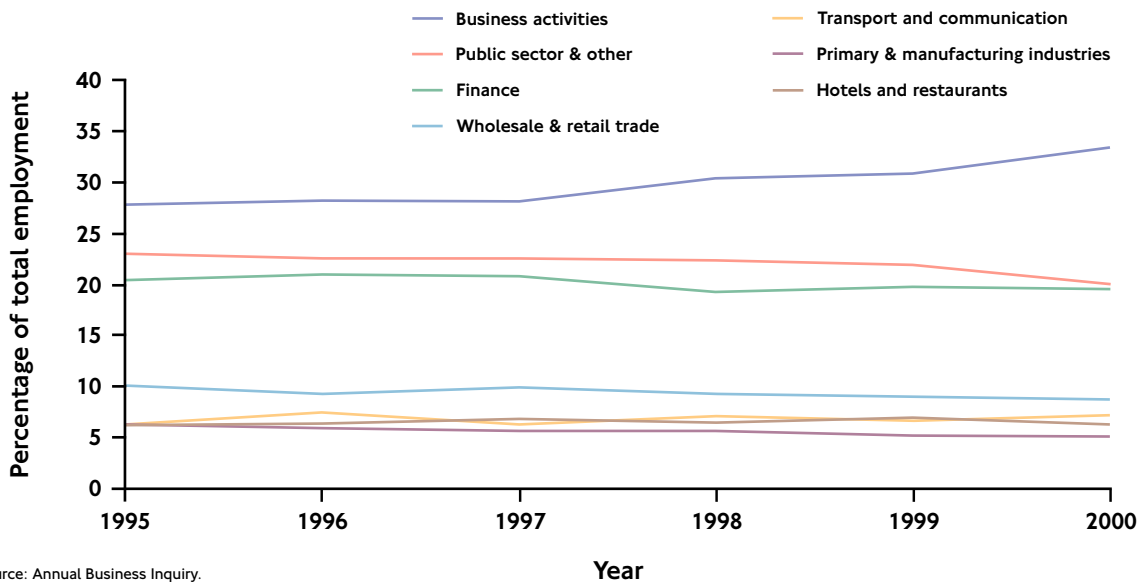
The economy of central London is complex and unique, and congestion charging in itself is not expected to alter significantly the overall economy or competitive position of London. The expected valuable benefits of the scheme in terms of quicker and more reliable journeys will be offset to a degree by the financial implications of the charge, which will affect certain types of activity more than others. Equally, indirect benefits to business resulting from improved public transport and environmental amenity will be part of a wide range of other less tangible effects that will also influence the attractiveness of London as a place to do business.

The monitoring programme will consider the relationship of congestion charging to long-term trends and influences on London's economy; understand how the business community perceives congestion charging and how it responds to it; measure the range and intensity of impacts on businesses and organisations; and monitor the effect of charging on activities of specific stakeholder or technical interest.

Trends in employment

The diagram below shows recent trends in employment by business sector, highlighting the steady growth in service-sector employment over recent years.

Trends in charging zone employment by business sector, 1995 to 2000.

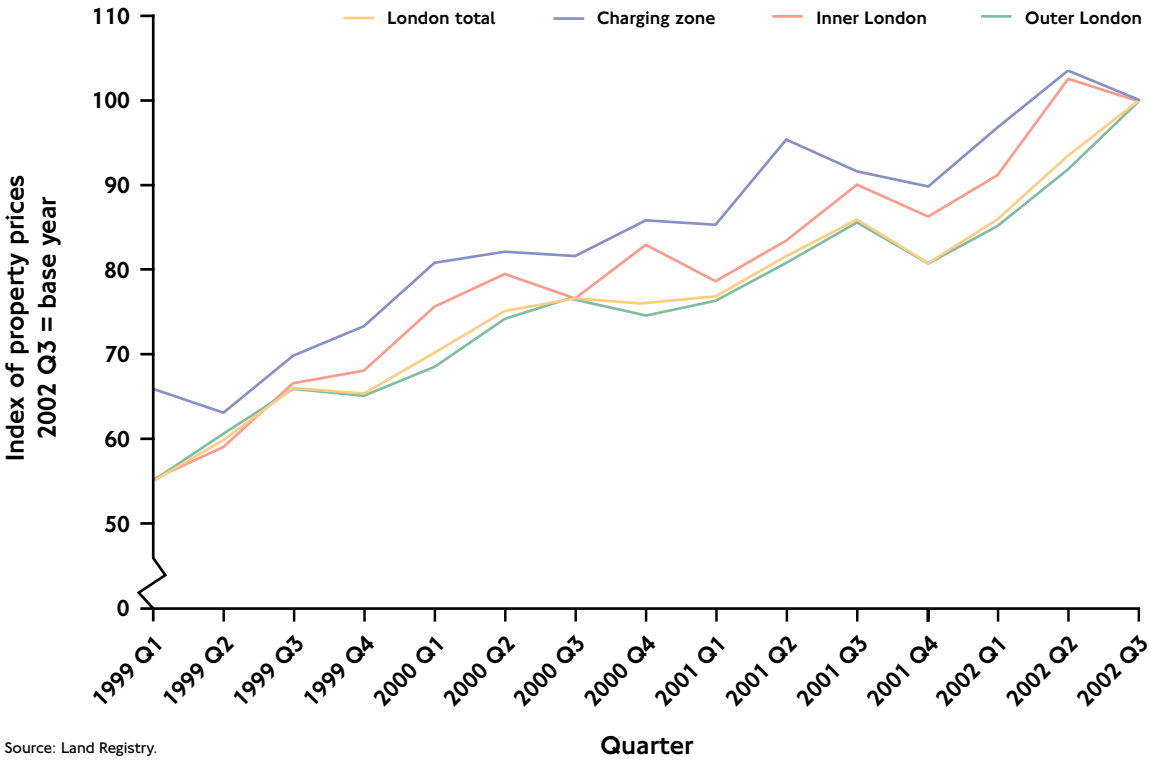


Source: Annual Business Inquiry.

Residential property prices

The diagram below shows recent trends in property prices across various defined areas of London.

Residential property prices, 1999 to 2002.



Source: Land Registry.

General business surveys

General surveys are being undertaken as part of the monitoring programme in order to track changing attitudes, awareness and expectations regarding congestion charging amongst businesses and organisations.

Attitudes towards congestion

During 2002, 50 percent of organisations perceived the impacts of peak-time congestion to be either critical or very bad for their business. In contrast, some 7 percent of organisations said that peak-time congestion was 'not a problem'.

Expected impact of congestion charging in reducing congestion

Just over 60 percent of all organisations interviewed expected congestion charging to be effective in reducing congestion. Around 30 percent thought the scheme would not be effective, while around 10 percent were not sure.

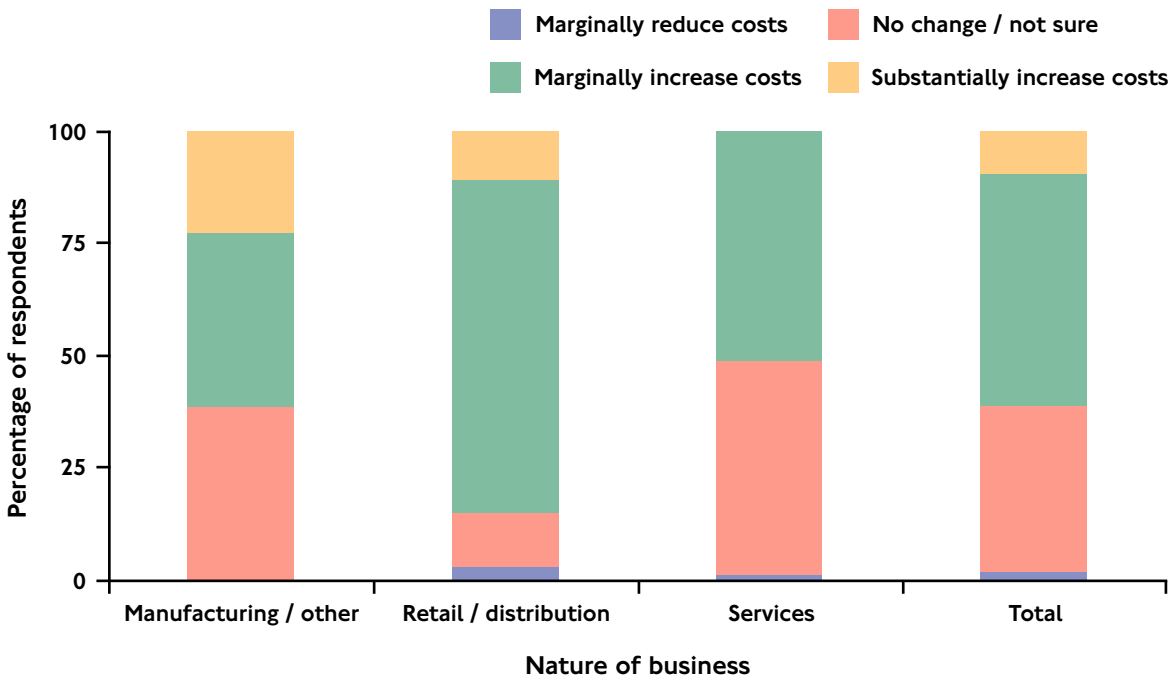
Small businesses were typically more sceptical than large businesses, with just over 50 percent of small firms expecting the scheme to be successful in reducing congestion as opposed to nearly 70 percent of large firms.

Impact on business costs

The biggest concern amongst organisations surveyed in 2002 was that congestion charging would lead to an increase in their costs. This could be a direct effect – such as having to pay the charge for vehicles operated by the firm – or an indirect effect, experienced as a result of suppliers and delivery companies increasing their prices.

The diagram below shows the expected impact of congestion charging on overall business costs.

Expected impact on overall business costs.



Organisations and activities of special interest

The monitoring programme will investigate the impact of congestion charging on specific organisations and activities deemed of particular importance or concern. These include central London hospitals, schools, commercial and local authority parking providers and the wholesale market at New Covent Garden.

Behavioural change

The monitoring programme will also seek to consider wider changes in behaviour by businesses or their employees that are related to congestion charging.

This includes, for example, changes in business travel method. Prior to the start of charging, around 25 percent of employers and around 15 percent of employees thought that congestion charging would definitely encourage people to use public transport instead of cars.

Social impacts

The social impacts monitoring programme will track the effects of congestion charging on people's attitudes, perceptions, abilities and behaviour in relation to their travel choices and daily lives.

Certain groups of people are thought more likely than others to be affected in specific ways. To address this, the social programme combines a general household survey of respondents living inside the zone and inner London, and an individual survey of respondents living in outer London and beyond the M25. These are supported by special inquiries which are designed to probe specific areas of interest or concern in greater depth.

Expected impact of congestion charging on selected tours

Non-drivers making trips to the charging zone, typically expected congestion charging to be more effective than drivers, and tended to be more optimistic the further they lived from central London. Eighteen percent of drivers within the charging zone thought the scheme would reduce congestion in contrast to 44 percent of non-drivers from beyond the M25.

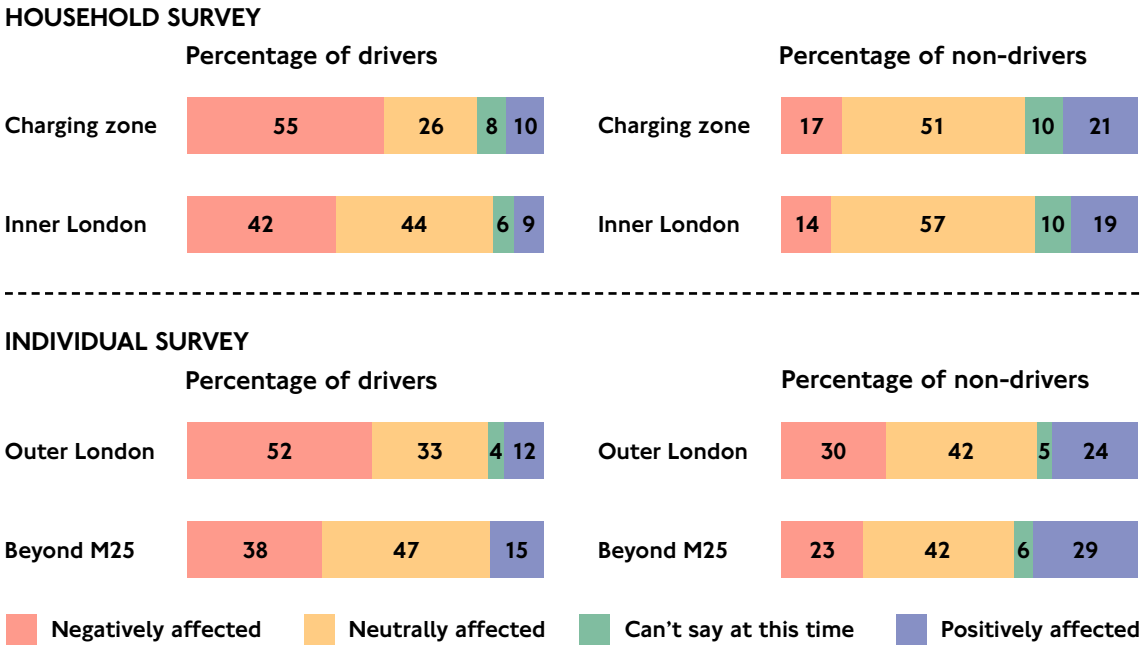
Anticipated advantages and disadvantages of congestion charging

The three most frequently anticipated benefits of congestion charging were reduced traffic, better public transport, and improved air quality. The proportions of people anticipating these benefits varied depending upon where they lived. Once again, those living beyond the M25 were most likely to anticipate benefits.

The most frequently anticipated disadvantages of congestion charging included increased travel costs, increased traffic on the boundary and outside the charging zone, and more crowding and discomfort on public transport.

The diagram below shows the anticipated overall impact of congestion charging for drivers and non-drivers living within the four survey areas.

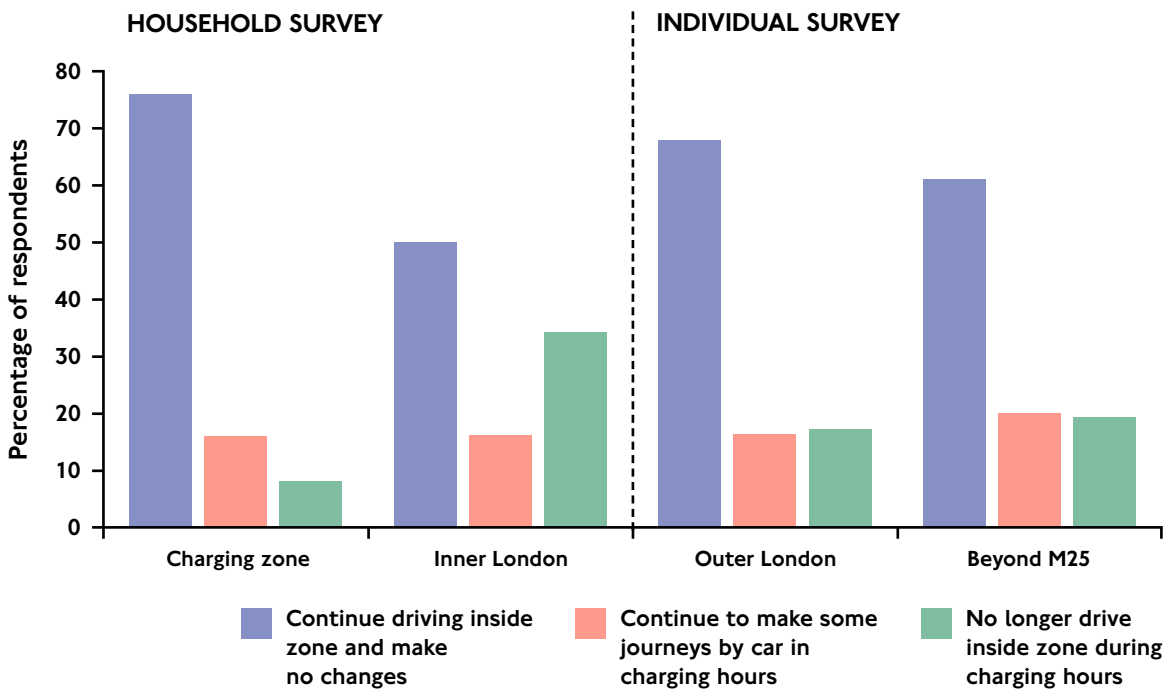
How drivers and non-drivers expected to be affected by congestion charging overall.



Expected changes to car journeys to the charging zone

The diagram below shows the extent to which drivers who customarily travelled within the charging zone would continue to do so following the start of charging. Even amongst those drivers living within the future charging zone (and hence entitled to a 90 percent discount when charging commences) a significant proportion of almost 25 percent expected to either make some change to their pattern of driving or cease driving in the zone altogether during charging hours as a result of the scheme.

Expected changes to car journeys to the charging zone.



Environment

Congestion charging will affect the volumes and patterns of vehicle travel in and around the charging zone. This will affect, albeit to a small degree, vehicle emissions, air pollution, road traffic noise and the other environmental consequences of traffic, such as visual intrusion and severance. Congestion charging should also facilitate a range of improvements to the street environment in the charging zone. Collectively, these effects should lead to a noticeable improvement in the quality of central London as a place to live, work and visit.

The monitoring in respect of air quality and noise needs to be compatible with the assessment frameworks that have been established for the Mayor's Air Quality[2] and Noise[3] Strategies, so that the impacts of congestion charging can be understood in the context of wider measures to address these issues.

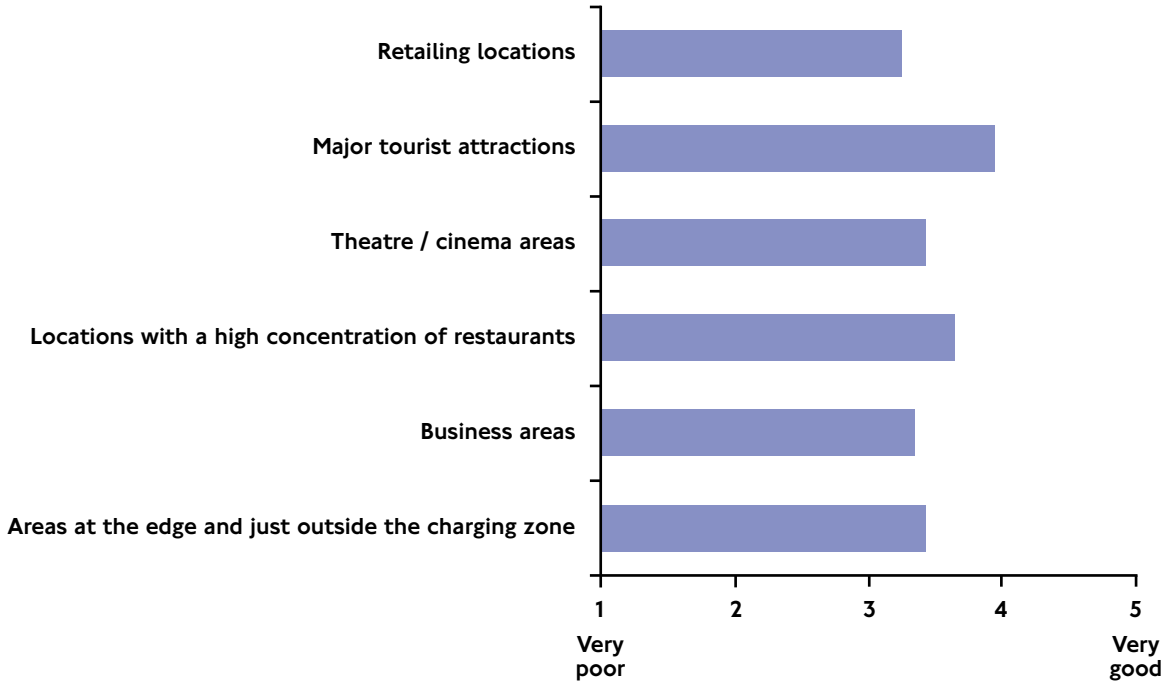
For air quality, the existing London Atmospheric Emissions Inventory, which is used as the basis for all air quality assessment work in London, will be updated with the wealth of new traffic information for central London that will arise from elsewhere in the monitoring programme. This will be used to produce annual London-wide air quality assessments, which will track progress towards national air quality objectives for nitrogen dioxide (NO_2) and fine particulate matter (PM_{10}), the two pollutants of greatest concern, alongside all other pollutants for which national objectives exist. The same data will also be available to boroughs in undertaking their own local assessments.

For earlier feedback on air quality effects, the extensive monitoring data gathered through the London Air Quality Network will be useful, although it expected that extraneous influences (particularly variation in the weather) will make impacts difficult to detect over the short-term.

For noise, an existing annual ambient noise survey will be adapted to include additional sites representative of each of the geographical areas potentially affected by congestion charging. Again, however, extraneous influences on measured data are expected to mask the small-scale changes that are expected to result from congestion charging. An approach based on London-wise noise mapping will also be used to determine change, again benefiting from the new traffic data gathered from the monitoring work.

Changes to how Londoners perceive elements of environmental quality will be addressed through a programme of on-street interview surveys, which will gather attitudinal data (e.g. how people perceive changes to air quality) that can be set alongside the more quantitative data gained through the above methods. An example of the type of analyses that will be undertaken is given below.

On-street public space surveys. Mean scores for overall 'pleasantness of area', by type of area, Autumn 2002.



Report contents

The Impacts Monitoring First Annual Report contains a comprehensive summary of the monitoring programme. There are nine chapters which make up the majority of the report, and nine appendices which provide additional supporting information.

The report chapters are:

1. **Introduction**
2. **The monitoring programme**
3. **Congestion**
4. **Traffic patterns**
5. **Public transport**
6. **Travel behaviour and secondary transport effects**
7. **Business and economic impacts**
8. **Social impacts**
9. **Environment**

The report is available on www.tfl.gov.uk/tfl/cc_monitoring.shtml

Hard copies of the report may be obtained from:

London's Transport Museum
Convent Garden
London
WC2E 7BB

Telephone: +44 (0) 20 7379 6344
Email: tarab@ltmuseum.co.uk

If you have any queries relating to this report or the wider impacts monitoring programme – please email TfL at ccsmonitoring@tfl.gov.uk

Technical notes

1. The Greater London (Central Zone) Congestion Charging Order 2001 (as amended). Report to the Mayor of London, February 2002, Transport for London. Available at www.tfl.gov.uk/tfl/cc_report_mayor.shtml
2. Cleaning London's Air: The Mayor's Air Quality Strategy, September 2002, GLA. Available at www.london.gov.uk/mayor/strategies/
3. City Soundings: The Mayor's Draft London Ambient Noise Strategy, March 2003, GLA. Available at www.london.gov.uk/mayor/strategies/

1. Introduction

1.1. Purpose

This is the first in a series of annual reports describing the measurement of the impacts of congestion charging in central London. It provides an overview of the monitoring programme, summarises conditions prior to the commencement of charging, and sets out the range of indicators and issues that will be monitored following the introduction of the scheme.

This report provides a summary of the information that is, or will be, available from surveys undertaken before the start of congestion charging. The more important indicators of pre-charging conditions are clearly identified in this report. Other information is presented so as to illustrate the coverage, depth and diversity of the monitoring programme.

1.2. Background

Congestion charging will affect all those who work in, live in or visit central London, and its consequences will be felt to some degree across much of Greater London.

Both the Mayor and TfL are committed to a 5 year comprehensive, objective programme of monitoring. The programme will assess the key traffic, transport, business, economic, social and environmental impacts of the scheme. It will consolidate information drawn from over 100 specially designed surveys and studies, while making use of already established surveys and data sources.

Over time, the monitoring programme will provide a comprehensive and robust resource for assessing the impact of congestion charging. It will also be an important mechanism by which experiences, insights, and emerging issues can be fed back to those with operational and policy responsibilities for the scheme.

More specific information relating to particular elements of the monitoring programme will be available through a variety of other means as the effects of charging start to accumulate and become measurable. A summary of TfL's approach to disseminating the results of the monitoring programme is given in Appendix 2.

1.3. Structure of the report

The rest of this introductory chapter outlines the guiding principles, data sources and outputs of the monitoring programme. A second chapter provides a summary overview of its constituent surveys and other research activities.

The remaining body of the report provides a full description of each area of monitoring activity, and sets out the key data outlining conditions prior to the start of congestion charging on 17 February 2003. A summary description of the scheme is provided at Appendix 1.

1.4. Commitment to monitoring

The Mayor is committed to monitoring the effects of congestion charging in central London. The outputs of the monitoring programme will be used by the Mayor and TfL to assess whether the scheme performs as intended and is delivering benefits to London. If the scheme is not operating as expected, the Mayor may consider variations to the scheme, its complementary public transport measures or its associated traffic management.

In all of this the timescales over which effects will accumulate and become measurable are important. Some traffic and public transport impacts will become apparent within a few months, possibly with some early indications of change within a few weeks. Other impacts will take longer to mature and become apparent, for example any attributable change in road accidents. Some effects, such as any impact on commercial rents or business locational choice, may take a couple of years or more before they can be detected. In broad terms, it is expected that some of the longer-term 'settled' effects of charging will start to become apparent six months or so after the scheme is inaugurated (i.e. from Autumn 2003 onwards).

Furthermore, neither the scheme or the monitoring will take place in isolation. There are other transport initiatives across London coming to fruition. There is the influence of the regional economy. These and a host of other factors will need to be considered and taken into account as part of any wider assessment of congestion charging.

1.5. Principles underlying the monitoring programme

The design of a monitoring programme for the scheme has inevitably involved prior judgements and assumptions about the nature, scale, timing and location of impacts. The main anticipated effects of the scheme have been set out in Transport for London's Report to the Mayor of London[1], published in February 2002. However, the programme retains flexibility to adapt to the emerging pattern of effects and stakeholder requirements.

The design of the monitoring programme has been guided by the following principles:

Monitoring should robustly detect and characterise the main expected effects of congestion charging. This means that changes to traffic, transport and other aspects of London life that have been anticipated as part of the planning and design of the scheme should be robustly measured, so that actual impacts can be compared with prior expectations.

Monitoring should enable unexpected or unanticipated effects to be determined. This means that monitoring should not just be limited to effects that have been anticipated. It should cover and attempt to measure possible effects that were not projected or quantified, and should include capacity to actively look for unanticipated effects, such that monitoring can be intensified or adjusted to investigate them.

Monitoring should seek to understand, as well as measure. This means that monitoring should employ a full range of quantitative and qualitative research techniques, in a complementary manner, to understand the processes through which the scheme affects travel patterns and other aspects of London life. In particular, it will be important to approach an understanding of the relative contribution of the scheme to observed change, alongside the contribution of all other influences - both long-standing and more short-term - that will be operating at the same time.

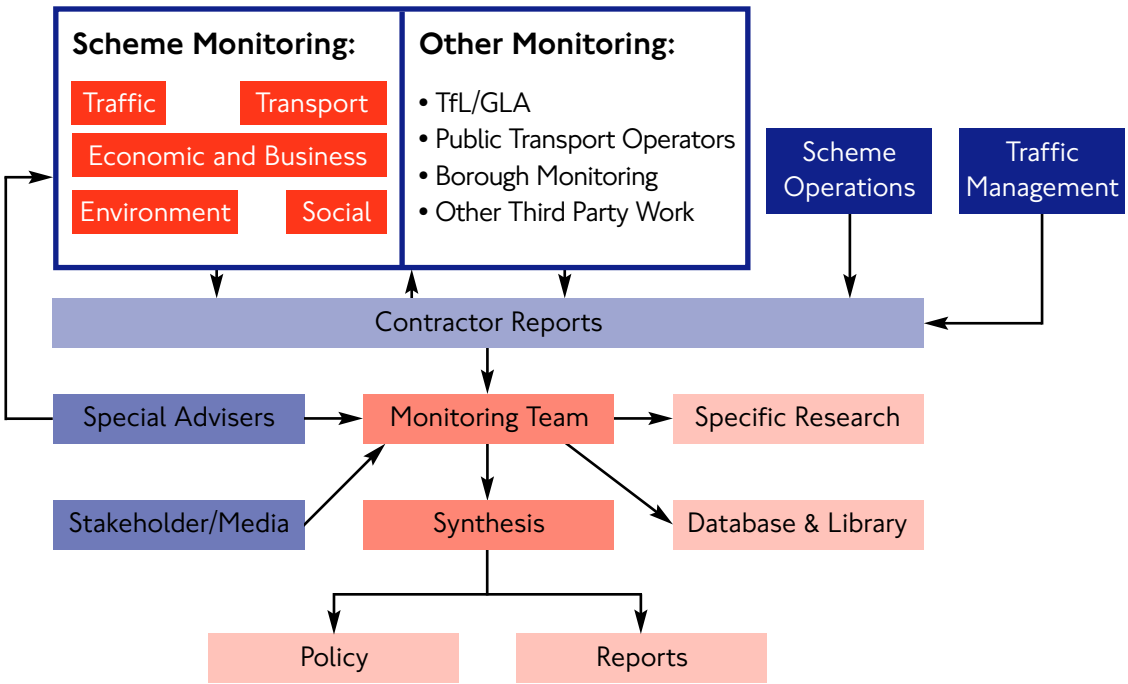
Monitoring should aim to meet the legitimate needs of all stakeholders for information. This means that monitoring should attempt to satisfy the requirements for information about the effects of congestion charging that have and will continue to be advanced by different interests. In some cases these relate to very specific locations, issues, timeframes, social groups or economic activities. These may have to be tackled through specific research activities or case studies overlaid on a 'core' of more generally-oriented surveys.

Monitoring should provide Best Value. In practical terms, this means that the monitoring programme must deploy techniques that are appropriate to the expected scale, extent and importance of the changes being measured.

1.6. Organisation of the monitoring programme

This section describes the overall organisation of the monitoring work that has been put in place. A graphical representation of this can be found below in Figure 1.1.

Figure 1.1. Organisation of the congestion charging monitoring programme.



The work is managed by a team of permanent TfL staff, with independent contractors undertaking each of the main data collection elements. The TfL team are supported by a number of specialist external advisers. These are leading academics or professionals who advise on specific aspects of the work, and help ensure that the monitoring is robust and benefits from accepted best practice. The specialists act in an independent advisory capacity according to their particular speciality.

1.7. Surveys and research

The monitoring programme consists of over 100 directly-sponsored survey and research activities. These have been designed to investigate specific questions, and to complement the wealth of existing transport and related monitoring that already occurs in London, which will form a vital part of the programme. A summary of the work programme appears at Appendix 3.

Up to one-half of the data that will be used to assess the impacts of the scheme will originate from third-parties. This will be either from the wider TfL monitoring effort in support of the Mayor's Transport Strategy, from public transport operators, or from other organisations and stakeholder groups such as the London boroughs and business organisations. Close relationships have been formed with these data providers, with a

view to sharing data and insights wherever possible. In many cases, these sources provide long-term datasets that extend back over five years or more.

The monitoring work will also interface closely with the congestion charging Operations and Traffic Management functions within TfL. Operations will be able to provide a wealth of information relating to the operation of the scheme, such as revenues, the take-up of the various discounts and exemptions, and aspects of customer service. Traffic Management will be particularly important in terms of understanding how the drivers and the road network respond to the introduction of charging in the early weeks following introduction of the scheme, and in responding to both short- and long-term traffic issues that arise.

Directly-sponsored survey work has been put in place progressively during late 2001 and 2002. In parallel, third-party data (which in many cases extends back to well before 2001/2) has been inventoried and assembled. The programme is scheduled to run until the end of 2005 in the first instance. It is expected that elements of the monitoring will continue beyond 2005, depending on the emerging pattern of effects, and our proposals for this longer-term monitoring will be made available during 2005.

1.8. Outputs from the monitoring programme

Outputs from the directly-sponsored surveys and from third-party monitoring will be assembled by the TfL team, and a library of all data relating to congestion charging impacts will be maintained. The TfL team (with input from stakeholders, specialist advisers and third-party data providers) will interpret and analyse incoming data, and produce a range of outputs. These will reflect the need to effectively manage the sheer volume and diversity of the information potentially available, and to ensure that information provided is accurate and meaningful.

Outputs will also need to reflect the different timescales and rates over which the effects of congestion charging become apparent and measurable. For example, changes to overall traffic patterns might be expected to reach a relatively stable position at between 3 and 6 months after charging is introduced. Data gathered prior to this, whilst extremely important for understanding how the scheme is working in the short-term, would not be expected to accurately reflect the long-term post-charging situation. On the other hand, effects on strategic business decisions and the economy of central London would be expected to be felt over rather longer timescales, perhaps several years.

Bearing this in mind, the broad categories of output, and the timescales over which they can be expected, are summarised below:

- **Annual reports,** to be produced at approximately 12 month intervals in the Spring of each year, providing a comprehensive summary of the entire monitoring programme;
- **Periodic bulletins,** at intervals over the 4 year initial term of the monitoring, focusing on specific topics or (in the short term) early indications of scheme effects;
- **Technical reports,** covering specific areas of the monitoring, and providing syntheses of emerging effects at a greater level of detail than is possible in the Annual Reports – at intervals from early 2004 onwards;
- **Datasets and contractor reports** will be made available on request to bona fide researchers according to the protocol set out in Appendix 2.

1.9. The scale and diversity of potential impacts

The effects of the congestion charging scheme will range to a greater or lesser extent across most aspects of London life. The monitoring programme aims to match the research with the scale, intensity and importance of the anticipated effects, which can be summarised as follows.

Traffic impacts

These are expected to be the most immediate and obvious impacts. The charge will cause some drivers to no longer drive a vehicle into or through the charging zone. Traffic levels are projected to reduce both inside and outside the charging zone, producing lower levels of delay and improved journey time reliability. However, on routes going around the charging zone there is expected to be some increase in traffic caused by displaced through-traffic.

The traffic management measures being introduced to complement the scheme are directed particularly at managing this displaced through-traffic. The effect of these measures will be assessed in due course by the monitoring programme.

There are likely to be more subtle and perhaps longer-term traffic impacts: potentially, for example, reduced road traffic accidents as a consequence of less traffic in and around the charging zone; and improved journey time reliability for journeys to, from and within the charging zone, and some increase in pedal and motorcycling for travel to the charging zone.

Public transport impacts

The scheme is expected to result in an increase in bus passengers on routes into and out of the charging zone. More modest increases are expected on Underground and rail services.

As a result of reduced congestion, it is expected that bus services to, from and within the charging zone will become more reliable and hence more attractive to shorter distance rail and Underground passengers.

A series of public transport initiatives – from improved information to additional bus services – has been introduced to complement congestion charging. The monitoring programme will need to take these into account when considering the effects of congestion charging on London's public transport.

Business and economic impacts

There are expected to be some fairly immediate impacts on businesses located in or near the charging zone. Deliveries, for example, should become easier and more reliable, albeit with a possible short-term increase in overall operational costs as a result of the charge. Longer-term, improved traffic conditions may allow new patterns of delivery activity.

Business journeys by car and taxi in and around the charging zone should become easier and more reliable. Employees using buses to travel to work should benefit. However, some concerns have been expressed about the impacts on small businesses, especially those located just outside the charging zone.

In turn each of these effects may have impacts on London's economy, through changes in productivity, property prices and the relative attractiveness of central London as a place to do business. All of this will take place against the backdrop of wider economic change reflecting the economic cycle and international events.

Social impacts

The potential effects on individuals, households and organisations are complex. Changes in travel patterns are an obvious impact, though these need to be set in the context of changes caused or influenced by other factors – such as a new job. Less obvious is the effect of the £5 charge within households where somebody drives daily into the charging zone. Over a year this would cost more than £1,000 – a significant addition to household motoring costs.

Particular groups of people will be affected in different ways, and their perceptions and attitudes towards the scheme will also vary. Shift workers who feel they need to continue to drive, for instance, may assess congestion charging in a quite different way from a periodic visitor to central London.

Monitoring the social impacts of congestion charging will require a range of techniques and the findings are less likely to be capable of quantitative measurement. However, the investigations could provide a deeper understanding of the reasons behind the more measurable traffic and transport impacts.

Environmental impacts

The environmental effects, in terms of visual, noise or atmospheric pollution are expected to be minimal, although we predict a small reduction in some vehicle emissions across London. Some concerns have been expressed about potentially localised, increased air pollution around the boundary of the congestion charging zone. The monitoring programme will deal with these concerns, and also operate in concert with established assessment frameworks for air quality and noise in London.

1.10. Scheme operation

The operation of the scheme will impact directly on those who pay the charge. Others will be affected, such as those who register for a discount or for a vehicle exemption, or operators of vehicle fleets who take advantage of the arrangements for easier payments.

The enforcement of the scheme will affect those who do not pay, either inadvertently or deliberately. Some will wish to make representations or seek adjudications. Those who persistently evade risk having their vehicles clamped or towed to a pound.

There will be a significant financial impact on TfL, in terms of receipts from charging and payments to the service providers for operating the scheme. Including penalty charges, TfL has projected net revenues from the scheme of £130 million per year.

The majority of these impacts will only become clear once the scheme is fully operational and has settled down. Transport for London's Congestion Charging Operations Team and the scheme service providers, Capita and NCP, will be monitoring all aspects of scheme operations. A variety of reporting methods will be used to allow in-depth study of services and chargepayer or 'customer' trends to assist in the management of all sub-contractors to ensure maximum effectiveness and 'customer' satisfaction.

Detailed information on the operation of the scheme will be provided in the Second Annual Monitoring Report.

Technical notes

[1] The Greater London (Central Zone) Congestion Charging Order 2001 (as amended): Report to the Mayor of London, Transport for London, February 2002.

2. The Monitoring Programme

2.1. Review of the monitoring programme

This section summarises the content of the monitoring programme. Further details are given in the individual sections dealing with each area of the monitoring work, and in the form of a reference table at Appendix 3.

The work falls under seven sections, each of which involves one or more independent contractors and the assembly of available third-party data. These sections (along with a set of related appendices) form the basis for the remainder of this report. They are:

- Congestion;
- Traffic patterns;
- Public transport;
- Travel behaviour and secondary transport effects;
- Business and economic impacts;
- Social impacts;
- Environment.

These sections are not mutually exclusive. For example, fully understanding the effects of the scheme on congestion will involve (to a greater or lesser degree) output from all seven of the above categories. These interdependencies are illustrated throughout this report.

Congestion

Measuring traffic congestion involves gathering information on both journey speeds and journey time variability. Two techniques are being used:

- **Moving car observer surveys** - an instrumented car that moves around a pre-defined and representative schedule of routes, recording time and distance travelled

  Such surveys have been undertaken regularly since the 1950s, and have been stepped-up considerably in 2002 within and around the charging zone to provide a greater level of detail. The charging zone, Inner Ring Road, and key radial routes approaching the zone are now being monitored continuously (on a two-monthly cycle), while elsewhere, where congestion effects are predicted to be minimal, i.e. the rest of inner London and outer London, the networks will be surveyed at one and three year intervals respectively.

- **Cameras** - taking full account of data protection principles, by using a process of anonymisation, data from some of the 250 enforcement and monitoring camera sites within and around the charging zone are being used to monitor traffic speeds and transit times by matching sample observations of the same vehicle between pairs of cameras, giving more information on traffic speeds than has ever been previously available.

Traffic patterns

Congestion charging is expected to result in less traffic in the charging zone and on its radial approach roads. It is also expected to lead to a small increase in traffic on the Inner Ring Road and some other orbital routes, which will be catered for by adjustments to traffic signal timings. Changes are also likely in the general pattern of trip-making, and the types of vehicle being attracted or deterred from the charging zone.

The monitoring programme will use a full array of techniques to gather information on traffic:

- area-based counts quantifying changes in traffic within the charging zone;
- cordon-based counts measuring traffic entering and leaving the charging zone, and measuring changes in radial traffic approaching the zone;
- screenline-based counts measuring changes in wider orbital traffic in inner London;
- site-specific counts to detect changes on local roads in and around the charging zone;
- counts on the Inner Ring Road and its main junctions, and in relation to specific incidents or schemes.

Public transport

The monitoring programme will establish whether public transport is adequately handling the additional demand expected to result from congestion charging; measure changes to the supply and demand for each public transport mode; and track how the changed traffic conditions brought about by charging affect bus services.

- **Bus service supply and patronage** are being measured by counts of buses and passengers at a large number of strategic 'Keypoints' on the bus network; and using revenue and ticket machine data.
- **Bus journey times and reliability** are being measured using automatic vehicle location technology; sample surveys conducted at bus stops to compare performance against schedule; and on-bus delay surveys that record the duration and causes of delays on route.
- **Underground patronage** is being tracked by data gathered from ticket gates and revenue and supplemented by on-platform passenger surveys.

- **Docklands Light Railway** patronage will be tracked using data published on a monthly basis along with existing travel pattern, reliability and customer satisfaction surveys.
- **National Rail** patronage is being assessed by using existing data from the Strategic Rail Authority (SRA) and Train Operating Companies, together with a strengthening of the existing programme of station and terminal counts at locations in and around the charging zone.

Travel behaviour and secondary transport effects

- **Travel behaviour** can be measured by personal interviews and traveller trip diaries, compared against historical data from the ten-yearly London Area Transport Surveys (1991 and 2001), the annual Central Area Peak Count survey, and data gathered from the social and economic programmes described below.
- **Road safety** is being monitored using data on reported accidents from the London Accident Analysis Unit, which has monitored personal injury accidents in London for the last 20 years.
- **Parking -** case studies undertaken with commercial and local authority parking providers will track changes to parking patterns within the zone. A specific study of a selection of National Rail and Underground stations seeks to identify changes in 'railheading' (driving to a station to catch a train).

- **London taxis and London licensed minicabs -** Public Carriage Office records will indicate changes to the numbers of licensed vehicles. This source is being supplemented by data on taxi movements from the traffic counting programme. A study of a sample of minicab businesses will look at changes as the licensing of private hire vehicles is progressed - in parallel with the introduction of congestion charging.

- **Pedestrians -** a series of on-street public space surveys will help to monitor general changes in pedestrian use of, and attitudes towards, the charging zone. Quantitative work will be undertaken in a boundary case study area to monitor changes to pedestrian activity on and across the Inner Ring Road.
- **Motorcycle and pedal cycle** activity is being monitored as part of the general traffic counting surveys, and backed up with additional studies of motorcycle and pedal cycle users, retailers and parking providers.

Economic and business impacts

The monitoring programme aims to take account of long-term trends and influences upon the London economy. It will assess the impact of congestion charging upon business in general and those economic and institutional activities of specific stakeholder interest. In addition, work is being undertaken to understand how the business community perceives and responds to the scheme.

The information to be gathered covers top-level indicators such as employment, through to data relating to specific sectors such as tourism, health services, and the property market. It will also include the following:

- **general business surveys,** undertaken with a cross-section of London businesses. These include in-depth face-to-face and telephone-based interviews with some 600 organisations located within and immediately outside the charging zone, as well as a separate depth-interview survey of over 50 small and medium sized businesses located within the boundary case study area;
- **economic case studies** will explore in detail the effects of congestion charging on a specific area of economic or public service activity, such as health service operations; schools; wholesale markets; and commercial and local authority parking;
- **freight and distribution businesses** are the subject of an in-depth study that will seek to assess the perceptions, experiences, planning, financial and administrative implications of charging for the logistics and distribution industries.

Social impacts

The social impacts programme aims to understand the effects that congestion charging has on people's attitudes, perceptions, and behaviour in relation to their travel options and daily lives. In order to gather information on these issues, the social impacts programme will include the following elements:

- **general household and individual surveys** are being conducted with some 2,300 households across seven different 'neighbourhoods' in the charging zone and inner London, in order to identify how the perceptions and implications of congestion charging vary by location. This will be supported by an individual survey of 2,100 travellers to central London from outer London and beyond the M25;

- **special inquiries** are being used to identify and characterise specific issues. These are typically focus group-based exercises with representative or particular groups who are able to offer unique insights into the effects of congestion charging or who have been brought to our attention as requiring specific monitoring. Special inquiries will also provide an important means of investigating issues which emerge once charging has begun. Examples of such groups include emergency service workers and disabled people;
- **on-street public space surveys** are being used to profile the social mix, usage, and perceptions of people who use a representative selection of locations within and around the boundary of the charging zone, and to discover if this changes when congestion charging begins.

Environment

The changing traffic patterns expected to result from congestion charging may have some effect, albeit small, on London's air quality, noise levels, and general environmental amenity.

- **Local air quality -** the monitoring programme aims to understand the relative contribution of congestion charging alongside other factors and initiatives influencing air quality. Data will be drawn from available monitoring sites affiliated to the London Air Quality Network, and will be supplemented by the use of emissions and air quality modelling techniques based on the London Atmospheric Emissions Inventory.
- **Energy use and greenhouse gas emissions -** changes to traffic patterns brought about by congestion charging should result in small but worthwhile net savings in both fossil fuel use and CO_2 emissions. An emissions modelling framework will be used to quantify these effects by extrapolation from the traffic data that will arise from the wider monitoring programme.
- **Noise -** changes to noise levels as a result of congestion charging are likely to be small, and are most effectively quantified by extrapolation from traffic data generated elsewhere in the programme. In addition, TfL's existing programme of sample noise surveys has been adapted to include exemplar sites reflecting the traffic changes associated with the scheme.
- **Quality of the central London environment -** this encompasses a range of quantifiable and unquantifiable factors, people's perception which will form an interesting complement to the measured data. This will be approached by attitudinal questions in the on-street public space surveys; general household social impacts surveys; and general business surveys.

Scheme operations

The operational processes underpinning congestion charging will yield useful information for impacts monitoring purposes; including the take-up of various discounts and exemptions by particular groups; the payment channels used; and the revenues raised.

Traffic management

Similarly, the Real Time Traffic Management system (which will be used to monitor and respond to traffic conditions on and around the Inner Ring Road) will provide journey time and congestion data of value to the monitoring programme.

2.2. Other considerations

Boundary case study area

The monitoring programme will yield comprehensive data on the incidence of the above effects in and around the charging zone. To provide a particular focus for the study of boundary-related issues, a case study area has been defined, located adjacent to the Inner Ring Road in the southern part of the Boroughs of Islington and Hackney. The primary rationale for the choice of this area is the presence of existing or planned monitoring capacity. Concentrating survey effort in this area will also allow consideration of the interaction between effects (e.g. local traffic schemes and congestion charging) in the context of a specific local area.

Distinguishing and attributing the effects of congestion charging

The monitoring programme aims to gather data that will allow an approach to be made to distinguishing the effects of congestion charging from all of the other influences affecting life in London. The extent to which we are able to do this will vary. For example, the wealth of new traffic data will allow greater clarity in identifying the causes of air quality change in central London than has previously been possible. On the other hand, the multiplicity of influences on business decisions and the limitations of attitude-based surveys will mean that isolating the effect of congestion charging on general economic trends may be extremely difficult.

2.3. Further information

This first annual report deals with the majority of the surveys and studies that have been carried out prior to congestion charging commencing in February 2003. The next annual report, due in Spring 2004, will contain information that will allow some form of initial overall assessment of the performance of the scheme.

Further information on any aspect of the programme is available by e-mail from: ccsmonitoring@tfl.gov.uk

3. Congestion

3.1. Introduction

The main objective of congestion charging is to reduce traffic congestion in and around central London. It is expected to achieve this by reducing the amount of traffic attracted into the charging zone.

This section first sets out to define 'congestion' and to describe the expected impact of the scheme on congestion. It then proceeds to describe measured conditions and trends in traffic speeds and travel rates which relate to the measurement of congestion in and around the charging zone prior to the start of charging on 17 February 2003. The section also looks at the new possibilities for measuring traffic conditions that are presented by the camera-based enforcement technology for the scheme, and briefly describes how additional information relating to congestion will arise from other parts of the monitoring programme.

3.2. Definitions of congestion

Congestion occurs when vehicles impede the progress of other vehicles. Congestion intensifies as the amount of traffic on the network (measured as 'vehicle-kilometres') increases. It is experienced as delay (measured as 'vehicle-minutes') by road users.

On a motorway or other road with few junctions, as traffic increases vehicles travel closer together and the delay is experienced primarily as slower journey times – increased vehicle-minutes. On an urban road network with many junctions the increased delay as a result of increased traffic is experienced primarily as increased time in queues at junctions – again increased vehicle-minutes.

Strictly speaking, congestion is the delay that vehicles impose on each other. But congestion can also be affected by other factors, in particular, the effective capacity of the road network. Congestion is a consequence of the balance of the capacity of the road network and the intensity of traffic flow. If there were little or no congestion it would suggest there was more than sufficient road capacity.

Excessive levels of congestion are uneconomic and wasteful. In an ideal world congestion would be contained to an optimal level – that which would apply if the capacity of road network were optimal and its traffic was at an optimum level. In practice the optimal level of congestion is difficult to define and 'excessive congestion' therefore has to be determined by more pragmatic means, taking account of public acceptability and political priorities. The level of congestion inside the future charging zone is considered to be excessive.

The general approach adopted here is the same as that currently used by the Department for Transport (DfT). This defines 'congestion' as the average 'excess' or 'lost' travel time experienced by vehicle users on a road network. Excess travel time is the time spent over and above that under 'uncongested' or 'free-flow' conditions. These concepts are defined in Table 3.1 and illustrated in Figure 3.1.

For London, 'uncongested' conditions are taken as being those applying during the early hours of the morning, when traffic flow is at its lightest, and traffic is most able to move around the network at its 'free-flow' speed. Comparable 'night-time' values are used by the DfT to establish prevailing levels of congestion in other English urban areas.

Table 3.1. Key measures in defining congestion.

Vehicle-kilometres	A measure of the overall volume of traffic on the road network. For example, 1,000 vehicles travelling an average of 4 kilometres produces 4,000 vehicle-kilometres.
Vehicle-minutes	A measure of the time spent by vehicles travelling on the road network. For example, 1,000 vehicles spending an average of 12 minutes on the road network produces 12,000 vehicle-minutes or 200 vehicle-hours.
Average network speed	Vehicle-kilometres divided by vehicle-hours. For example, 4,000 vehicle-kilometres divided by 200 vehicle-hours equals 20 kilometres per hour. Network speed includes time in queues at junctions and is slower than 'driving speed'.
Average network travel rate	Vehicle-minutes divided by vehicle-kilometres (that is, the inverse of speed). It is a measure of the average 'slowness' of vehicles travelling on the road network and can be a more convenient concept than average network speed for dealing with congestion matters. For example, 12,000 vehicle-minutes divided by 4,000 vehicle-kilometres produces an average travel rate of 3 minutes per vehicle-kilometre.
Uncongested network travel rate	One way of determining uncongested travel rates is to measure network conditions when traffic flows are very light – typically in the early hours of the morning. In urban areas a typical value would be around 1.5 minutes per vehicle-kilometre, corresponding to a network speed of about 40 kilometres per hour.
Congestion	The difference between the average network travel rate and the uncongested network travel rate in minutes per vehicle-kilometre; i.e. the delay, 'lost travel time' or 'excess travel rate'.

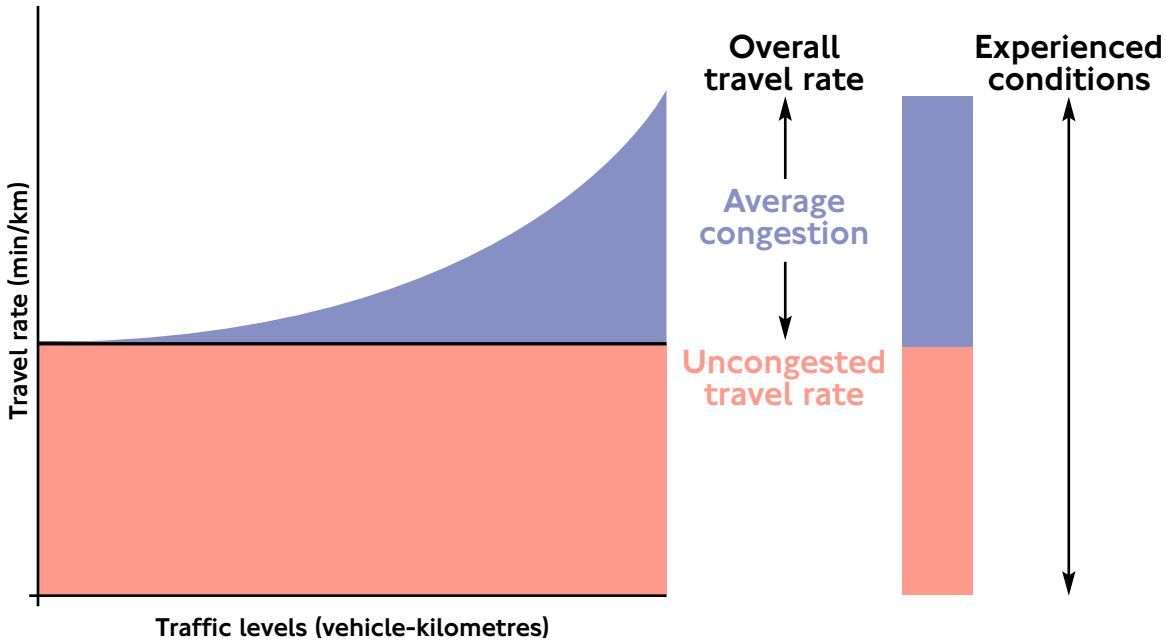
The most recent night-time speed survey of central London in 2001 indicated little change in 'uncongested' average night-time traffic speeds since the previous survey of 1991. It is important however, to understand that the uncongested travel rate is not a realistic target for traffic operations; since it can only be achieved when there is very little traffic. It is simply the starting point for calculating the intensity of congestion.

When there is very little traffic on a road network, 'free-flow' conditions are said to apply. For example, if the free-flow average speed of the network is 40 km/h, the free-flow travel rate is 1.5 min/km. And if traffic is experiencing a travel rate of 2.4 min/km and hence moving with an average network speed of 25 km/h, the excess travel time or congestion is 0.9 min/km.

Figure 3.1 shows the general relationship between experienced travel conditions, congestion and traffic levels. All other things being equal, increased traffic means increased congestion. It also means an increase in the unreliability of journey times, which is not shown in the figure.

Hence, by deterring some drivers – and hence some vehicles – congestion charging should reduce the level of traffic, which should in turn reduce the congestion experienced by other road users.

Figure 3.1. Congestion increases with traffic levels.



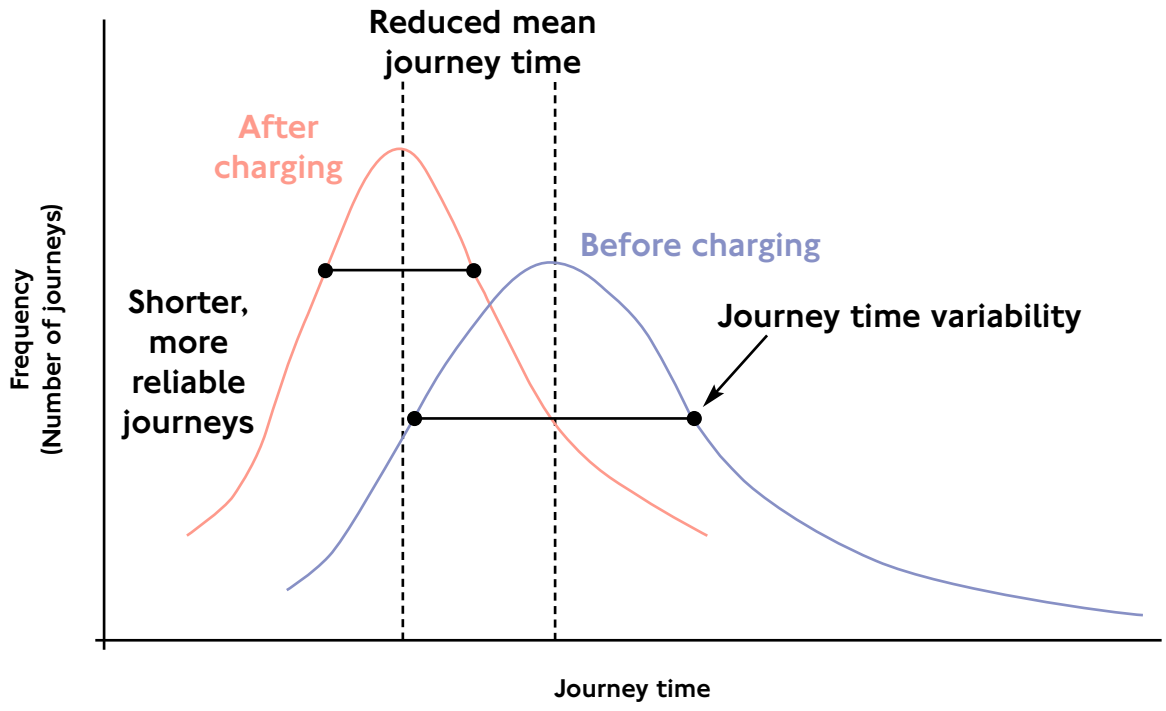
Comparing actual travel rates with uncongested travel rates has a number of limitations. For example:

- it does not consider the added variability of journey times which arises when congestion increases (the increasing 'slowness' can mask the increasing unreliability of journey times), see Figure 3.2;
- it does not embrace other consequences of increasing congestion, such as drivers diverting to less suitable roads or spreading their journey times to avoid the most congested conditions;
- it does not explicitly recognise the concept of the optimum level of congestion: there is a risk that 'uncongested' conditions are regarded as somehow the target to be attained;
- it does not explicitly take account of the numbers of vehicle occupants experiencing congestion, nor their individual valuations of how much they would be prepared to 'pay' to experience reduced congestion.

Nevertheless, comparing travel rates does give a relatively reliable indicator of congestion - especially when comparing the same road network with different levels of much the same mix of vehicles. The concept of excess travel time has also been tested in research studies and found to match to a reasonable extent with public perceptions of congestion.

To place the data for London presented in this section in context, the results from the DfT's latest surveys of congestion on roads in England show the average level of congestion in large urban areas to be 0.4 minutes per vehicle-kilometre.

Figure 3.2. An illustration of potential changes in journey time characteristics.



3.3. Expected congestion impacts

Congestion charging in central London is forecast to reduce traffic delays both inside and outside the charging zone.

- Inside the charging zone, TfL has projected that congestion will reduce by 20 to 30 percent as a consequence of there being less traffic coming into or circulating within the charging zone in response to the charge.
- The Inner Ring Road around the charging zone is expected to carry additional orbiting traffic. Transport for London will adjust the traffic signals controlling the Inner Ring Road to reflect the new pattern of traffic, with the objective of maintaining congestion on the road at or below pre-charging levels.
- On radial routes outside the charging zone within inner London, TfL expects a reduction in congestion as a consequence of less traffic coming into or leaving the charging zone. On orbital routes in inner London outside of the Inner Ring Road, there are expected to be some increases in traffic though this will be largely catered for by adjustments to traffic signals. The net effect is expected to be a modest overall reduction in congestion across inner London.
- In outer London and beyond, congestion charging is projected to result in a slight reduction in congestion, though this is expected to be too small to readily measure.

3.4. Measuring congestion

Moving Car Observer Surveys

The measurement of congestion primarily involves gathering data describing average travel speeds on the road network of interest. Traditionally, average traffic speeds in London have been measured through Moving Car Observer (MCO) surveys. This method consists of an instrumented car (often referred to as a 'floating car') that travels around the network, following a pre-defined schedule of routes and behaving in the same way as the generality of other traffic.

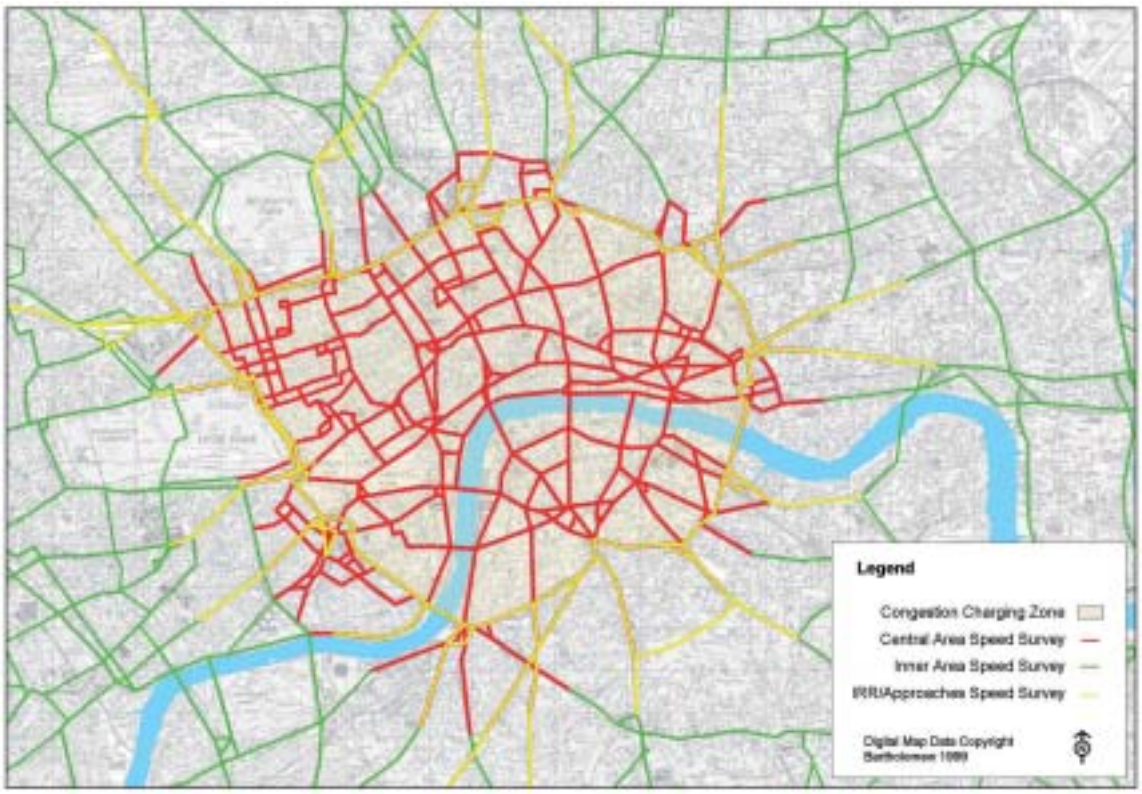
The routes are selected so as to be representative of traffic conditions across the network. The car records time and distance covered, and over the course of any one survey will return an average speed for traffic on the surveyed network and details of the variation in speed throughout the survey.

The scope of this work is summarised in Table 3.2, and the survey networks involved (for central and inner London) are shown by Figure 3.3[1]. Note in particular the inclusion of a new survey from 2001 covering the Inner Ring Road and key radial approaches (yellow on the map in Figure 3.3). This is additional to coverage on these roads by the central London speed survey, which will continue in its historical form.

Table 3.2. Moving car observer (floating car) surveys.

Area	Provision up to 2001	Provision from 2002
Central London (including charging zone and Inner Ring Road)	One 2-month survey every 3 years, covering three time periods.	One 2-month survey every 2 months (i.e. continuous), covering six time periods.
Inner Ring Road and key radial approaches	Included in central London speed survey	One 2-month survey every 2 months (i.e. continuous), covering six time periods.
Inner London	One 6-month survey every 3 years, covering three time periods.	One 6-month survey every year, covering four time periods.
Outer London	One 12-month survey every 3 years, covering three time periods.	One 12-month survey every 3 years, covering three time periods.

Figure 3.3. Moving car observer (floating car) survey networks.



Despite the strengths of this approach, these surveys do not provide an insight into the variability in journey times, nor do they differentiate effects on buses, taxis or goods vehicles, whose use of the network may be different from that of cars and vans. Also they do not provide immediate feedback on day-to-day congestion levels, a typical survey for the charging zone taking 2 months to complete.

Measuring congestion using ANPR cameras

These weaknesses can be overcome through effective analysis of data received from the network of ANPR cameras that have been put in place, primarily for the purpose of enforcing the charge. There are more than 500 video cameras, each observing a single lane of traffic, distributed across some 250 sites within and around the charging zone (a mixture of internal 'enforcement' sites and external 'monitoring' sites). These cameras are linked to Automatic Number-Plate Recognition (ANPR) technology, whereby the Vehicle Registration Numbers or 'Marks' (VRMs) of passing traffic are 'read' and translated into a computer-readable character stream.

This output can be used, taking full account of the principles of data protection, by using a process of anonymisation, to monitor traffic speeds and transit times by matching observations of the same vehicle between pairs of related cameras, where both time and distance are known.

To extend the capabilities of the enforcement cameras, 70 'monitoring-only' cameras have been located at intervals around the Inner Ring Road, and at selected points on the main inbound radial approach roads. These additional cameras have no enforcement function, but will provide ANPR data for monitoring. They will also be used for general traffic management purposes around the boundary of the charging zone, and have been positioned optimally for this purpose.

Although limited by the availability and position of ANPR cameras, and the fact that there is not a long-term 'pre-charging' dataset, this source still provides unprecedented opportunities for monitoring congestion and traffic conditions in and around the charging zone. Initial work with these data is described in section 3.10.

3.5. Congestion: inside the charging zone

Inside the charging zone traffic currently experiences some of the most intense levels of traffic delays in the UK. Transport for London expect that congestion charging will reduce delays inside the charging zone during charging hours by between 20 and 30 percent.

Key indicators of conditions before charging are as follows:

- at comparable times of the year, average 'all-day'[2] network speeds within the charging zone have declined from 17.2 km/h in 1986 to 14.1 km/h in 2000. In 2002, average network speeds were again around 14 km/h;

- this means that average travel rates – a measure of the 'slowness' of traffic – increased from 3.5 min/km in 1986 to 4.2 min/km in 2000. In 2002 the comparable rate remained at 4.2 min/km;
- compared to uncongested conditions of 1.9 min/km, a travel rate of 4.2 min/km means traffic inside the charging zone is experiencing delays or congestion of 2.3 min/km. It is to this value that the expectation of a 20 to 30 percent reduction in congestion applies.
- during 2002, traffic spent over half its time either stationary or moving at less than 10 km/h during the period of future charging hours.

Charging zone: trends in average network speeds

As explained above, the starting point for assessing the intensity of congestion are surveys of average road network speeds. Available results, using the MCO floating car method, and for the road network inside the charging zone (i.e. within the Inner Ring Road), are set out in Table 3.3.

Table 3.3. Average network speeds (km/h) within the charging zone, 1986 to 2002.

Year		AM peak	Inter-peak	PM peak	
1986 Jun/July		18.0	16.3	18.5	
1990 Jun/July		15.1	15.6	16.1	
1994 Jun/July		17.3	15.9	16.2	
1997 Jun/July		15.4	14.5	15.1	
2000 Jun/July		15.2	13.2	15.1	
	AM shoulder				PM shoulder
2002 Jan/Feb	22.0	14.3	13.5	15.3	15.0
2002 Mar/Apr	21.9	12.6	13.8	13.1	15.4
2002 May/Jun	17.9	14.2	14.9	12.9	15.5
2002 Jul/Aug	22.5	15.5	13.5	14.8	14.1
2002 Sep/Oct	18.0	13.8	12.8	13.1	14.5
2002 Nov/Dec	20.9	14.7	12.7	13.2	13.3

Historically, surveys were carried out in the early summer period every 3 to 4 years. To give greater resolution for the period immediately before charging started, the historical programme was intensified to operate continuously, the integrity of the historical 2-monthly cycle being preserved. In addition, further surveys of the two charging 'shoulder periods' were carried out (the periods between 06:00 and 07:00 and between 18:30 and 20:00), all of these additions being reflected in Table 3.3.

The statistical precision of each of the individual average network average speeds is around plus/minus 1 km/h at the 95 percent confidence level. Thus, for the AM peak period in 1986, the 'true' average network speed for the charging zone was between 17 and 19 km/h. With the exception of the 1994 results, and bearing in mind the accuracy associated with these figures, the pattern since 1986 has generally been one of steadily-declining average speeds.

A more reliable appreciation of the underlying trend in network speeds in the charging zone can be obtained from the 'all-day' averages (combined AM peak, inter-peak and PM peak), as shown in Table 3.4. For 2002, this includes results from the time of year most comparable to the historic series. The accuracy of the individual all-day network speeds is plus/minus 0.5 km/h at the 95 percent confidence level.

Table 3.4. Average 'all day' network speeds (km/h) within the charging zone, 1986 to 2002.

1986 Jun/Jul	1990 Jun/Jul	1994 Jun/Jul	1997 Jun/Jul	2000 Jun/Jul	2002 May/Jun
17.2	15.6	16.3	14.9	14.1	14.2

This shows a gradual decline in all-day network speeds from around 17 km/h in 1986 to around14 km/h in 2002.

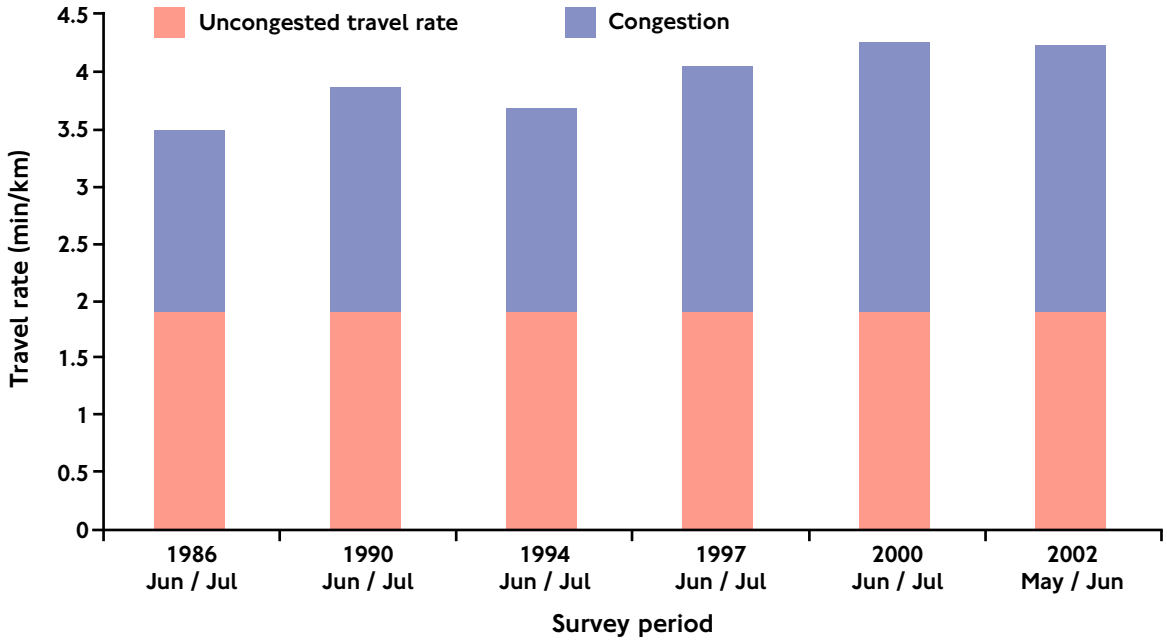
Charging zone: congestion

As explained above, congestion is here defined as the delay or 'excess travel rate', over that which would have been experienced under 'uncongested' conditions, which is considered to be the travel rate applying during the early hours of the morning.

The uncongested average network speed inside the charging zone has been measured at 31.6 km/h in 2001. This is virtually identical to the value of 31.3 km/h measured in 1991.

These values represent an uncongested travel rate on the road network inside the charging zone of 1.9 min/km. Combining the travel rates for all-day conditions in Table 3.4 with the uncongested night-time travel rate provides a perspective on congestion trends (at comparable times of the year) within the charging zone for the period back to 1986.

Figure 3.4. 'All day' travel rates (min/km) inside the charging zone, 1986 to 2002.



The average network travel rates inside the charging zone have increased from 3.5 min/km in 1986 to 4.2 min/km in 2000. In 2002 it remained at 4.2 min/km for the comparable time of year, though it fluctuated throughout the year. This rate of 4.2 min/km has therefore been taken to represent settled conditions inside the charging zone prior to the start of congestion charging.

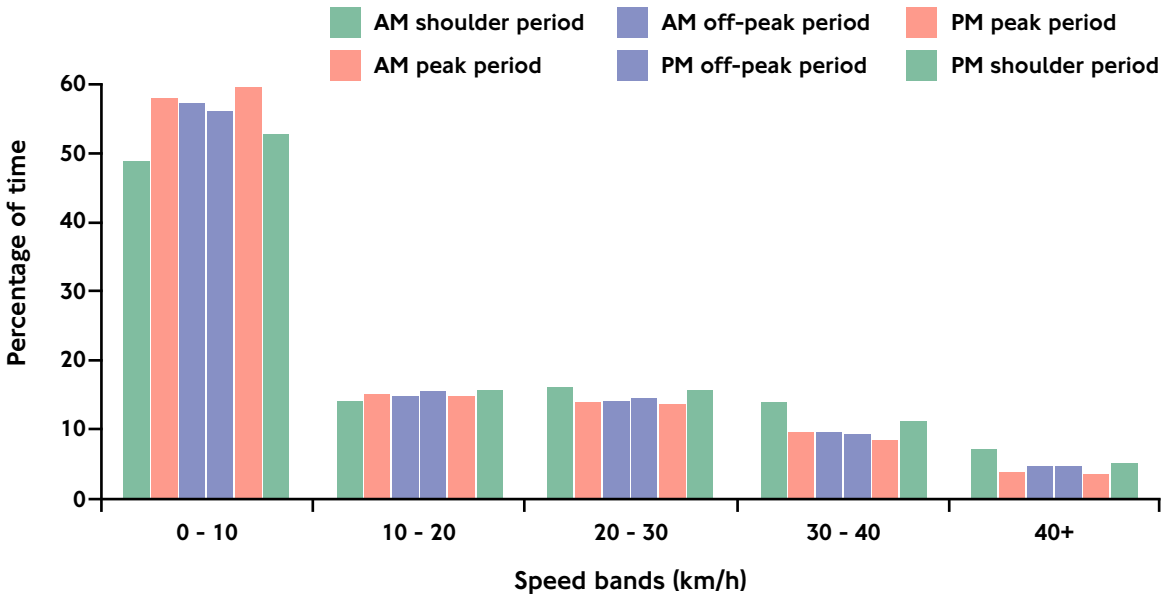
Compared to uncongested conditions of 1.9 min/km, a travel rate of 4.2 min/km means that traffic is experiencing delays or congestion of 2.3 min/km. Transport for London expect 'all-day' congestion to reduce by between 20 and 30 percent as a result of congestion charging. As a result, average 'all-day' network speeds would increase from around 14 km/h to over 16 km/h.

Charging zone: speed distributions

Another way of looking at network speeds within the charging zone is in terms of speed distributions, i.e. the proportion of time spent driving within various speed bands. The speed distribution from the MCO survey for May/June 2002 is shown in Figure 3.5.

Among the features demonstrated by this figure are that, during charging hours, over half of the time spent by vehicles within the charging zone is spent either stationary or moving at less than 10 km/h. As charging is implemented, TfL would expect to see a shift in the character of this distribution, with a decrease in the proportion of time spent travelling at low speeds and a corresponding increase in the higher speed bands.

Figure 3.5. Distribution of network speeds within the charging zone, May/June 2002.



3.6. Congestion: on the Inner Ring Road

Traffic travelling on the Inner Ring Road will not be subject to the congestion charge. Therefore, traffic that currently makes trips through the charging zone may divert to the Inner Ring Road in preference. Changes to traffic volumes or patterns here could lead to changes in congestion.

Traffic conditions on the Inner Ring Road are similar to those applying within the charging zone. Transport for London will be seeking to ensure the level of congestion on the Inner Ring Road does not increase once congestion charging is implemented.

Key indicators of pre-charging conditions on the Inner Ring Road before charging are as follows:

- average speeds in the morning peak have decreased from 18 km/h to 16.9 km/h in comparable periods between 1986 and 2002;
- the average travel rate in the charging period has increased slightly from 3.6 min/km to 3.8 min/km in comparable periods between 1986 and 2002.
- A value of 3.7 min/km has been taken to represent settled conditions before charging. This means traffic is experiencing delays of 1.9 min/km above that of the uncongested situation of 1.8 min/km in June/July 2002;
- during 2002 traffic spent one half its time either stationary or moving at less than 10 km/h during the period of future charging hours.

Inner Ring Road: trends in average network speeds

A similar process to that for conditions inside the charging zone has been followed for establishing trends in congestion on the Inner Ring Road. This road has historically been covered by the central area MCO speed survey, which covers an area larger than the charging zone (see Figure 3.3).

From 2002, to provide greater resolution for this important road, a new and additional MCO speed survey was put in place that covers the Inner Ring Road and key approach radials only. Results from both surveys, as appropriate for the year, are shown in Table 3.5. Note that only five 2-monthly surveys were conducted during 2002.

At the 95 percent confidence level the precision of the individual network speeds in Table 3.5 is plus/minus 1.3 km/h. The pattern shown by Table 3.5 is one of varying network speeds.

Table 3.5. Average network speeds (km/h) on the Inner Ring Road, 1986 to 2002.

Year		AM peak	Inter-peak	PM peak	
1986 Jun/July		18.0	17.9	13.5	
1990 Jun/July		15.9	17.3	14.2	
1994 Jun/July		16.1	18.4	17.6	
1997 Jun/July		16.9	16.4	16.5	
2000 Jun/July		16.6	15.2	13.4	
	AM shoulder				PM shoulder
2002 Jan/Feb	22.2	14.8	15.0	15.1	17.8
2002 Mar/Apr	25.7	17.0	16.8	14.9	19.7
2002 Jun/July	29.9	16.9	16.2	14.6	19.3
2002 Sep/Oct	23.5	13.9	14.5	12.0	18.3
2002 Nov/Dec	23.2	14.5	16.0	14.5	19.1

Table 3.6. presents this more reliably in terms of all-day average speeds, with an precision of plus/minus 0.6 km/h at the 95 percent confidence level.

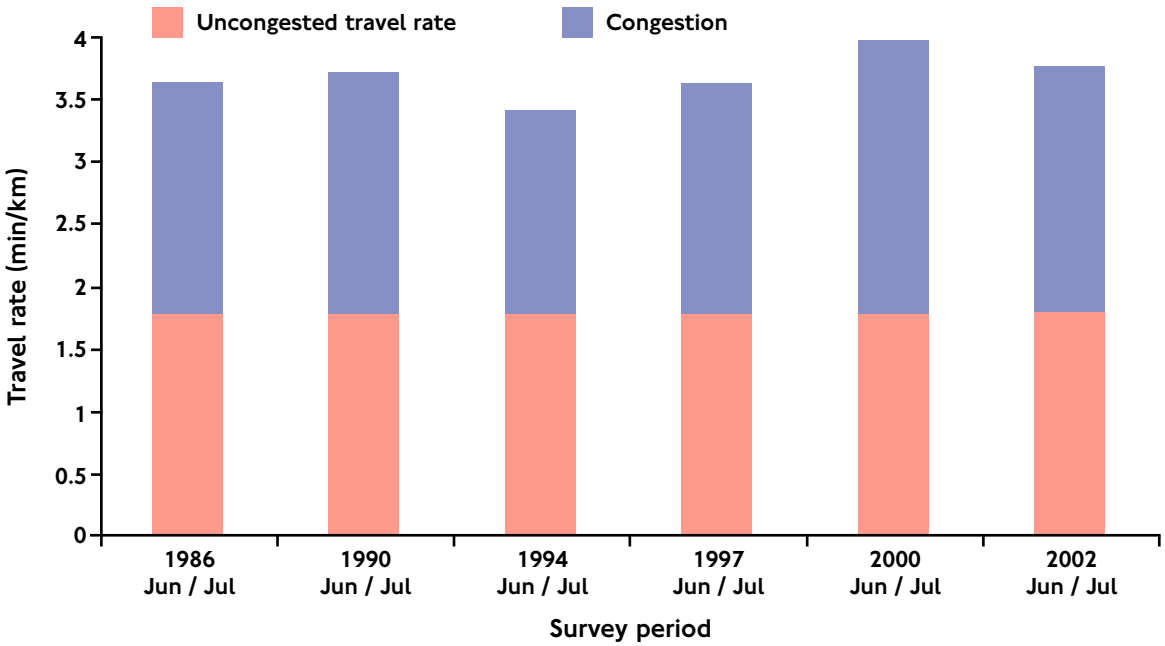
Table 3.6. Average 'all day' network speeds (km/h) on the Inner Ring Road, 1986 to 2002.

1986 Jun/Jul	1990 Jun/Jul	1994 Jun/Jul	1997 Jun/Jul	2000 Jun/Jul	2002 Jun/Jul
16.5	16.1	17.6	16.5	15.1	16.0

Inner Ring Road: congestion

The night-time uncongested network speed on the Inner Ring Road has been measured at 33.6 km/h in 2001. This is much the same as the value of 32.6 km/h measured in 1991. These represent an uncongested travel rate of 1.8 min/km. Combining the travel rates for all-day conditions and the uncongested night-time travel rate gives a perspective on congestion trends on the Inner Ring Road for comparable periods back to 1986. This is shown in Figure 3.6.

Figure 3.6. 'All day' travel rates (min/km) on the Inner Ring Road, 1986 to 2002.

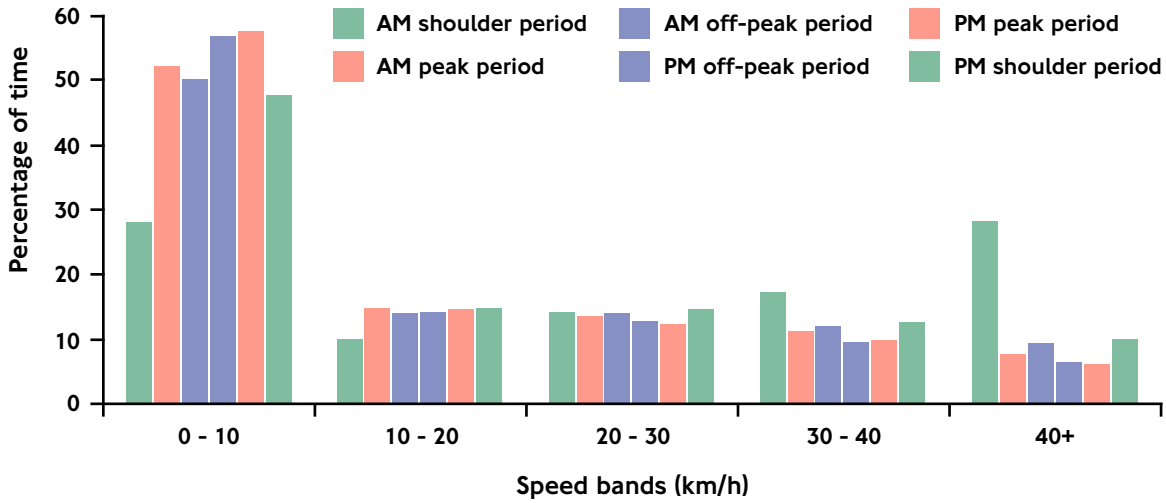


The average all-day network travel rate on the Inner Ring Road in comparable periods between 1986 and 2002 has varied from 3.4 min/km to 4.0 min/km. A value of 3.7 min/km has been taken to represent settled conditions prior to the start of charging. Uncongested conditions have been measured at around 1.8 min/km, hence the appropriate value of congestion on the Inner Ring Road prior to charging is 1.9 min/km.

Inner Ring Road: speed distributions

Figure 3.7 presents the data for the Inner Ring Road as a speed distribution. The pattern is similar to that for the charging zone, with about half the time spent at speeds of less than 10 km/h. Transport for London would expect little change in this distribution as a result of new traffic patterns under congestion charging.

Figure 3.7. Distribution of network speeds on the Inner Ring Road, June/July 2002.



3.7. Congestion: main roads in inner London

Inner London is defined here as the area covered by the inner London MCO speed survey. This is the area bounded by the North and South Circular Roads, excluding the charging zone, the Inner Ring Road and its immediate surrounds - see Figure 3.3.

Transport for London expect that congestion gains from reductions in radial traffic to and from the charging zone to be offset to some extent by the effects of increases in traffic making wider orbital movements beyond the Inner Ring Road.

The inner London MCO speed survey has historically been conducted at 2 to 3 year intervals. From 2002, the survey will be conducted annually in the Spring.

Key indicators of conditions before charging in inner London are as follows:

- average speeds measured in the Winter months of November to March steadily declined between 1991/1992 and 2000/2001;
- average speeds in the morning and evening peak periods increased in the Spring 2002 surveys;
- the average overall travel rate during charging hours has decreased marginally from 2.9 min/km to 2.8 min/km between 1988 and 2002. This means in 2002 traffic is experiencing average delays of 1.3 min/km above the uncongested travel rate of 1.5 km/h;
- traffic spends over 40 percent of its time either stationary or moving at less than 10 km/h.

Main roads in inner London: trends in average network speeds

The trend for network speeds in inner London is shown in Table 3.7. At the 95 percent confidence level, the precision of each of the individual network speeds is plus/minus 0.7 km/h.

Note that in this case no surveys are conducted to cover the 'shoulder' periods either side of the charging day.

Table 3.7. Average network speeds on main roads (km/h) in inner London, 1988 to 2002.

	AM peak	Inter-peak	PM peak
Feb 1988 - Jun 1988	18.9	23.5	18.7
Nov 1991 - Mar 1992	21.3	25.4	21.2
Nov 1994 - Mar 1995	21.5	24.2	20.6
Nov 1997 - Mar 1998	19.2	23.7	18.3
Nov 2000 - Mar 2001	18.7	22.1	18.2
Mar 2002 - Jun 2002	21.2	22.1	20.0

One feature of the historical surveys is that they have been carried out at different times of the year, and this should be borne in mind when interpreting these results. Until the Winter 2000/2001 surveys, speeds had generally declined. However, in Spring 2002 the average speeds in the morning and evening peak periods increased, despite no change in the inter-peak period average speed.

Table 3.8 presents this information in terms of all-day average speeds, with a 95 percent confidence interval in each case of plus/minus 0.4 km/h.

Table 3.8. Average 'all-day' network speeds (km/h) on main roads in inner London, 1998 to 2002.

Feb 1988 - Jun 1988	Nov 1991 - Mar 1992	Nov 1994 - Mar 1995	Nov 1997 - Mar 1998	Nov 2000 - Mar 2000	Mar 2002 - Jun 2002
20.8	23.1	22.5	20.9	20.1	21.3

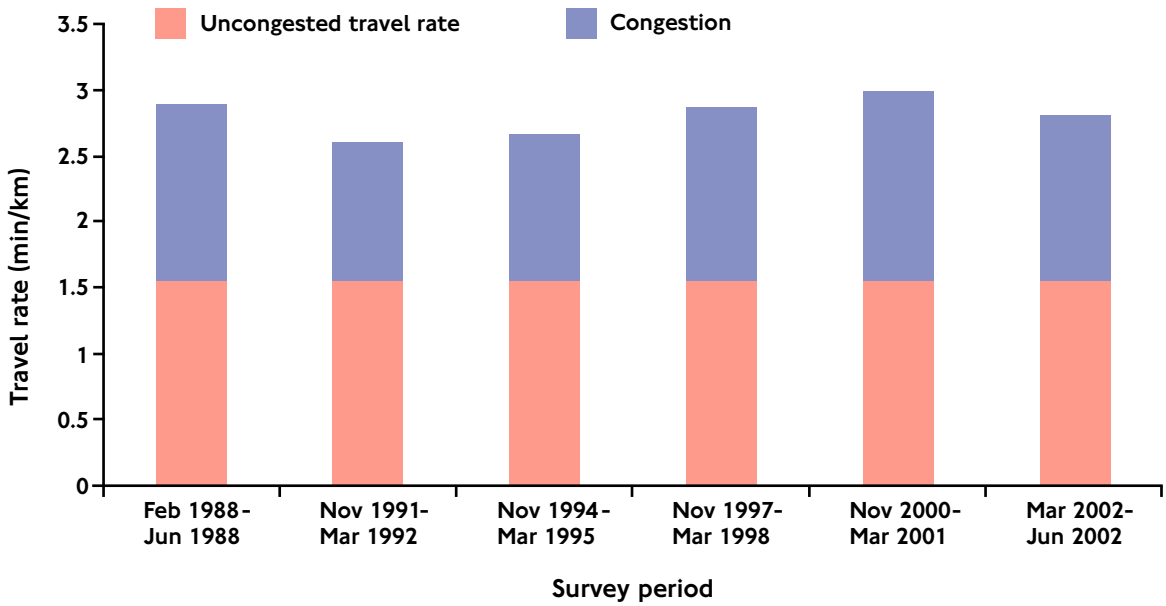
Main roads in inner London: congestion

The night-time uncongested network speed for a sample of main roads in inner London was measured at 39 km/h in 2001; this is much the same as the value of 41 km/h measured in 1991. These represent an uncongested travel rate of 1.5 min/km.

Combining the travel rates for 'all-day' conditions and the uncongested night-time travel rate provides a perspective on congestion trends in inner London for the period back to 1986. This is shown in Figure 3.8.

With an observed uncongested travel rate of around 1.5 min/km in 2001 the representative level of congestion on main roads across inner London before congestion charging is therefore around 1.3 min/km.

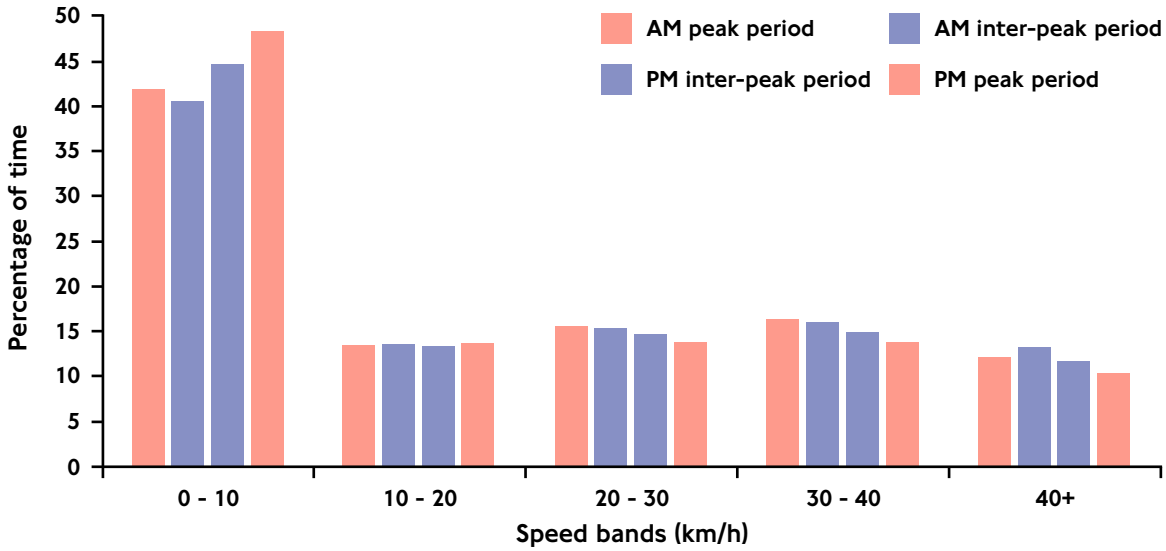
Figure 3.8. 'All-day' travel rates (min/km) on main roads in inner London, 1988 to 2002.



Main roads in inner London: speed distributions

Results from the most recent survey of network speeds on main roads in inner London are displayed in Figure 3.9. Transport for London would expect only small changes in the character of this distribution as a result of congestion charging.

Figure 3.9. Distribution of network speeds in main roads in inner London, March/June 2002.



3.8. Congestion: main roads in outer London

Congestion levels in outer London are not expected to change significantly as a result of congestion charging. There is an existing MCO speed survey in place. This has historically been undertaken on a 3-yearly cycle, and this frequency will remain unchanged.

Key indicators of conditions before charging in outer London are as follows:

- the average speed in the morning peak periods declined between the 1989/1990 and 1996/1997 surveys, with the inter-peak average speed remaining constant, in the 1998/2000 survey the morning peak speed increased;
- the overall average travel rate of 1.8 min/km has remained steady between 1989 and 2000. This means that traffic is experiencing average delays of 0.6min/km over the uncongested travel rate of 1.2 min/km;
- traffic spends under 40 percent of its time stationary or moving at less than 10 km/h; it spends over 25 percent of its time moving at over 40 km/h during peak periods.

Main roads in outer London: trends in average network speeds

Recent historic trends in average network speeds for outer London are shown in Table 3.9. At the 95 percent confidence level the accuracy of these individual network speeds is plus/minus 0.4 km/h. These averages are likely to have been affected by improvement to the main road system in outer London in recent years.

Table 3.9. Average network speeds (km/h) on main roads in outer London, 1989 to 2000.

	AM peak	Inter-peak	PM peak
Jan 1989 – Jul 1990	29.6	36.5	31.9
Nov 1992 – May 1994	28.2	36.7	31.7
Feb 1996 – Jul 1997	27.4	36.5	30.6
Sep 1998 – May 2000	29.4	35.2	30.7

Table 3.10 presents this information in terms of all-day network speeds. The 95 percent confidence intervals applying to these estimates is plus/minus 0.2 km/h.

Table 3.10. Average 'all-day' network speeds (km/h) on main roads in outer London, 1989 to 2000.

Jan 1989 - Jul 1990	Nov 1992 - May 1994	Feb 1996 - Jul 1997	Sep 1998 - May 2000
32.9	32.5	31.9	32.2

Main roads in outer London: congestion

The night-time uncongested network speed for a sample of main roads in outer London was measured at 50 km/h in 2001; this is much the same as the value of around 51 km/h measured in 1991. These represent an uncongested travel rate of 1.2 min/km.

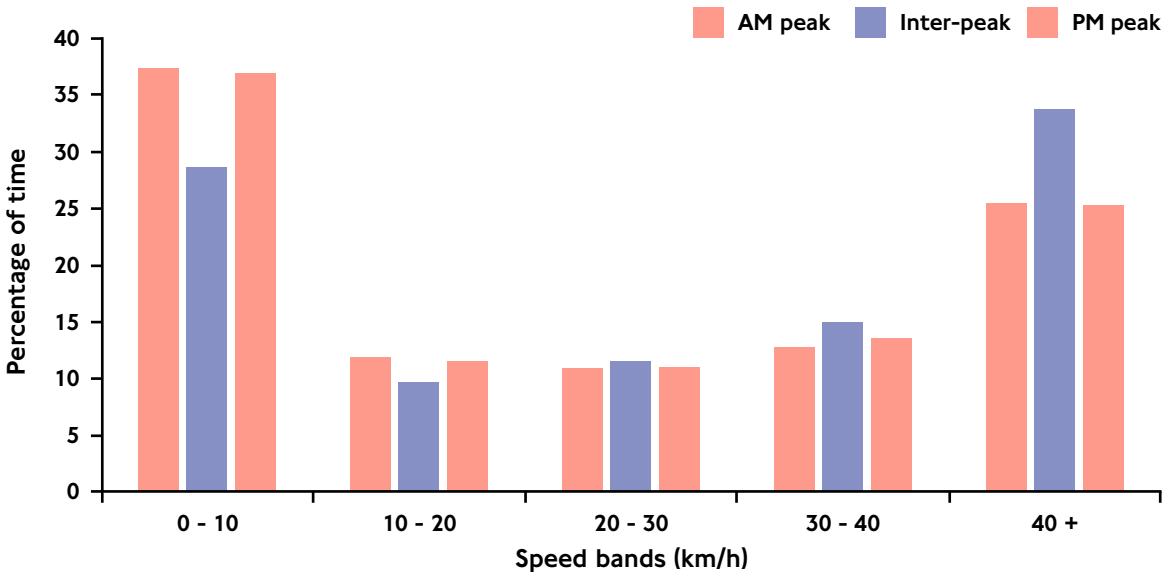
The 'all day' travel rate in outer London has remained steady between 1989 and 2000 at around 1.8 min/km over the charging period, resulting in average congestion levels of 0.6min/km, though there are frequent local variations and significant differences between peak and inter-peak conditions.

Figure 3.10. 'All day' travel rates (min/km) on main roads in outer London, 1989 to 2000.

Main roads in outer London: speed distributions

The most recent outer London speed survey results have been used here to demonstrate the proportion of time spent travelling at different speeds.

Figure 3.11. Distribution of network speeds on main roads in outer London, 1998/2000 survey cycle.



In the peak periods, on average, traffic spends less than 40 percent of its time either stationary or moving at less than 10 km/h, for the inter-peak period this falls to less than 30 percent of its time. It also spends over 25 percent of its time in peak periods and over 35 percent of its time in the inter-peak period moving at 40 km/h or more.

3.9. Traffic density

Information derived from the MCO speed surveys can be used in various other ways to explore congestion. One is to consider how the average 'crowding' of vehicles varies across a road network.

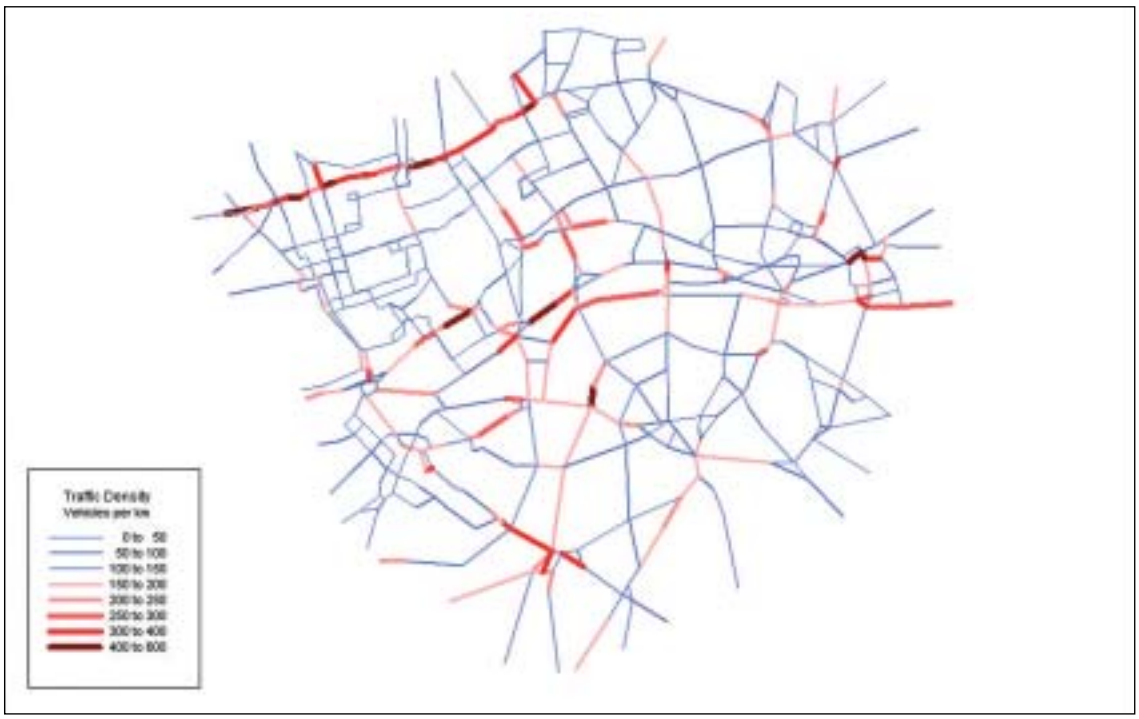
This is best illustrated in terms of a 'traffic density map', where density is measured as vehicles per kilometre in both directions, and can be considered as a 'birds-eye' view of traffic on the network as if traffic formed in a single lane in each direction.

A major shortcoming of the MCO method in this regard is the limited number of transits of individual links that it is possible to cover in each survey cycle. Therefore, to provide representative results, it is necessary to combine data from several survey cycles.

This has been done here for the central area speed survey (in this case, in its extended form, covering the Inner Ring Road and some roads outside) for the period January to August 2002 (four survey cycles). Figure 3.12 shows the resulting traffic density map for the AM peak period. Although presented here largely for illustration, some interesting patterns are shown.

Broadly, congestion is linked to traffic density and the amount of road space. Therefore, for the period covered, the highest traffic densities were found on the northern part of the Inner Ring Road, and around Vauxhall Cross and on routes in the vicinity of Trafalgar Square. These locations would normally be among the busier on the network. It is however possible that conditions at some locations have been exacerbated by roadworks and other temporary disruptions to the network that occurred during 2002.

Figure 3.12. AM peak traffic density map for the charging zone and surrounding area, January to August 2002.



3.10. Measuring congestion using Automatic Number Plate Recognition (ANPR) cameras

Since early 2003, the network of enforcement and monitoring cameras within and around the charging zone have provided unprecedented new data describing traffic conditions. This does mean that comprehensive data describing pre-charging conditions are not available from this source. Nevertheless, these cameras will be an important source of information in the post charging period, and this section describes how data from them will be used in the monitoring programme.

The most obvious monitoring application of these cameras is to measure traffic speeds by matching observations of the same vehicles moving between related pairs of cameras. This can be undertaken on a link-by-link basis, or in terms of a skeletal road network, which can be used for monitoring movements from, to, within and around the charging zone. This network would be comparable, although not identical to, that used for the MCO speed surveys, and an important task will be to compare speed estimates from the two sources to establish whether there is a stable relationship between them.

New opportunities for analysis

The volumes of vehicles captured by the cameras will be such that large statistical distributions of transit times will accumulate over a matter of hours. This is sufficient to permit analysis of data over relatively short timescales. As well as average transit speeds between pairs of cameras, the data will be sufficient to allow analysis of variability in transit times. This aspect of congestion cannot be addressed through MCO survey data as they involve only a very limited number of transits of each link per survey cycle.

Furthermore, by interfacing with other datasets, such as the Driver Vehicle License Agency (DVLA) licensing database, it is possible to analyse separately the behaviour of different classes of traffic. For example, it will be possible to look specifically at congestion affecting London licensed taxis. Other new analyses of traffic patterns in and around central London should also become possible once data from this source are more fully understood.

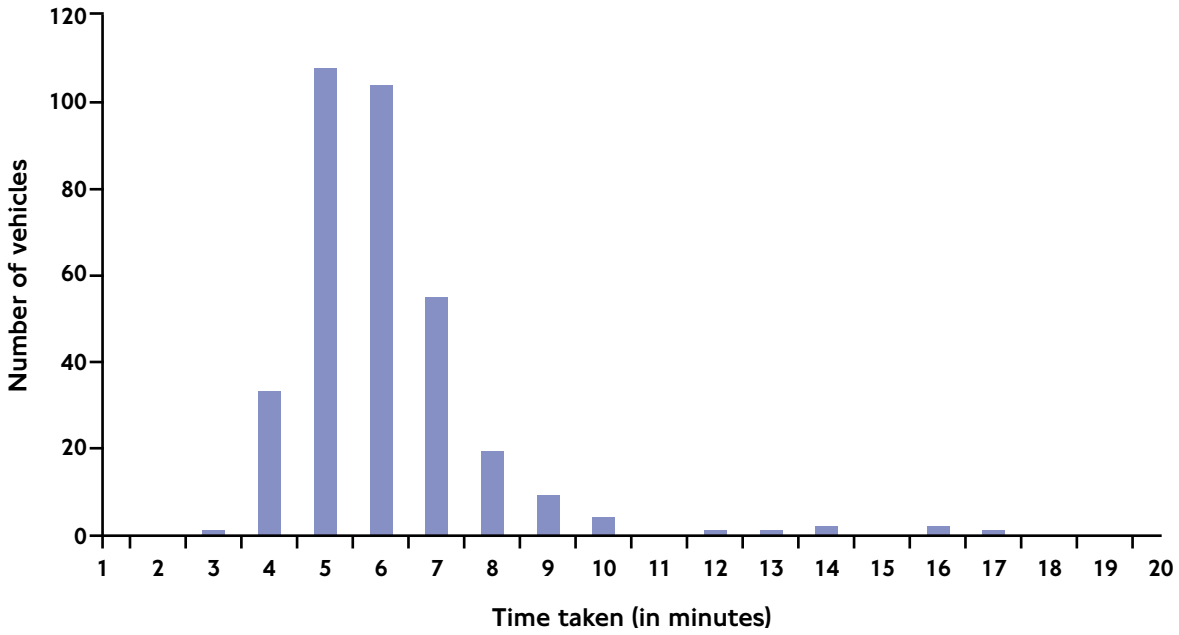
Using ANPR data

Data from this source are relatively new and it will take some time before their properties are fully understood. There are several practical difficulties to be overcome in constructing and monitoring a skeletal network comprised from camera locations that are optimised for enforcement, as opposed to traffic monitoring, purposes. These include: multiple route choices and stopped time between cameras, multiple captures over the day by the same vehicle making different trips, various forms of 'noise' in the data (e.g. mis-reads of VRMs), and the development of screening rules to deal with these.

Some early data from ANPR cameras

Bearing these limitations in mind, Figure 3.13 shows a typical 'raw' distribution of transit times between a single pair of cameras for an arbitrary weekday in January 2003 before charging started. As one might expect, the character of the distribution tends towards normal, but with a lengthy 'tail', probably reflecting vehicles that stop between cameras or those that take an indirect route. Statistical rules to deal with these 'outliers' and other issues are currently being developed.

Figure 3.13. Example distribution of transits between ANPR cameras Upper Street - Pentonville Road. All vehicles, example weekday January 2003.



After congestion charging starts one might typically expect to see an overall reduction in the average transit time between pairs of cameras, as well as a narrowing of the spread of the distribution, reflecting a greater reliability of travel times (as illustrated in Figure 3.2).

Data from this source are being included in the monitoring programme in two phases. An early requirement was for a simple yet robust set of screening rules to be applied to the data such that indicative early analyses could be undertaken in connection with the implementation of the scheme in February 2003. Recognising that these initial rules will be unlikely to be found optimal once the properties of the data are more fully understood, a programme of research is underway to refine them for implementation later in 2003. Data collected during 2003 are being archived, after a process of anonymisation to be compliant with data protection rules, so that analyses can be re-run at a later date using the refined screening rules.

Other uses of ANPR data

Beyond journey speeds and reliability, data from ANPR cameras have the potential to significantly improve our more general understanding of traffic patterns in London. Some examples of new analyses that might be possible include:

- route-choice in respect of journeys around the Inner Ring Road or through the charging zone;
- new data on trip frequencies and timing;
- different behaviour of vehicles in the various discount and exemption categories;
- new information for air quality analyses, such as age and technology profiles of the vehicle fleet based on actual observation.

Progress with these and other research topics will be reported at intervals as experience with the data develops.

3.11. Other perspectives on congestion

Reducing congestion is the main purpose of congestion charging. Progress towards this goal can be measured quantitatively using the methods described above.

However, much of the remainder of the monitoring programme will provide supporting information of various kinds. This could be either in the form of additional 'measures' of congestion itself, or in terms of data describing the effects of changes to congestion - on other transport modes, on the central London environment, on businesses and on the people who use central London.

This section outlines this broader canvass and provides pointers to where further information can be found in the remainder of this and subsequent reports.

Additional measures of congestion

Regular drivers' panel

Technology-based measures of congestion do not necessarily reflect the experiences of individuals making 'real' journeys. In particular, individuals have the capacity to adjust their travel behaviour in response to changes to the transport environment. To assess this, TfL has set up a panel-based study of approximately 100 drivers who make regular car journeys into the charging zone. It will operate for approximately 6 months, 3 months either side of the start of charging. It is expected to yield valuable information on the variability of individual regular journeys (timing, route choice, journey time reliability), for both before and after comparisons, and also detailed analysis of how individuals themselves 'adapt' to the scheme.

The SCOOT urban traffic control system

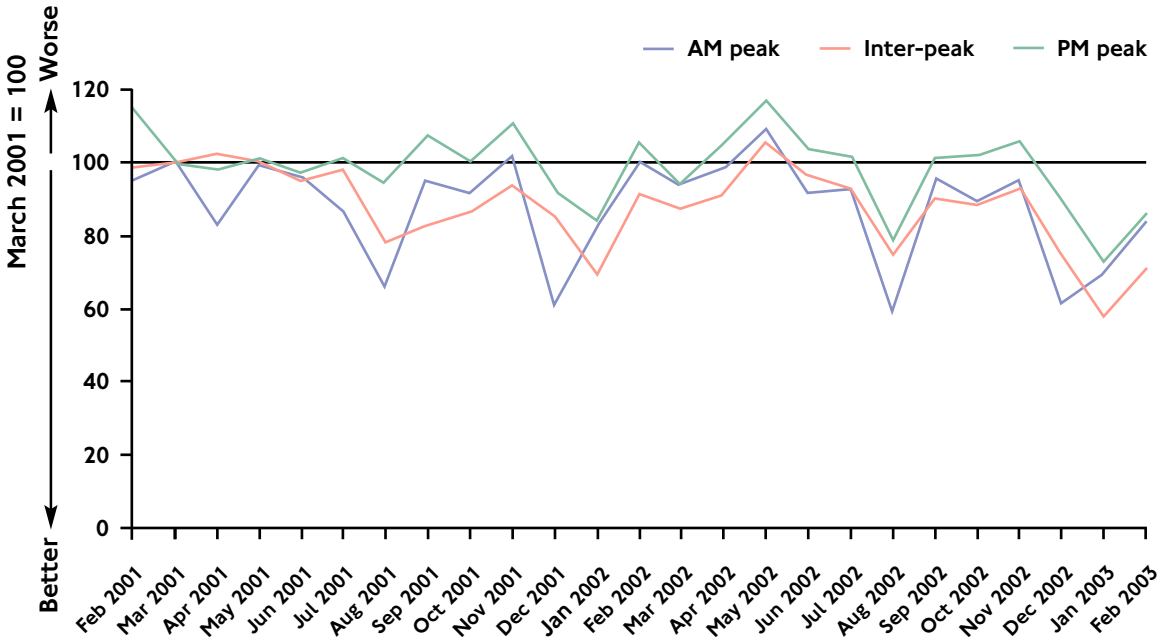
SCOOT is a computer system used for controlling traffic signals. SCOOT detects traffic conditions by means of wire loops placed just under the road surface that detect the presence of vehicles. The system uses this information to dynamically optimise traffic signal settings.

Enhancements to the existing SCOOT system in London have been made for traffic management purposes in connection with the scheme. ASTRID (Automatic SCOOT TRaffic Information Database) captures selected data generated by SCOOT. These data can be analysed to derive various indicators of traffic flow and congestion.

The use of ASTRID data for monitoring is a developing research area. Like all monitoring technologies, ASTRID data have specific characteristics and limitations that affect the correct use and interpretation of the data.

Figure 3.14 illustrates one of the potential uses of the data. In this case, a monthly 'congestion index' (which does not relate directly to the definitions set out earlier) has been derived for the whole Transport for London Road Network. The graphic shows AM, inter-peak and PM peak congestion relative to a March 2001 base up to and including January 2003. In this case a gradual improvement in levels of congestion relative to March 2001 is evident (index less than 100). Work is underway to explore how similar indices can be derived that are more appropriate for the geography of the scheme, and progress will be reported in the next annual report.

Figure 3.14. Congestion index on the TfL main road network, March 2001 to January 2003.



Freight and logistics industry case study

The decongestion effects of the scheme are expected to particularly benefit operators of freight, delivery and servicing vehicles in central London, through faster and, crucially, more reliable journeys.

The freight industry has many 'hard' data to offer, such as that arising from industry tracking and scheduling technologies (some now utilising GPS satellites), along with insights into how they themselves optimise the performance of their vehicle fleets under different traffic regimes (e.g. before or after congestion charging). In addition, data and insights are potentially available from freight operators covering other areas of interest to the monitoring programme. Examples include: operation of fleet payment schemes, effects on cash flow and profitability, steps taken to optimise value (e.g. re-scheduling of deliveries, 'passing-on' the charge).

Monitoring the consequences of congestion and decongestion

Implications for other transport modes

Reduced congestion will have direct implications for other road-based transport modes. Buses, in particular, would be expected to gain in terms of greater journey time reliability, as would taxis. Additional ways in which these effects are being specifically monitored are discussed in Chapters 5 and 6.

Implications for business and the economy

The imposition of the congestion charge and the potential offsetting gains from reduced congestion is likely to affect the overall climate for business in and around central London. The way that businesses perceive and respond to these challenges and opportunities will be examined in detail by the economic and business work programme described in Chapter 7.

Implications for Londoners

Congestion charging will have direct implications for those who drive in and around central London. Again, the most obvious trade-off will be between the cost of the charge, and the offsetting benefits from less congestion. However, the scheme will also have more varied implications for all those who live or travel to and within central London. The effects of congestion charging on aspects of people's travel behaviour and wider daily lives is examined in Chapter 6 and 8.

Implications for the environment

Less congestion should mean that a reduced level of traffic moves around the road network with greater efficiency. This should mean that less fuel is consumed and less air pollution and 'greenhouse gas' produced. Of course, there could be some countervailing effects, such as possible increases in traffic on the Inner Ring Road, and it will be important to establish whether Londoners perceive any significant environmental effects arising from the scheme. The ways in which these are being monitored is discussed in Chapter 9.

Technical notes

1 Indicators of conditions within the charging zone are based on central London speed survey results disaggregated to this specific geographical area and include all surveyed links within the Inner Ring Road as shown in Figure 3.3.

Indicators of conditions on the Inner Ring Road utilise central London speed survey results prior to 2002 and the Inner Ring Road and Key Radials Speed Survey since January 2002, both disaggregated to this specific geographical area including all surveyed links on the Inner Ring Road as defined in Figure 3.3.

Although the road signage directing traffic around central London has varied slightly in the past the definition of what is termed here as the Inner Ring Road is the same for all historical data presented.

These surveys are completed over a predefined series of routes, the majority of runs completed within the following time periods:

AM Shoulder	06:00 - 07:15
AM Peak	07:45 - 09:15
AM Inter-peak	10:00 - 12:00
PM Inter-peak	14:00 - 16:00
PM Peak	16:45 - 18:15
PM Shoulder	18:45 - 20:00

In inner and outer London these surveys are completed over a predefined series of routes, in the majority of runs completed within the following time periods:

AM Peak	07:45 - 09:15
AM Inter-peak	10:00 - 12:00
PM Inter-peak	14:00 - 16:00
PM Peak	16:45 - 18:15

2 'All-day' network speeds are a combination of AM peak, interpeak and PM peak survey periods as defined above.

4. Traffic Patterns

4.1. Introduction

This section describes traffic conditions before the start of congestion charging in and around the charging zone. It draws on information from long-term traffic monitoring programmes, and from new surveys that have been put in place during 2002 specifically to measure the effects of the scheme.

4.2. Expected traffic impacts of congestion charging

The scheme is expected to deliver decongestion benefits by reducing the volume of traffic entering and circulating within the zone during charging hours. It is expected to result in a reduction of 10 to 15 percent in the amount of traffic (measured as vehicle-kilometres and excluding two-wheeled vehicles) circulating within the charging zone. The scheme is also expected to produce several other changes to traffic patterns in and around the charging zone. In summary, these are:

- an increase in traffic on the Inner Ring Road, as drivers elect to avoid paying the charge by diverting around the boundary of the charging zone;
- a reduction in traffic on the radial approaches to the charging zone, reflecting reduced overall vehicle-trips to and from the charging zone;
- some increase in orbital traffic in inner London, from drivers also seeking to avoid paying the charge by diverting around the charging zone on roads beyond the Inner Ring Road;
- other changes to the pattern of trip-making e.g. drivers changing the times of trips to be outside of the charging hours;
- changes to the make-up of traffic, as different types of vehicle are differentially attracted or deterred with respect to the charging zone.

4.3. Monitoring framework

Each of these effects has been explored to a greater or lesser extent as part of the design of the scheme. For some effects, quantified projections have been made. The traffic monitoring programme seeks to measure these effects to a relatively high degree of precision, and so consists of substantial new traffic flow monitoring capacity throughout central and inner London. In combination with established traffic flow counting programmes, these use the full array of traffic counting techniques, including cordon, screenline and area-based surveys, and manual and automatic counting methods, each used to their particular strength in the London and scheme context.

The key elements of the total traffic counting effort are as follows:

- area-based counts within the charging zone, to quantify changes in traffic circulating within the charging zone;
- cordon-based counts at the charging zone boundary (just inside the Inner Ring Road), to measure traffic entering and leaving the charging zone;

- counts on the Inner Ring Road itself, to measure traffic changes on this important route;
- cordon-based counts just outside of the Inner Ring Road, to measure changes in radial traffic approaching the zone, and to retain compatibility with long-term counting practice;
- screenline-based counts capturing changes in wider orbital traffic in inner London and, for example, crossing the river Thames;
- site-specific counts on local roads throughout the charging zone and in inner London, to detect any significant or adverse traffic change on local roads;
- counts of a selection of main junctions around the Inner Ring Road, to examine changes to turning movements with respect to the Inner Ring Road;
- counts in relation to specific issues, incidents or schemes e.g. to quantify the impact of major works in the period leading up to congestion charging, or local traffic management 'complementary measures';
- counting programmes primarily intended for other monitoring purposes (e.g. sponsored by individual boroughs) that will provide additional information in respect of specific areas or parts of the road network, and/or information with which to corroborate and enhance the findings of the main congestion charging counting programmes.

The framework for measuring traffic change in relation to congestion charging is described in detail in Appendix 5.

In developing an understanding of traffic conditions against which changes brought about by congestion charging can be compared, it is necessary to bring together data from a variety of sources. This is for two reasons:

- the 'geography' of congestion charging imposes new traffic monitoring requirements on to the existing traffic monitoring framework in London. These new requirements are reflected in the large number of new traffic surveys that have been implemented during 2002. However, because these new surveys commenced in 2002, they do not provide a view of long-term traffic trends that would be required for a complete appreciation of 'before' conditions ahead of congestion charging;
- 2002 has been characterised by an unusual amount of disruption to the road network in central London. This means that measurements taken during 2002 may not be wholly representative of 'settled' conditions before charging. It is therefore necessary to draw upon other long-term traffic surveys in and around the charging zone, often providing data going back 10 years or more, to allow background trends in traffic to be established.

4.4. Recent traffic trends and key traffic levels before charging

The following summarises recent traffic trends and gives key values for traffic in and around the charging zone, as measured by the monitoring programme. Further details are given throughout this section.

- Available long-term indicators of traffic within the charging zone show a historic trend of slowly-declining traffic levels. Much of this decline is accounted for by reductions in the number of cars, which have fallen by up to one-third over the past 15 years.
- Between 2000 and 2002, traffic levels inside the zone (as measured by the Thames screenline) fell more sharply, by 7 percent for all traffic and by 9 percent for potentially chargeable vehicles (i.e. cars, vans and lorries). There are indications that some of this fall during 2002 may be temporary, caused by exceptional conditions in 2002 in and around central London. A recovery of at least some of this 2002 fall might therefore be expected during 2003 in the absence of congestion charging.
- A total of 1.5 million vehicle-kilometres were driven within the charging zone by all vehicles during the course of a typical 2002 charging day equivalent (i.e. 07:00-18:30 weekdays). Excluding pedal cycles and motorcycles[2], the equivalent figure is 1.3 million vehicle-kilometres. The expected 10 to 15 percent reduction in traffic applies to this figure of 1.3 million vehicle-kilometres.
- On a typical 2002 weekday a total of 388,000 vehicles of all kinds crossed into the charging zone during charging hours. The corresponding figure for outbound traffic was 377,000 vehicles. These include multiple crossings by the same vehicle. Not all of these vehicles will be subject to the charge.
- On the cordon regularly surveyed just outside of the charging zone (the TfL central cordon), traffic levels have been falling since the mid-1990s, with a bigger fall experienced between 2001 and 2002. Between 2001 and 2002 inbound traffic levels on this cordon just outside the charging zone have fallen by 6 percent for all traffic, and by 8 percent for potentially chargeable vehicles. The total all-vehicle flow across this cordon during charging hours for 2002 was 497,000 inbound and 456,000 outbound.
- For congestion charging monitoring the TfL central cordon has been extended to lie wholly outside of the charging zone (see also Appendix A5). This serves as an indicator, currently available for 2002 only, of total radial traffic approaching the zone outside of the Ring Road. The total all-vehicle flow across this cordon during charging hours for 2002 was 519,000 inbound and 475,000 outbound.
- On the Inner Ring Road, the estimate of total vehicle kilometres (all vehicles) on an average 2002 weekday during charging hours is 0.6 million.

- For orbital traffic movements outside of the congestion charging zone, a reference total of 582,000 vehicles were recorded crossing a system of four radial screenlines, of which 23 percent were on the Inner Ring Road itself.
- Historical data from a selection of permanent traffic counting sites in inner London suggest that weekday average traffic levels have declined by about 10 percent between 1994 and 2001. However, traffic crossing a cordon enclosing inner London has been relatively static, with small falls (3 percent inbound, 1 percent outbound), being recorded between 1999 and 2002.
- Traffic crossing the London boundary cordon continues to increase steadily, values for 2001 being 7 percent higher inbound and 11 percent higher outbound compared to 1989.

4.5. Key traffic indicators to end 2002

The next sections present a summary of available traffic data describing conditions before congestion charging starts. These indicators are grouped under the following geographical headings:

- traffic circulating within the charging zone;
- traffic entering and leaving the charging zone across the charging zone boundary;
- traffic entering a wider definition of central London;
- traffic on the Inner Ring Road;
- orbital traffic movements across screenlines outside of the Inner Ring Road;
- wider traffic trends in London.

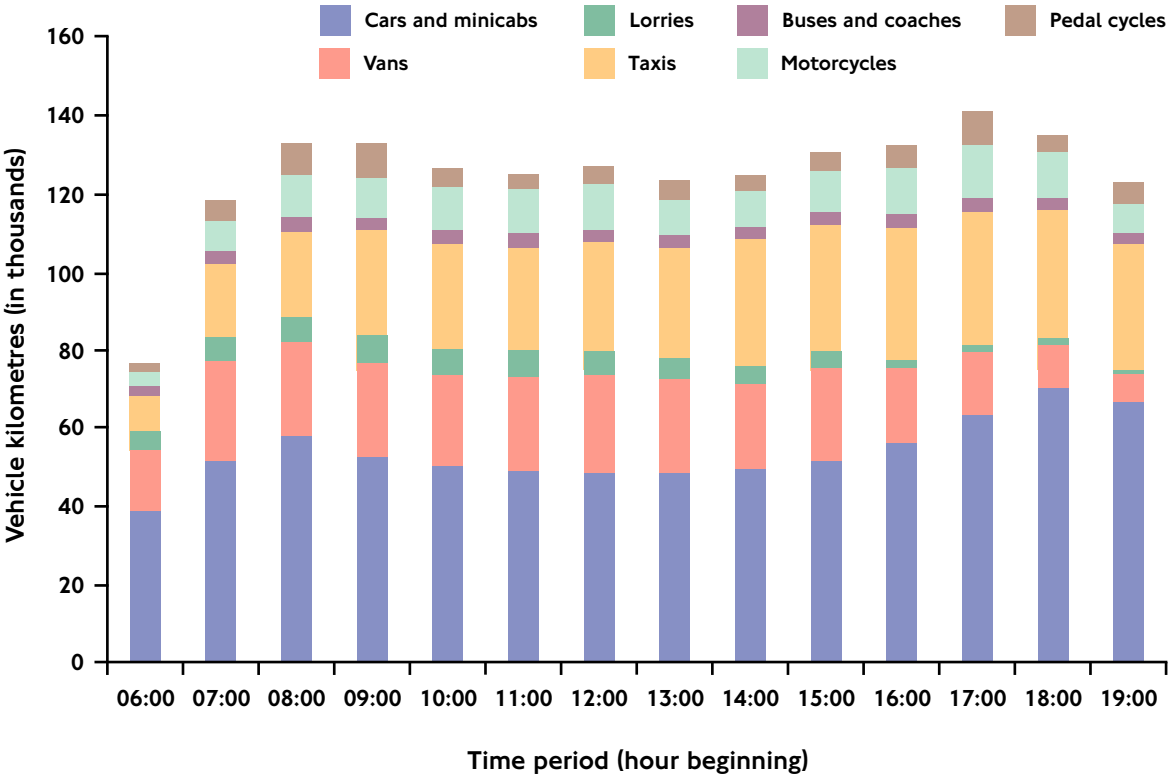
Appendix 5 sets out the statistical precision applying to these indicators.

4.6. Traffic circulating within the charging zone

Total vehicle-kilometres driven

Vehicle-kilometres driven is the most appropriate measure to quantify changes to the total volume of traffic circulating within the charging zone. Figure 4.1 shows the estimate of vehicle-kilometres driven within the charging zone for a typical 2002 weekday[1], broken down by each of the main vehicle types.

Figure 4.1. Vehicle-kilometres driven within the charging zone. Typical 2002 weekday, 06:00 to 19:00.



The estimate of total vehicle-kilometres per typical 2002 weekday during charging hours is 1.5 million. Excluding two-wheeled vehicles (pedal cycles and motorcycles), which are not subject to the charge and not therefore included in the expectation of a 10 to 15 percent reduction in traffic, the equivalent figure is 1.3 million vehicle-kilometres. The most obvious features from Figure 4.1 are:

- overall traffic levels were broadly constant throughout the hours when charges would apply;
- car traffic (including minicabs) constituted rather less than 50 percent of all traffic across the future charging day;
- licensed taxi traffic constituted nearly 25 percent of all traffic.
- motorcycles and pedal cycles made up 12 percent of all traffic.

Vehicle-kilometres are calculated from individual point-based counts that are extrapolated to represent the wider road network. Because of this extrapolation, there will always be an element of uncertainty associated with the resulting absolute estimate of vehicle-kilometres. However, this uncertainty does not apply when considering estimates between two periods that have been calculated using an identical set of count locations and assumptions (e.g. the overall network length by the various classes of road). The methodology employed can therefore be expected to give estimates of year-on-year change in traffic volumes within the charging zone that are accurate to plus/minus 2.5 percent at the 95 percent confidence level.

These counts will be repeated at intervals following the start of congestion charging, during both Spring and Autumn 2003, following which it will be possible to derive a direct comparison of vehicle-kilometres for a 2003 post-charging year.

Traffic crossing the Thames screenline

The first of two long-term indicators of traffic circulating within the charging zone that has been measured on a consistent basis is traffic crossing the six Thames bridges that are located within the zone. These form part of the wider Thames screenline, which has traditionally been counted on a biennial basis during the Autumn. This survey gives estimates of traffic levels crossing these bridges that are accurate to plus/minus 4 percent at the 95 percent confidence interval.

Figure 4.2. Traffic crossing the six Thames bridges inside the charging zone. Both directions combined, 07:00 to 18:30, weekdays.

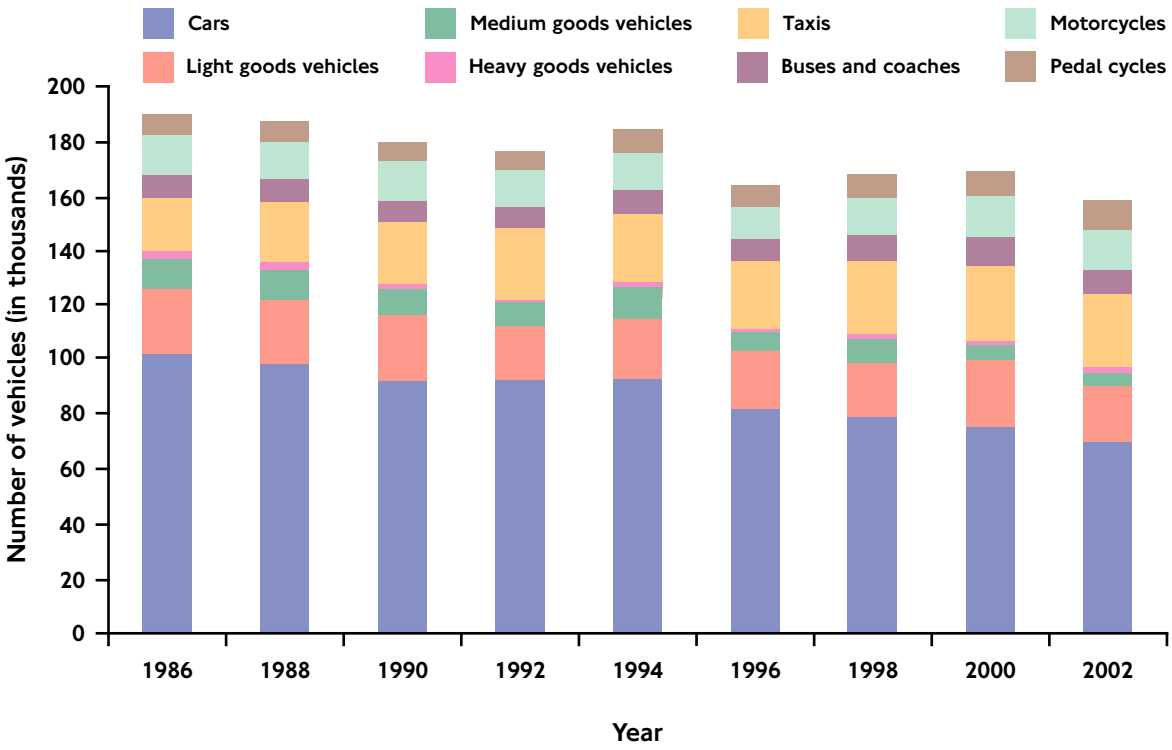


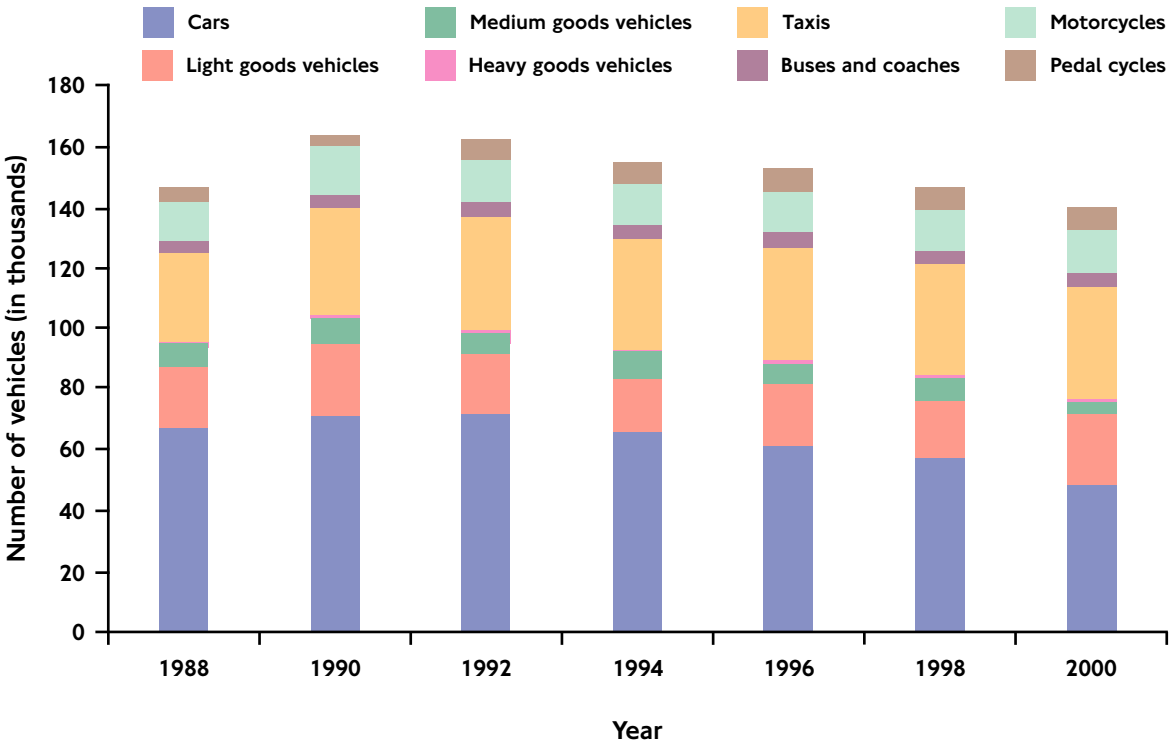
Figure 4.2 shows the long-term trend in total traffic crossing the Thames within the charging zone. This traffic has declined relatively consistently since the mid-1980s, with a 7 percent drop recorded between 2000 and 2002, and an overall reduction of 17 percent between 1986 and 2002. It is evident from Figure 4.2 that the overwhelming majority of these reductions are accounted for by cars, which have decreased by one-third between 1986 and 2002.

Traffic crossing a north/south screenline within the charging zone

A second long-term indicator of traffic circulating within the charging zone is provided by the portion of the 'Northern screenline' that is situated within the charging zone. The recent historical trend in traffic at this screenline is shown by Figure 4.3.

In comparison to the Thames screenline, the long-term trends shown by these figures are less distinct. Overall traffic volumes in 2000 (the last time that this screenline was counted) are only marginally down on those of the late 1980s, although rather more markedly lower than the levels reached during the mid-1990s. Again, however, there has been a clear long-term decline in the numbers of cars, down by over one-quarter during the period covered by the figures.

Figure 4.3. Traffic crossing a north/south screenline within the charging zone, 07:00 to 18:30, weekdays.



4.7. Traffic entering and leaving the charging zone across the charging zone boundary

The congestion charging zone boundary has not historically been counted, and there is therefore no long-term time series describing recent trends in the volume of vehicles crossing into and out of the charging zone. Intensive measurements of traffic crossing this boundary have however been made throughout 2002, from which it is possible to derive estimates for a typical 2002 weekday[1] of total traffic entering and leaving the future charging zone.

The 2002 estimate indicates that, during charging hours, a total of 388,000 vehicles of all types crossed into the congestion charging zone, and a total of 377,000 vehicles of all types crossed out of the zone. These include multiple crossings by the same vehicle, and crossings by categories of vehicle (i.e. buses, licensed taxis, pedal cycles and motorcycles) that will not be subject to the charge. The way in which these crossings are distributed throughout the day is shown in Figures 4.4 and 4.5.

Figure 4.4. Inbound traffic flows across the congestion charging zone boundary. Typical weekday 2002.

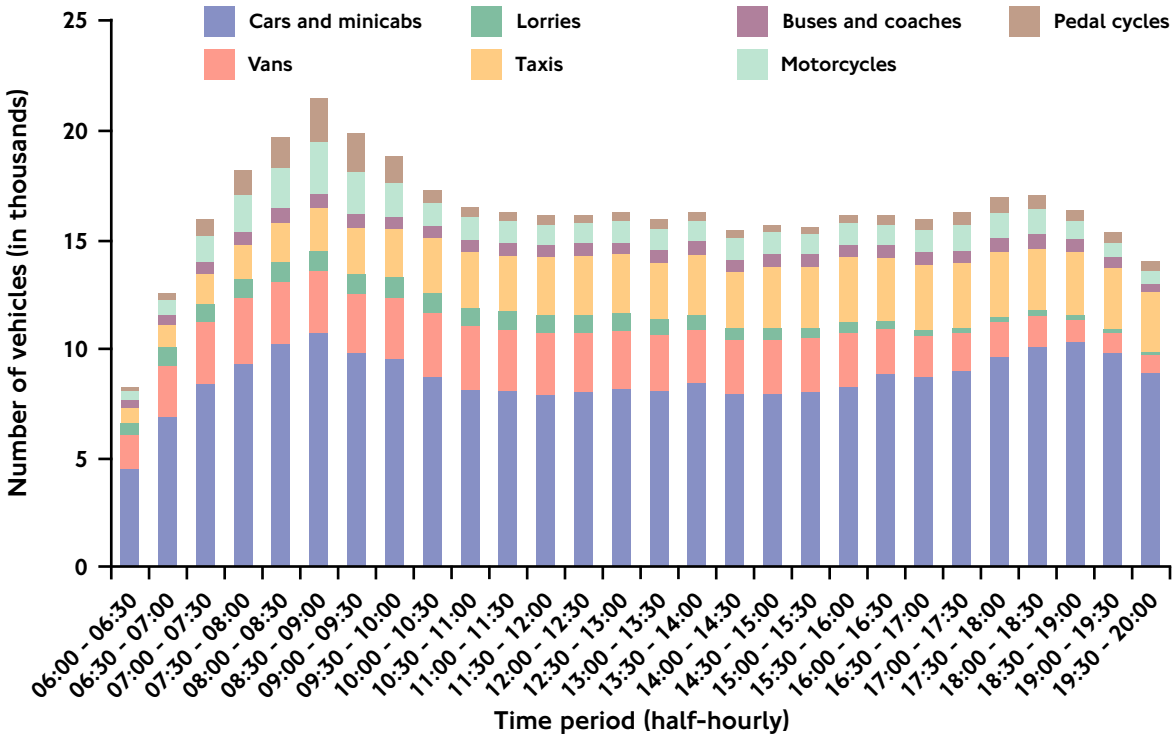
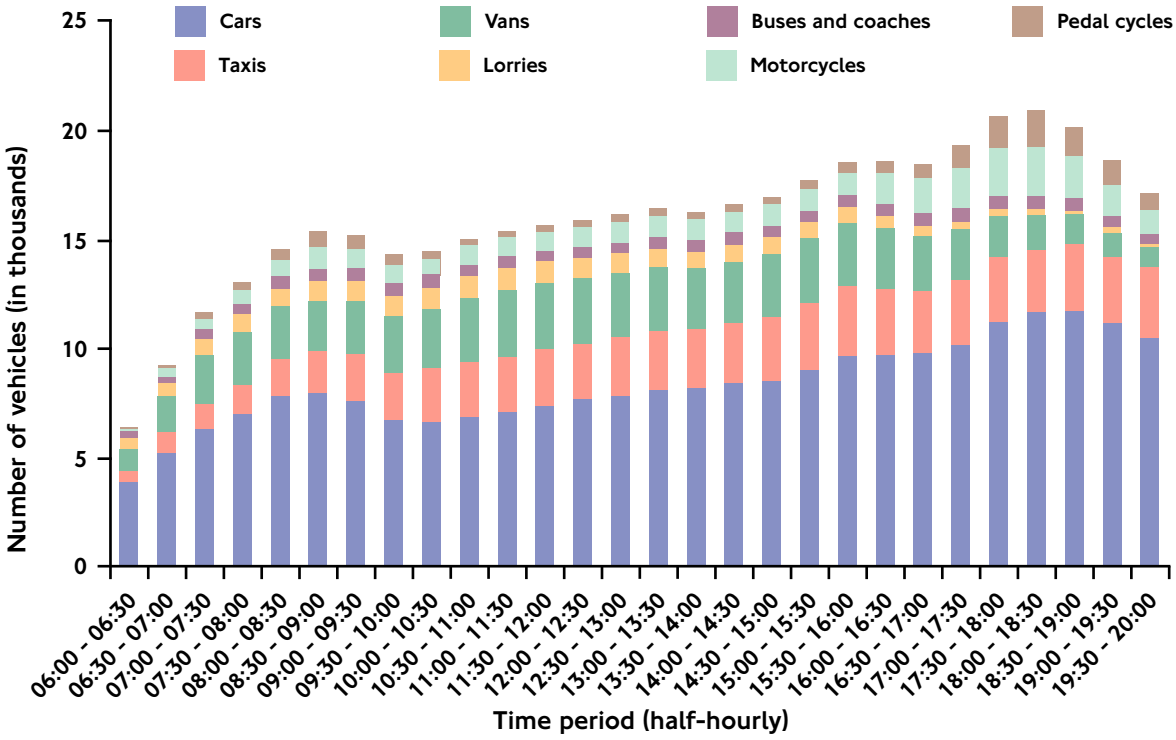


Figure 4.5. Outbound traffic flows across the congestion charging zone boundary. Typical weekday 2002.



When these counts are repeated after congestion charging starts (during both Spring and Autumn 2003), the following indicators of change will become evident through a comparison of the results:

- changes to the total volumes of traffic entering and leaving the charging zone;
- changes to the mix of types of vehicles entering or leaving the charging zone;
- changes to the pattern of traffic throughout the day, perhaps reflecting some changes to the timings of journeys in order to avoid paying the charge.

4.8. Traffic entering a wider definition of central London

The most appropriate long-term indicator of traffic to and from central London is provided by the TfL central cordon. This cordon lies mostly outside of the charging zone boundary (except for a short distance south of the Thames), and encloses an area of London significantly larger than the charging zone (see Appendix 5). This cordon has been counted on a consistent basis since the mid-1980s.

As well as indicating any changes in traffic approaching central London, this cordon can readily be adjusted to lie completely outside of the charging zone. In this 'extended' form, this cordon will provide a measure of traffic change on the radial routes approaching the charging zone. This 'extended central London cordon' was counted during Autumn 2002, at the same time as the un-extended version, and will continue to be counted in conjunction with future counts of the original central London cordon.

The following measurements are presented in respect of counts at these cordons:

- recent historical trends in inbound and outbound traffic at the central London cordon during charging hours (Figures 4.6 and 4.7);
- recent historical trends in inbound traffic at the central London cordon by main time period (Figure 4.8);
- Autumn 2002 counts for inbound and outbound traffic from the extended central cordon, by time of day and main vehicle type (Tables 4.1 and 4.2).

Figure 4.6. Inbound traffic crossing the central cordon, 07:00 to 18:30, weekdays.

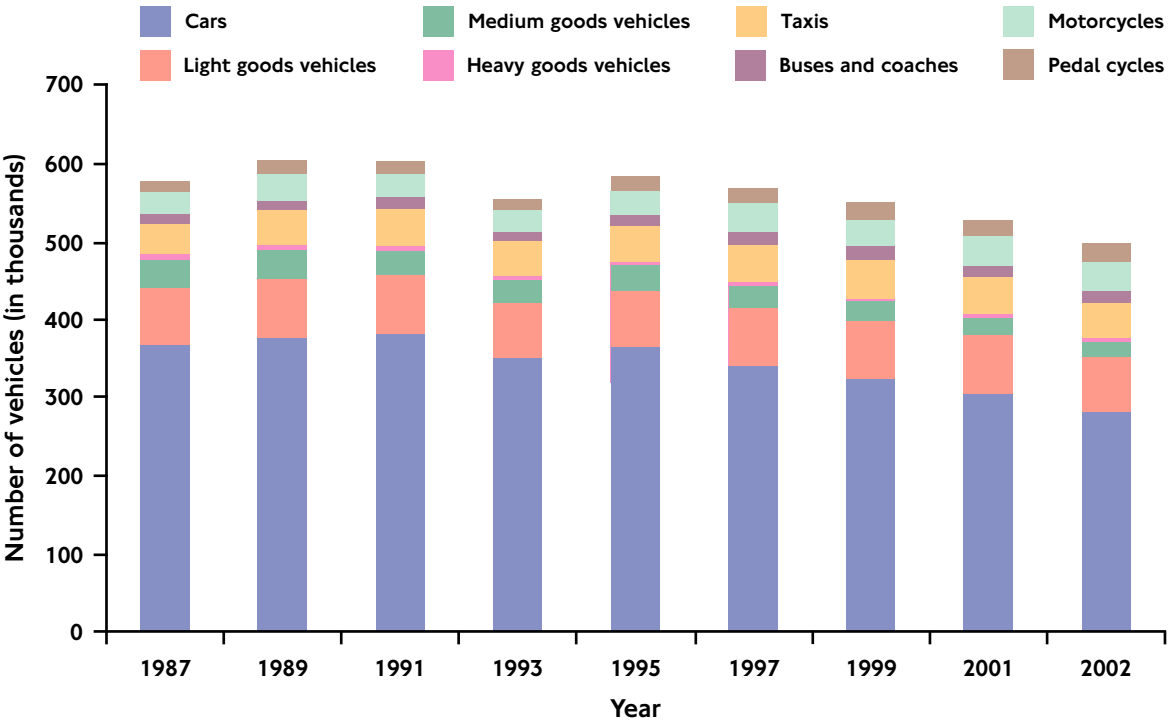
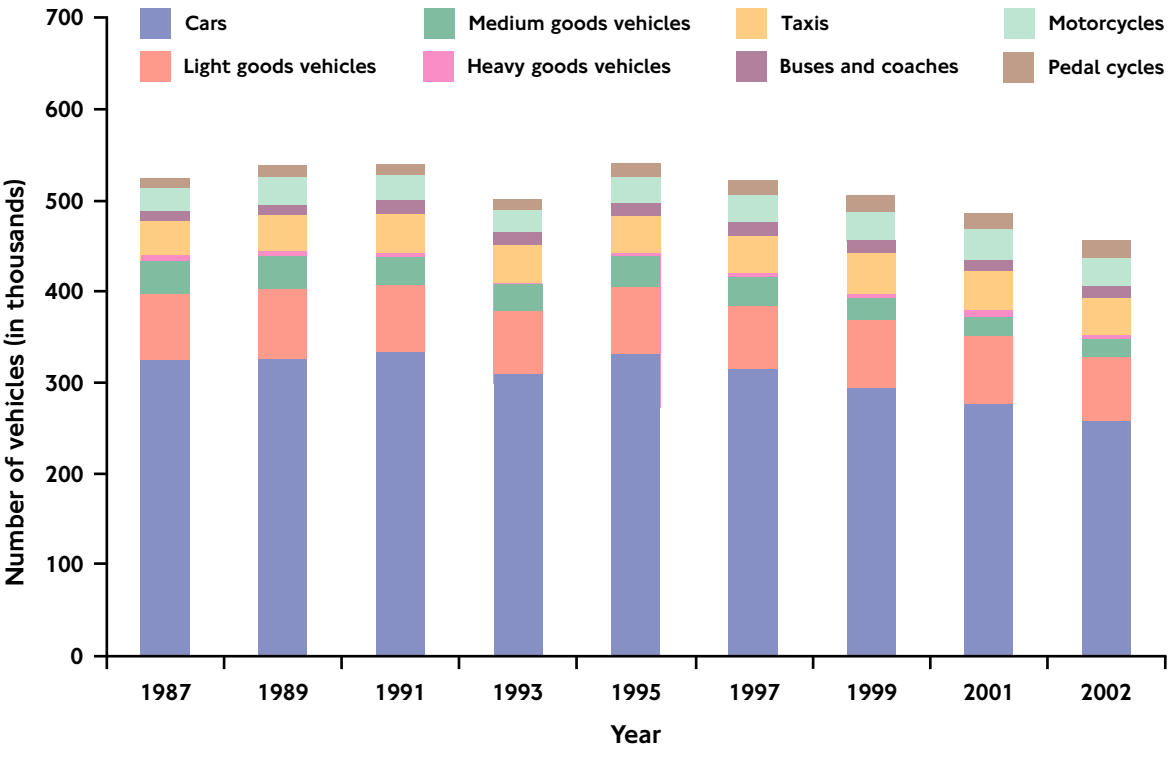


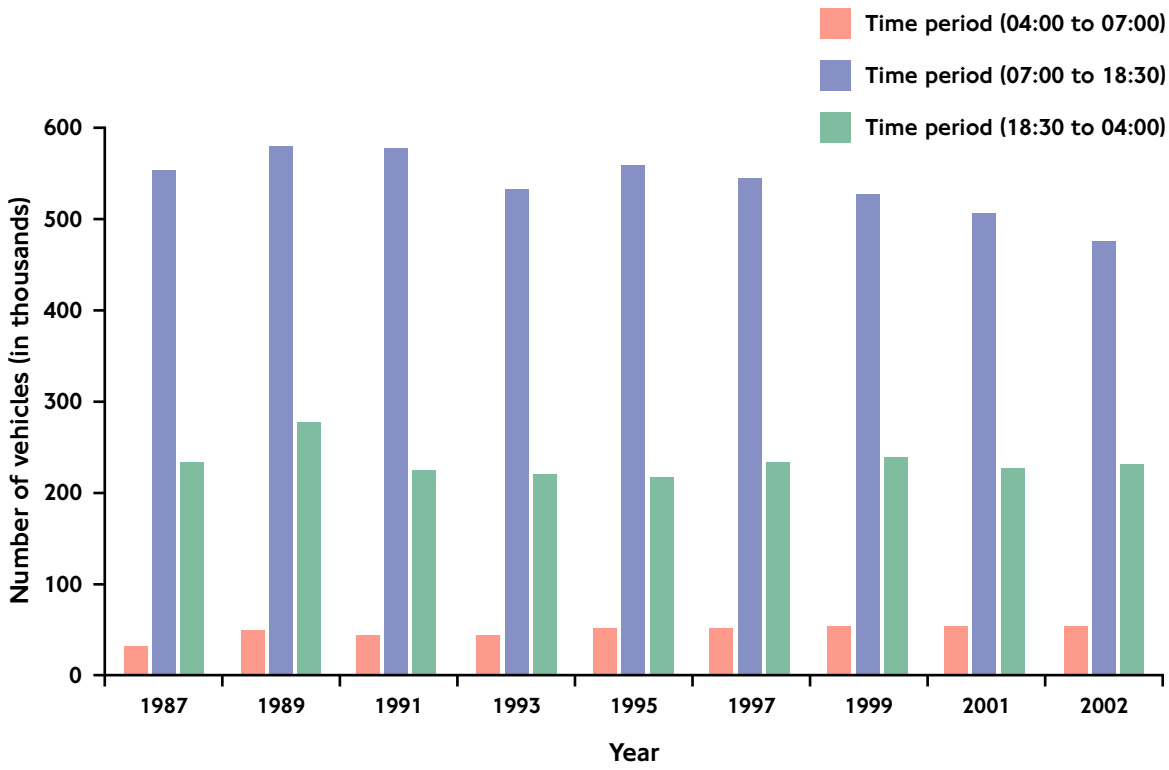
Figure 4.7. Outbound traffic crossing the central cordon, 07:00 to 18:30, weekdays.



The trend since the mid-1990s at the central London cordon has been a steady decline in the total volumes of traffic. Total inbound traffic during charging hours in 2002 was 15 percent lower than in 1995. Again, cars are seen to account for most of this decline, having reduced by 23 percent over the same period. Between 2001 and 2002, total inbound traffic declined by 6 percent and potentially-chargeable vehicles by 8 percent.

Figure 4.8 shows the trend for inbound traffic by time period. Interestingly, the declines in total traffic seen during charging hours have not been repeated at other times of the day.

Figure 4.8. Inbound traffic crossing the central cordon by time period, weekdays.



In the absence of a historical time-series for the central cordon in its extended form, data from the Autumn 2002 count are presented in tabular form in Tables 4.1 and 4.2. Repeating this count during Autumn 2003 will give a direct comparison of traffic volumes by vehicle type on the radial road network just outside of the charging zone.

Table 4.1. Autumn 2002 counts for inbound traffic at the extended central cordon (in thousands).

Time	Cars	Light goods	Medium goods	Heavy goods	Taxis	Bus / Coach	Motorcycles	Pedal cycles	All vehicles
00:00-06:00	42.7	5.5	2.2	0.6	11.4	2.3	1.0	0.4	66
06:00-07:00	18.2	5.7	1.4	0.6	2.2	1.0	1.9	0.8	32
07:00-10:00	88.4	23.3	6.4	2.0	9.2	4.3	15.1	13.1	162
10:00-16:00	142.1	39.3	11.2	3.2	23.7	7.5	14.0	7.3	248
16:00-18:30	68.4	10.8	2.4	0.6	11.1	3.3	7.3	4.6	108
18:30-20:00	42.8	3.9	0.9	0.3	7.6	1.7	3.7	2.7	64
20:00-24:00	77.5	4.9	1.6	0.3	20.3	3.1	3.5	2.0	113
Charging hours	198.9	73.4	20.0	5.8	44.0	15.2	36.4	25.0	519
24 hours	480.2	93.4	26.1	7.5	85.4	23.4	46.4	30.9	793
Un-extended central cordon (for comparison)									
Charging hours	280.4	70.6	18.9	5.6	43.9	15.6	36.9	25.8	497
24 hours	451.4	89.8	24.8	7.3	85.3	23.9	45.9	31.0	759

Table 4.2. Autumn 2002 counts for outbound traffic at the extended central cordon (in thousands).

Time	Cars	Light goods	Medium goods	Heavy goods	Taxis	Bus / Coach	Motorcycles	Pedal cycles	All vehicles
00:00-06:00	50.0	6.6	2.4	0.6	11.0	2.1	1.3	0.8	75
06:00-07:00	13.9	4.2	1.1	0.4	1.4	0.7	0.8	0.4	23
07:00-10:00	63.2	17.1	5.2	1.7	6.7	3.6	6.6	4.6	109
10:00-16:00	133.3	41.3	11.9	3.2	22.5	7.0	13.0	6.2	238
16:00-18:30	75.5	14.0	2.6	0.6	10.7	3.1	12.1	8.9	128
18:30-20:00	45.3	4.5	1.0	0.3	7.3	1.7	6.2	5.2	71
20:00-24:00	87.9	5.5	1.7	0.4	20.7	2.9	5.7	4.2	129
Charging hours	271.9	72.4	19.7	5.5	39.9	13.8	31.6	19.8	475
24 hours	469.0	93.1	26.0	7.2	80.2	21.1	45.7	30.4	773
Un-extended central cordon (for comparison)									
Charging hours	256.6	71.0	19.2	5.3	40.3	14.0	30.8	19.1	456
24 hours	443.3	90.7	24.9	6.9	81.1	21.7	45.3	30.3	744

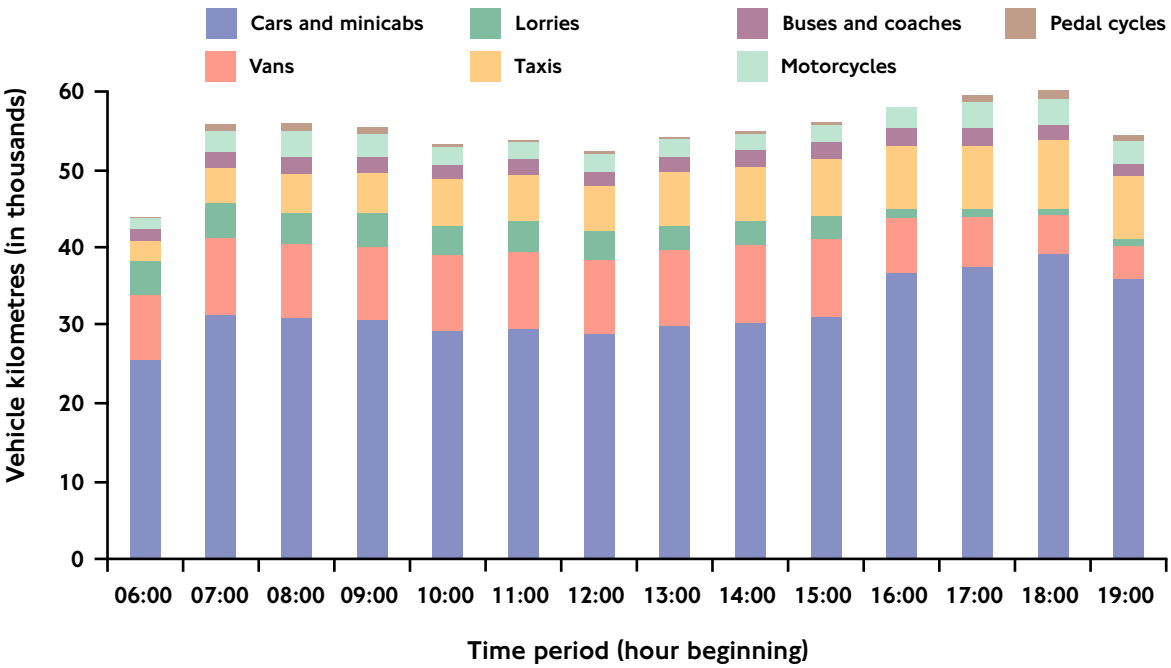
4.9. Traffic on the Inner Ring Road

The Inner Ring Road forms the most obvious alternative route for through traffic wishing to avoid the charging zone. The performance of the Inner Ring Road in accommodating additional orbital traffic will be important.

As with other key indicators of traffic change, traffic on the Inner Ring Road has only been measured on a comprehensive basis for 2002. Figure 4.9 shows an estimate of vehicle-kilometres driven on the Inner Ring Road in both directions combined for a typical weekday during 2002[1].

The estimate of total vehicle-kilometres per average 2002 weekday during charging hours is 0.6 million (all vehicles).

Figure 4.9. Vehicle-kilometres driven on the Inner Ring Road. Typical 2002 weekday, both directions combined.



4.10. Orbital traffic movements outside the Inner Ring Road

Once charging is introduced, some traffic making through journeys across the charging zone may use the Inner Ring Road, or the network of other roads outside of the charging zone to avoid paying the charge. To measure these changes, and the relative balance between changes on the Inner Ring Road and further out, four radial screenlines have been established (see Appendix 5), extending outwards from, and including, the Inner Ring Road. Autumn 2002 counts on these screenlines are set out in Table 4.3. Again, any changes in strategic-scale orbital movements outside the Inner Ring Road will become evident from repeats of these counts to be undertaken during 2003.

Table 4.3. Traffic crossing four radial screenlines. Autumn 2002.

Time period	Total flow (thousands two-way)	Percent using Inner Ring Road
Northern screenline		
07:00-18:30	151	23%
06:00-20:00	177	24%
Eastern screenline		
07:00-18:30	132	12%
06:00-20:00	155	12%
Southern screenline		
07:00-18:30	102	25%
06:00-20:00	122	26%
Western screenline		
07:00-18:30	197	29%
06:00-20:00	231	29%

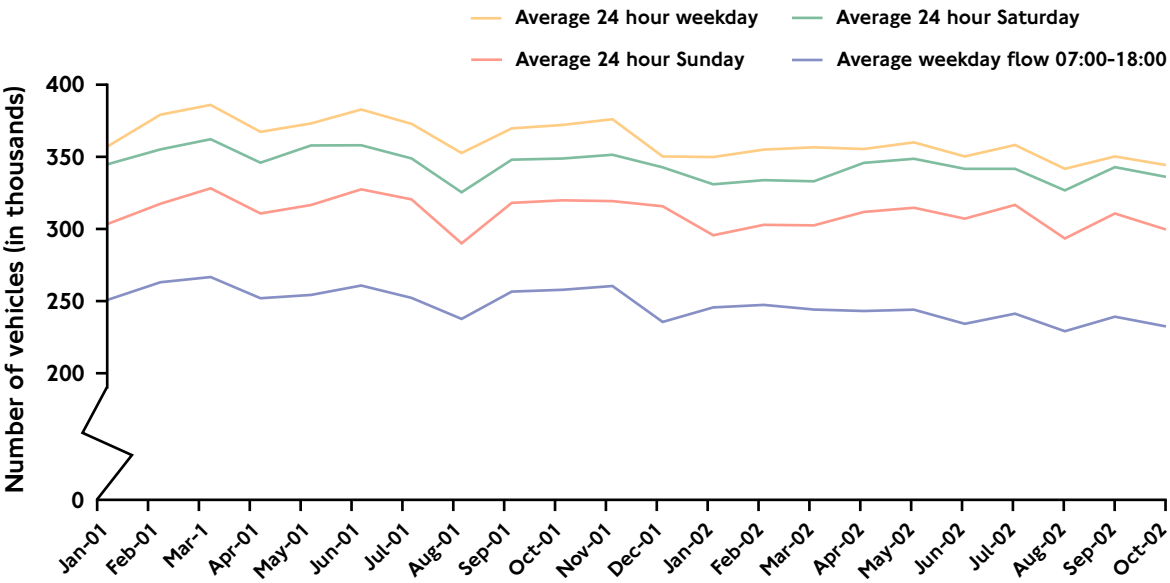
4.11. Wider traffic trends in London

Congestion charging is expected to have some measurable traffic effects for a distance of several kilometres outside of the charging zone boundary. In addition, prevailing traffic trends across the whole of London will need to be understood to place changes detected following in the introduction of congestion charging into context. This section presents a selection of available indicators by which wider traffic trends in London will be monitored.

Traffic circulating in inner London

Figure 4.10 shows recent trends in traffic volumes in inner London. These data originate from a relatively small selection of permanent automatic counters located throughout inner London, and are not necessarily 'representative' in strict statistical terms. Nevertheless, data for all time periods does show a slowly-declining trend, superimposed on a background 'seasonal' fluctuation. Taking the period between 1994 and 2001, total traffic volumes in inner London measured in this way have fallen by approximately 10 percent on weekdays, and by about 5 percent on both Saturdays and Sundays.

Figure 4.10. Recent trends in traffic in inner London (DfT permanent automatic counting sites).



Traffic crossing a cordon enclosing inner London

Traffic entering and leaving inner London has historically been measured across the TfL inner London cordon. This is similar in concept to the central cordon described in Section 4.8. Figures 4.11 and 4.12 show the recent historical trend in traffic (during the future charging hours) measured at this cordon (inbound and outbound directions).

The trend shown is one of relative stability, with declines in total traffic between 1999 and 2002 in the inbound and outbound directions of 3 and 1 percent respectively. It is noteworthy that both the total volumes of cars and the proportion of traffic that they account for, has been relatively constant at this cordon.

Is it worth noting that the relative proportions of traffic accounted for by the various vehicle types (e.g. taxis) at this cordon differs significantly from that at the central cordon (see Figures 4.6 and 4.7).

Figure 4.11. Inbound traffic crossing the Inner London cordon, 07:00 to 18:30, weekdays.

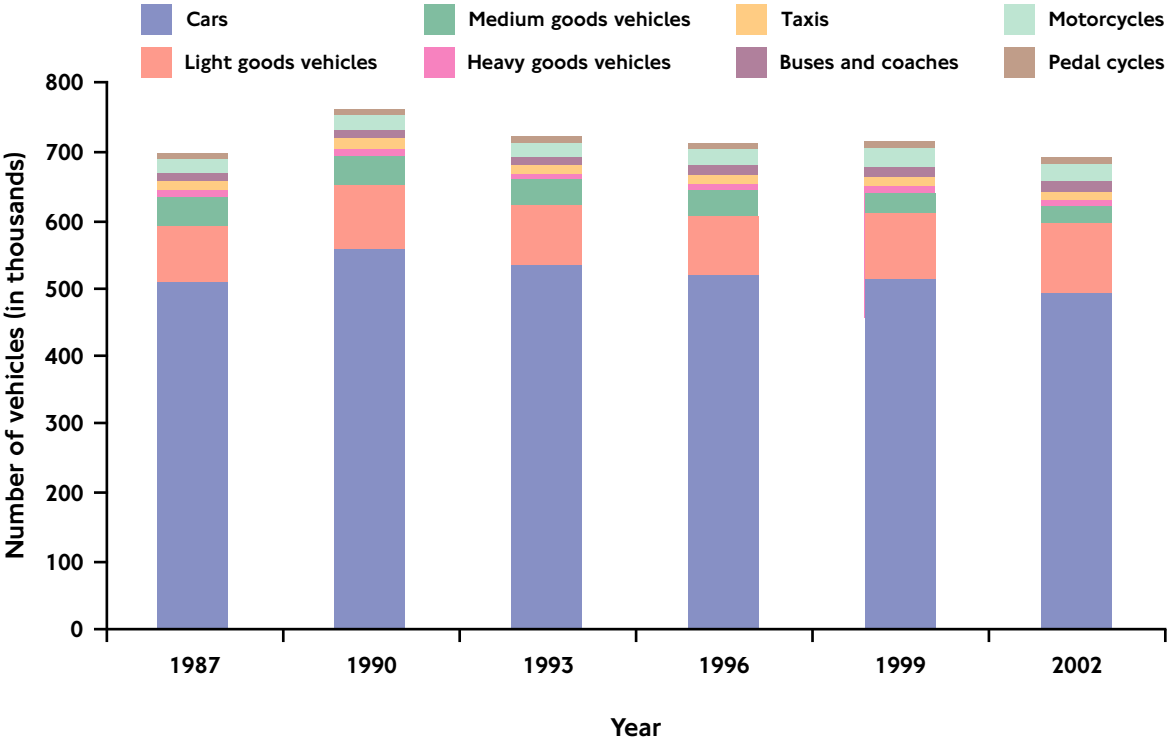
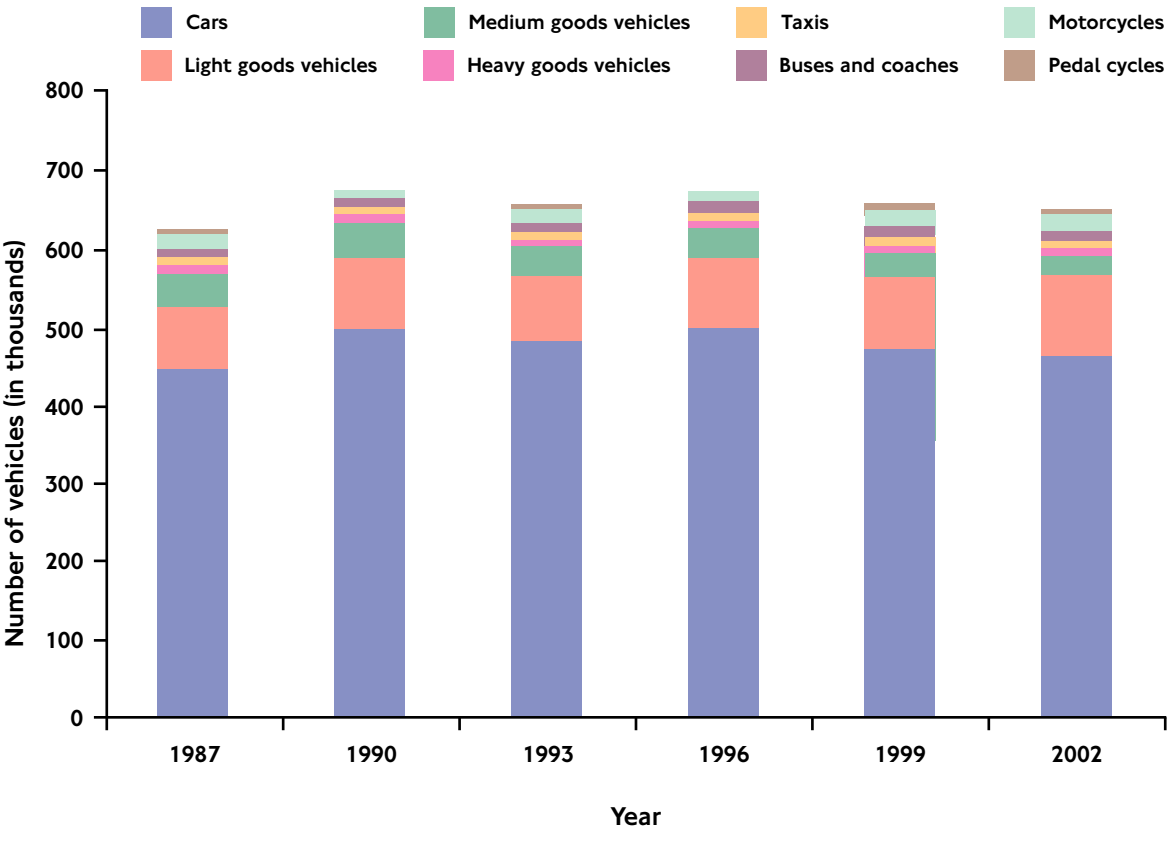


Figure 4.12. Outbound traffic crossing the Inner London cordon, 07:00 to 18:30, weekdays.



Traffic crossing the London boundary cordon

Traffic entering and leaving Greater London has historically been measured across the TfL London boundary cordon. Figures 4.13 and 4.14 show the recent historical trend in traffic measured at this cordon (inbound and outbound directions).

Here, the recent trend is of a steady increase in traffic, levels in 2001 being 7 percent greater inbound and 11 percent greater outbound than in 1989 (the period 1986 to1989 being affected by the opening of the M25). Measurements taken at a selection of permanent automatic traffic counting sites throughout outer London suggest a 2 percent rise in traffic circulating in outer London on weekdays between 1994 and 2001, and a 4 percent rise on both Saturdays and Sundays.

Figure 4.13. Inbound traffic crossing the London boundary cordon, 07:00 to 18:30, weekdays.

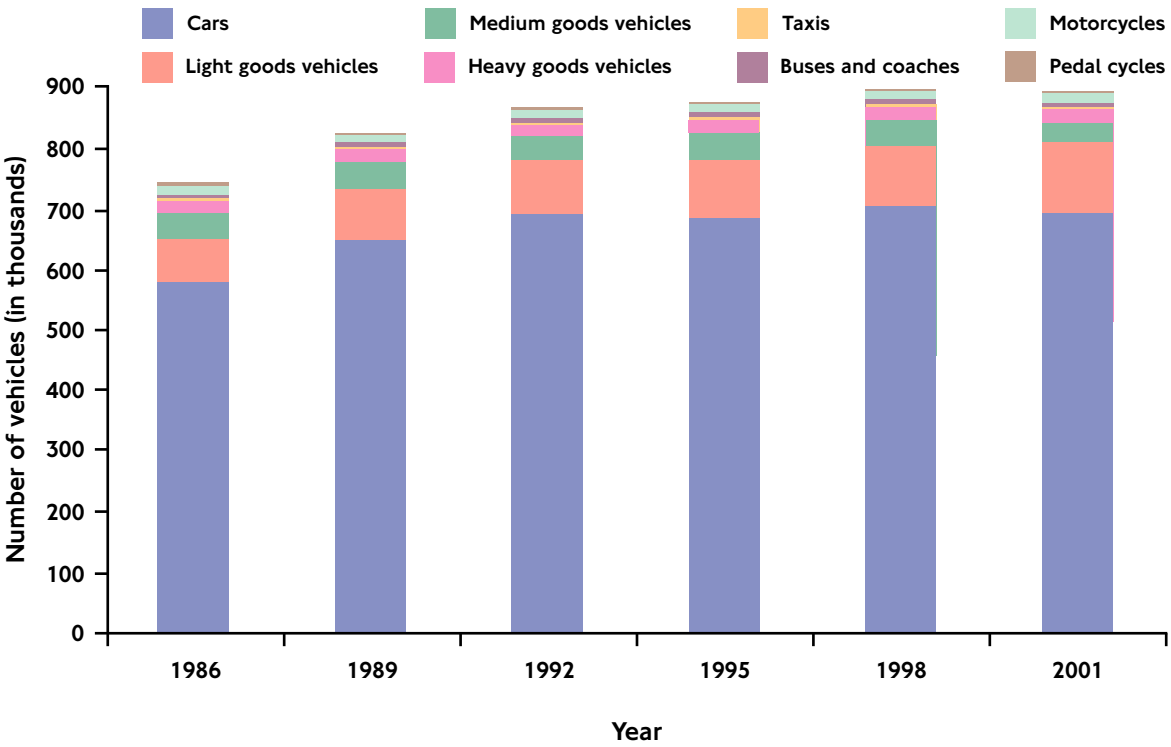
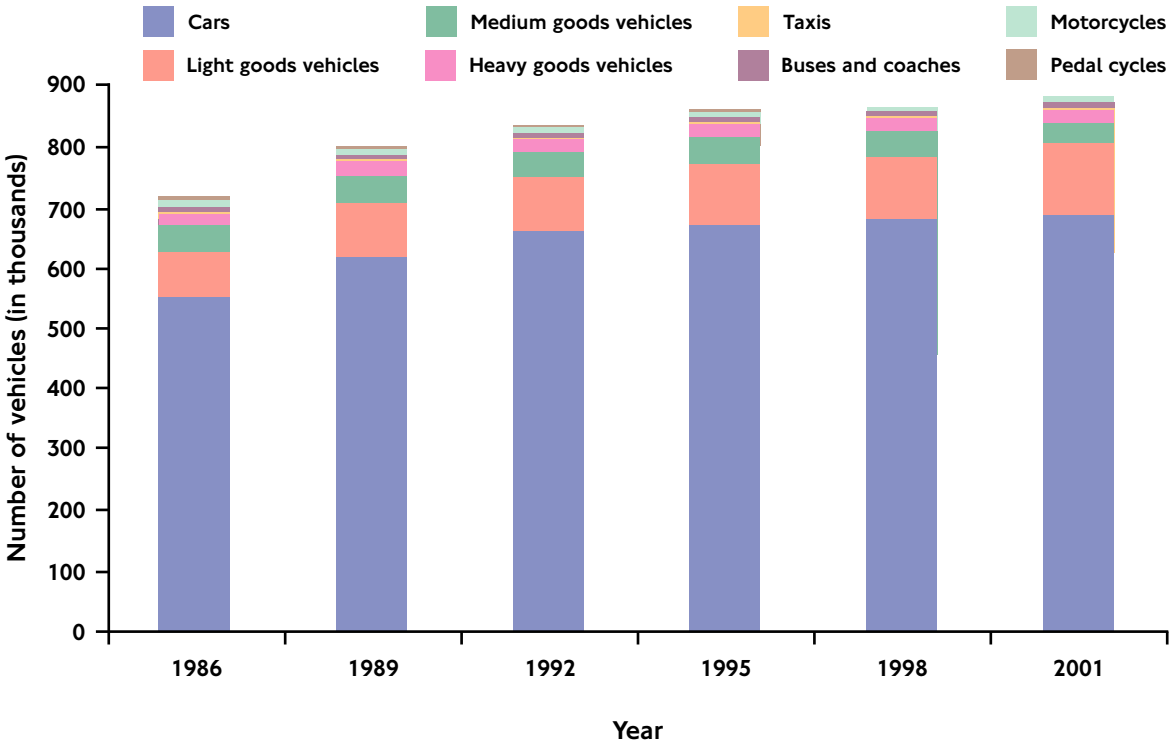


Figure 4.14. Outbound traffic crossing the London boundary cordon, 07:00 to 18:30, weekdays.



4.12. January 2003 counts

Some additional traffic counts were planned to take place in and around the charging zone during the first six weeks of 2003, the period immediately prior to the introduction of charging. The primary purpose of these counts was to increase TfL's understanding of pre-charging traffic conditions, particularly in the light of the large amount of disruption to the road network that took place during 2002. In the event, snowfall early in the month, coupled with the closure of the Central line from late January, were two factors which affected the validity of these counts. Some of these counts were continued over the period of the implementation of congestion charging in February and March 2003, in order to monitor the immediate impacts of the scheme. Further information on these counts, together with early data reporting traffic changes after charging started, will be reported in Autumn 2003 and in the next Annual Monitoring Report.

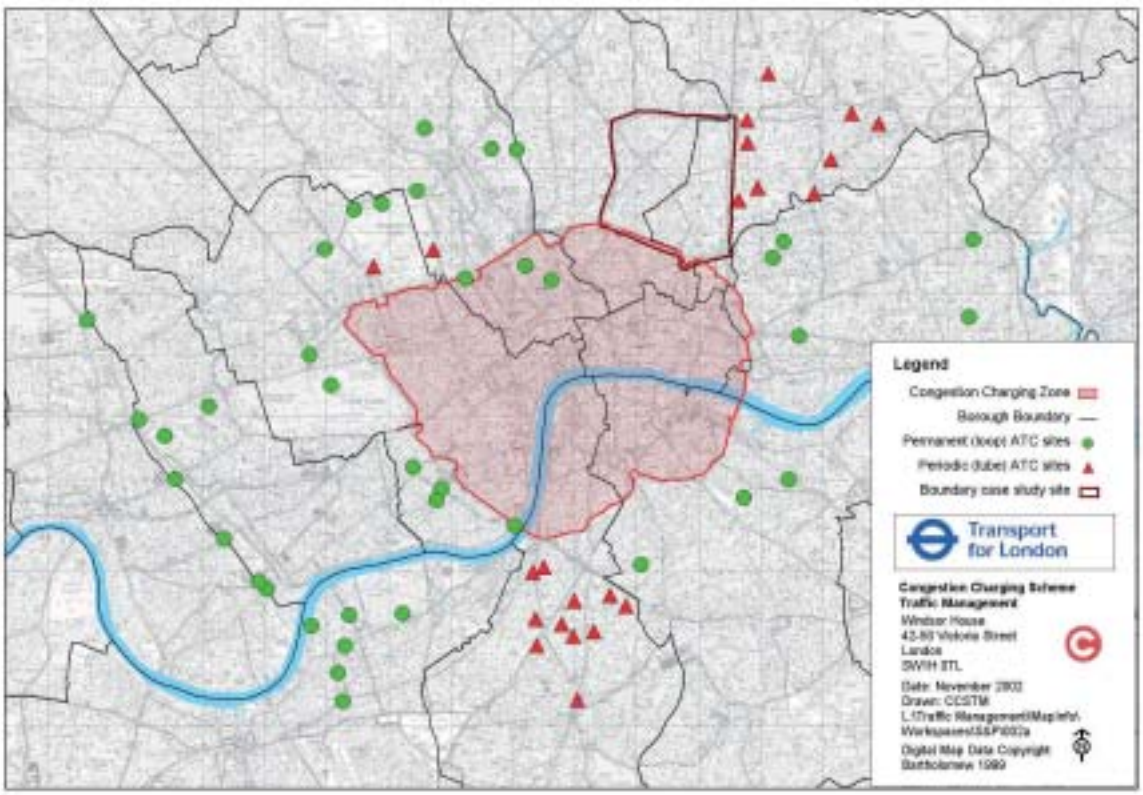
4.13. Traffic change on local roads

The traffic monitoring so far described is intended to measure traffic change at the strategic (area-wide) level. To obtain the required levels of precision for our estimates of traffic change, it is necessary to draw a sample of counting points that are collectively representative of the area being studied. This either implies 'blanket' (i.e. 100 percent) coverage, such as for the measurement of traffic crossing the charging zone boundary, or a stratified-random sample of points within an area. In either case, the actual points at which counts are taken may or may not coincide with roads or locations that are of specific local interest.

To provide additional coverage of traffic change at locations that are of specific local interest, TfL has made available resources to undertake traffic counts at locations nominated by central and inner London boroughs. In the majority of cases these consist of the installation of automatic traffic counters, either permanent, loop-based installations or temporary 'tube'-based counters, which will be revisited at intervals after charging starts.

The locations of these sites and the type of counting capacity installed in each case are shown by Figure 4.15.

Figure 4.15. Traffic monitoring sites on local roads.



In some cases, boroughs have requested TfL support for other local traffic monitoring initiatives (not shown on the above map). These are briefly described below:

- funding to upgrade existing local automatic traffic counting networks (London borough of Wandsworth and Corporation of London);
- funding to undertake additional surveys of local roads using borough resources (London borough of Southwark);
- junction turning counts (London borough of Camden);
- funding for additional manual classified traffic counts (Corporation of London);
- funding for local area network speed surveys (Corporation of London).

For London borough of Islington, it is intended that intensive before and after monitoring will be undertaken in connection with local traffic schemes ('complementary measures' for congestion charging) as these schemes become operational. This (very local) information can then be interpreted in the context of strategic-level traffic changes observed through the wider monitoring programme. This programme is described further in Appendix 6.

In addition to all of the traffic count programmes so far described, TfL has, and will continue to undertake investigations into specific local traffic issues related to congestion charging. In the period prior to congestion charging, this activity has focused on determining the impact on traffic flows of the various infrastructure works that have been carried out within and around the charging zone during 2002 (e.g. Vauxhall Cross, World Squares and Shoreditch Triangle). These have allowed us to obtain a more robust view of pre-scheme traffic levels during 2002. After congestion charging, the monitoring programme includes provision for deployment of additional traffic counting capacity to investigate particular traffic issues as they arise.

Technical notes

1 The annual estimates for traffic in the charging zone and on the Inner Ring Road for 2002 are based on a combination of counts taken during the Spring and Autumn 'neutral' counting periods.

2 The term 'motorcycle' as used in this report includes all powered two-wheeled vehicles.

5. Public Transport

5.1. Introduction

This chapter is concerned with the impacts of congestion charging on public transport. Charging is expected to achieve decongestion benefits through reducing the volumes of traffic moving to, from and through the charging zone. Of the trips that transfer from car the majority are expected by TfL to transfer to public transport. These trips will be covered by the monitoring described in this chapter.

Some car users may make other changes in preference to paying the charge, including; transferring to other modes (for example walking, cycling or car sharing); travelling to a different destination; or travelling at times outside charging hours. These trips will be covered by the monitoring described in Chapters 4, 6, and 8.

Comprehensive and long-standing monitoring programmes are undertaken by the bodies responsible for each of the public transport modes. With some minor modifications and selective additions, these will provide the majority of the data that is required for congestion charging monitoring. Where coverage of these surveys is not adequate, additional new surveys have been put in place.

Aspects of each public transport mode covered by the monitoring programme include:

- Bus – patronage, supply, capacity, journey speeds, reliability, and passenger views;
- Underground – patronage, revenue, supply, reliability, and passenger views;
- National Rail – patronage;
- Docklands Light Rail (DLR) – patronage, supply, and passenger views.

5.2. Expected public transport impacts

There is expected to be a net increase in patronage of public transport as a result of congestion charging. The effect is expected to reflect both car-users shifting to public transport as well as some transfer between public transport modes, such as from rail and Underground to bus.

Once new travel patterns have settled, buses are expected to take the bulk of the increased patronage. Only a marginal impact on the number of passengers on the Underground and Rail is expected and it may be difficult to separate the changes in patronage attributable to congestion charging. Nevertheless it is considered important that the impacts on Underground and National Rail services, as a consequence of congestion charging are properly measured.

It is also expected that changes in the performance of the road network due to congestion charging may be reflected in improvements to bus journey times and reliability. Consequently a considerable amount of bus operational data has been assembled for the congestion charging monitoring programme. Recent patronage levels and projected increases are shown in Table 5.1.

Table 5.1. Key indicators of public transport patronage 2002, with TfL projected increases following implementation of charging.

	07:00-10:00 Passengers	07:00-18:30 Passengers	Projected passenger increase 07:00-10:00
Bus passengers entering charging zone (Autumn 2002)	76,000	193,000	Up to 15,000
LUL passengers exiting stations in and around charging zone (Spring 2002)	547,000	1,322,000	Up to 5,000
National Rail passengers arriving at stations in and around charging zone (Spring 2002)	451,000	564,000*	

*Rail passengers departing stations in and around the charging zone. Includes double counting of National Rail and the Underground

This data is not a direct indication of the total number of people entering the charging zone on public transport as some double-counting will arise when passengers change between public transport modes, e.g. from National Rail to Underground, or from Underground to Bus, within the charging zone. However, Chapter 6 addresses this to some extent in terms of modal share in trips to central London.

The highest intensity of passenger trips on the public transport networks is for 'inbound' trips to central London in the morning peak period, 07:00 -10:00, conditions during this time period will therefore be of key interest.

There will be some level of statistical uncertainty in these results. The bus occupancy and rail surveys are based on single day observations at individual locations spread over a period of time. It will be possible to assess the significance of the change between the surveys before and after charging by direct comparison of the data. By contrast, data on Underground and DLR patronage is available on a continual basis through monitoring of gated and controlled exits. Where there is a continuous dataset, the 4-week period in April/May is considered to be an appropriate baseline indicator.

5.3. Pre-charging key public transport indicators

Buses

- Between 07:00 and 10:00, the morning peak, in Autumn 2002 approximately 76,000 bus passengers entered the future charging zone on a typical weekday. Over the whole charging day, 07:00 to 18:30, an estimated 193,000 bus passengers crossed the boundary inbound and 162,000 outbound.
- During the charging day 8,300 buses crossed the boundary inbound and 7,800 outbound in Autumn 2002.

- Scheduled bus mileage increased by 10 percent to 6.9 million km per 4-week period on routes operating on and within the Inner Ring Road between January 2002 and January 2003.
- Average bus journey speeds on sections of route inside the future charging zone remained broadly steady at around 11 km/h during 2002. Average journey speeds in January 2003 were slightly faster than any period in 2002 at 11.6 km/h.
- On a selection of bus routes approaching the Inner Ring Road journey speeds varied between 14 and15 km/h during 2002 and on the Inner Ring Road between 12 and 14 km/h.
- While the reliability of the bus network in Greater London improved between 2001 and 2002, routes operating within the future charging zone or on the Inner Ring Road performed worse than the network as a whole compared to targets set between January 2002 and January 2003, with the exception of charging zone routes in January 2003
- The amount of mileage scheduled but not operated that was apportioned to traffic delays on routes serving the charging zone increased in 2002 compared to the year before, even after the normal seasonal variation is taken into account. This is most likely due to a higher than normal volume of roadworks. In January 2003 this improved on routes inside the charging zone over and above that expected due to seasonality.

Underground

- 382,000 people a day on average exited the 31 stations within the charging zone in the morning peak period, 07:00 – 10:00, in April/May 2002.
- 164,000 people a day on average exited the 20 stations on or near the charging zone boundary in the morning peak period, 07:00 – 10:00, in April/May 2002.

National Rail

- 451,000 rail passengers entered central London in the morning peak period, 07:00 – 10:00, from the Spring 2002 surveys.
- 692,500 rail passengers left from central London between 06:00 and 20:00, and 564,000 in the charging period, from the Spring 2002 surveys.
- The peak hour was between 08:00 and 09:00 with 229,000 rail passengers entering central London, 50 percent of the total during the morning peak period in Spring 2002.
- Waterloo was the busiest station with 82,500 rail passengers arriving in the morning peak period in Spring 2002.

DLR

- Bank and Tower Gateway are the only DLR stations within the charging zone.
- 7,800 passengers a day on average exited Bank station, and 2,100 exited Tower Gateway, 07:00 – 10:00, in April/May 2002.
- The number of passenger exits from both DLR stations during the future charging day was 23,000 in January 2003, the same as it was in January 2002.

5.4. Monitoring the bus network

This section primarily deals with the impact of congestion charging on local buses in Greater London. These are operated under contract to London Buses, part of TfL. Commuter coaches are operated by private companies and tend to have very limited stopping arrangements (they generally originate from outside of London). They are, however, included in a number of occupancy counts described below.

London Buses undertook a detailed review of the inner London bus network which included examination of measures needed to complement congestion charging. This resulted in frequencies being enhanced on 53 existing routes, bigger buses were introduced on 10 routes, 15 services were restructured or extended and seven new routes were introduced, all during 2002 and early 2003.

The main indicators that will enable us to understand how the bus network is operating relate to patronage, service supply, journey times and reliability.

Bus patronage

Bus patronage in central London had been expected to increase as a result of congestion charging and the associated service improvements. The principal means used to measure patronage for the monitoring programme is the 'Keypoints' survey. Counts of buses and bus passengers arriving and departing at strategic locations on the bus network throughout London are carried out regularly by London Buses in the 'Keypoints' survey.

To monitor bus service supply and patronage in and around the charging zone the Keypoints survey has been expanded as follows:

- bus occupancy count surveys; a count of passengers, buses and coaches at randomly selected sites on and within the charging zone boundary took place in the Spring and Autumn periods in 2002, based on a similar methodology to Keypoints;
- Autumn boundary counts during 2002 and 2003; counts of passengers and buses passing every bus entry point on the boundary will be surveyed either by Bus Occupancy Counts or Keypoints surveys.

Bus patronage: central London

Counts of bus passengers entering central London have traditionally been taken in Autumn each year as part of the Central Area Peak Count (CAPC) survey whose cordon varies in places from the charging zone boundary as illustrated in Figure 5.1. Results of these counts from 1986 are illustrated in Figure 5.2.

There has been a general increase in bus passengers entering central London since the early 1990s, with 88,000 crossing the CAPC cordon in 2002 between 07:00 and 10:00.

Figure 5.1. Count sites of buses and bus passengers in and around central London in 2002/2003.

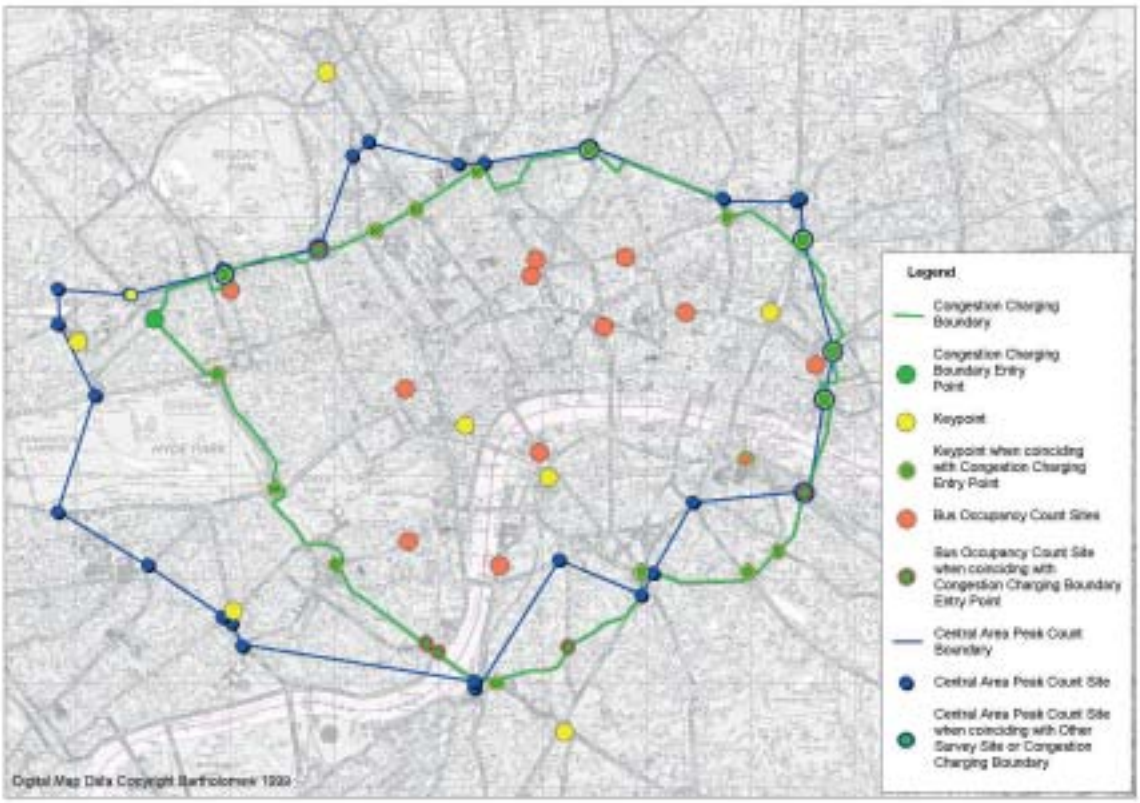
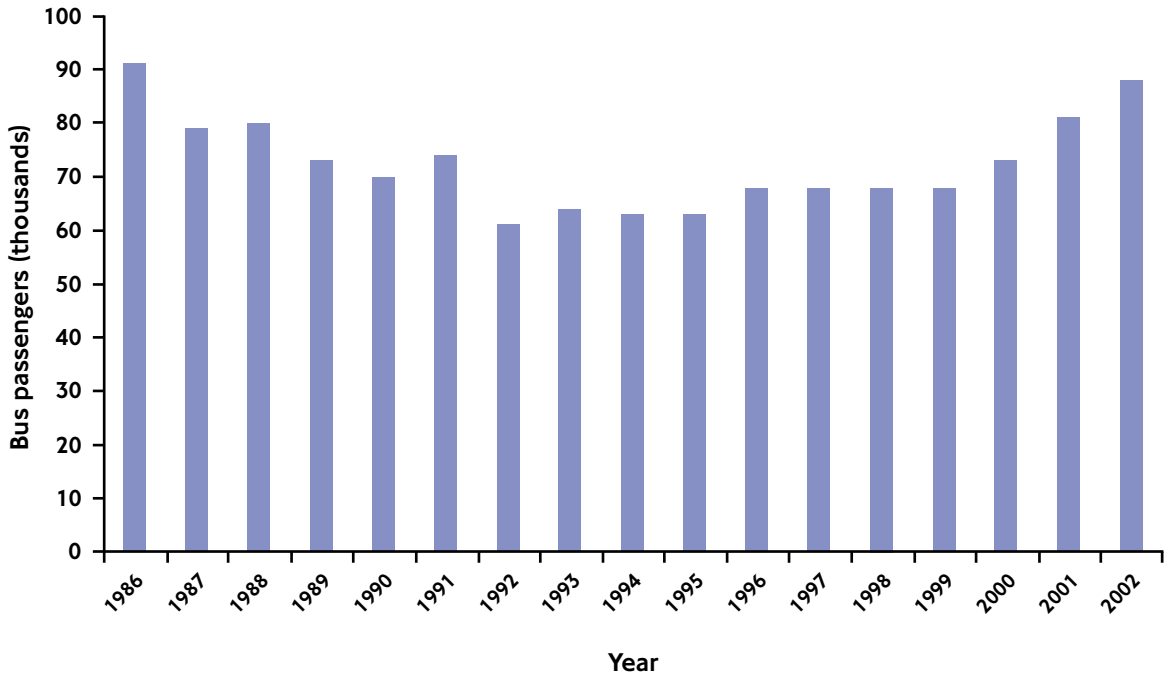


Figure 5.2. Bus passengers, Central Area Peak Count, 07:00 and10:00, 1986 to 2002.



Bus patronage: charging zone boundary

Counts of buses and bus passengers crossing into and leaving the zone were completed at each location where buses enter or exit the charging zone in Autumn 2002[1]. Results for the morning peak and future charging day patronage counts are illustrated in Figures 5.3 and 5.4.

These surveys estimated that 76,000 bus passengers entered the charging zone in the morning peak period. Throughout the whole charging day a total of 193,000 passengers entered the zone and 162,000 left it. Most of the difference between the two counts is considered to be due to passengers leaving the zone after 18:30. This difference appears to be evenly distributed across the sites.

Figure 5.3. Total bus passengers entering the charging zone at all entry points between 07:00 and 10:00, Autumn 2002.

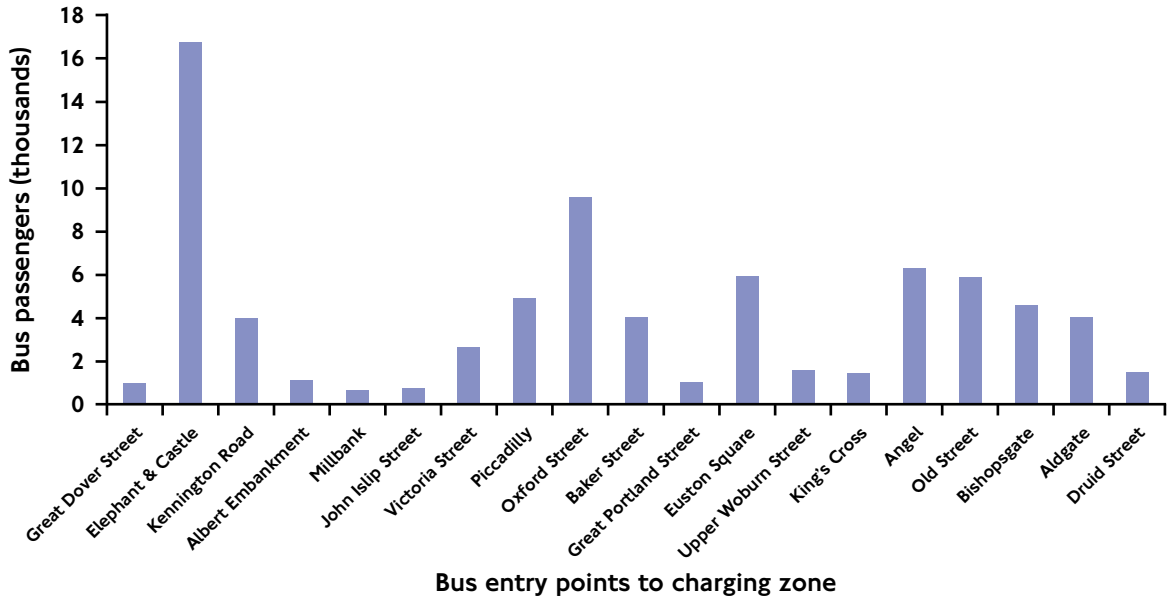
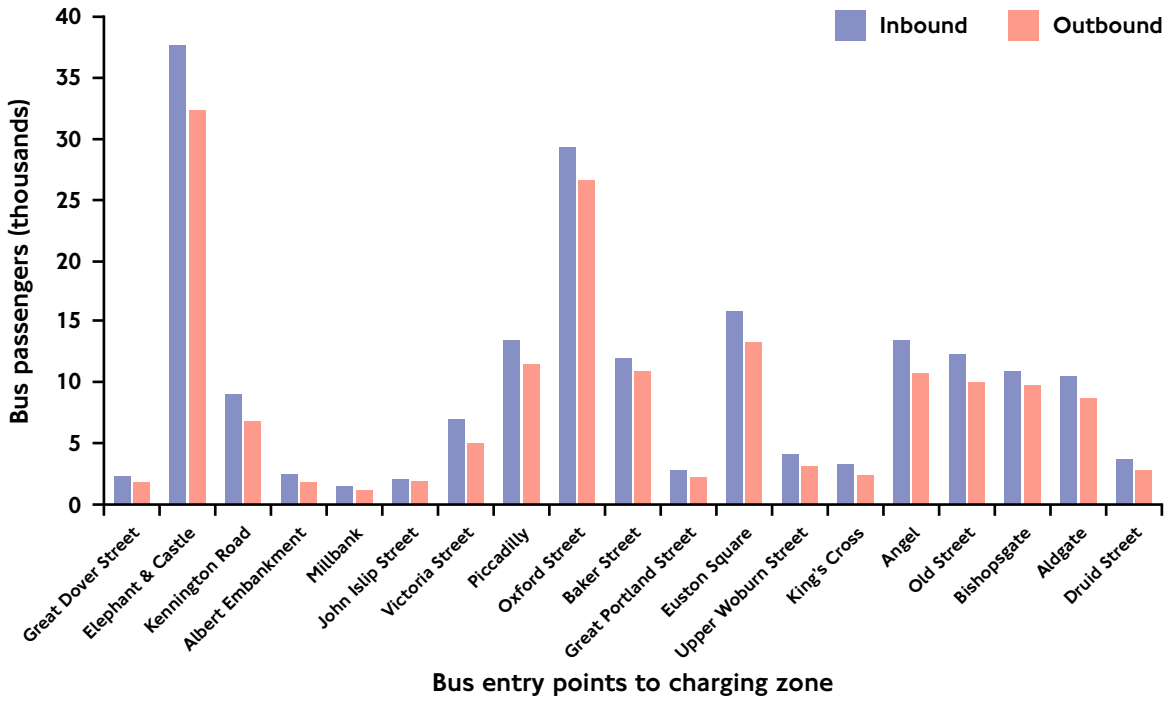


Figure 5.4. Total bus passengers crossing the charging zone boundary at all entry points between 07:00 and 18:30, Autumn 2002.



Bus network supply

As described above, London Buses reviewed the central area network and have implemented a range of improvements. The network will continue to be reviewed and amended as passenger demand dictates.

The Autumn 2002 surveys counted the number of buses crossing the boundary into the zone[2]. Across the boundary a total of 86 bus routes entered the charging zone at one or more sites. Approximately 20 percent of the service enhancements planned for congestion charging were in place at the time the surveys commenced.

These counts indicated a total of 2,400 buses crossing into the charging zone boundary in the morning peak period. Across the future charging period a total of 8,300 buses were recorded crossing the charging zone boundary inbound and 7,800 outbound.

Figure 5.5. Number of buses entering the charging zone between 07:00 and 10:00, Autumn 2002.

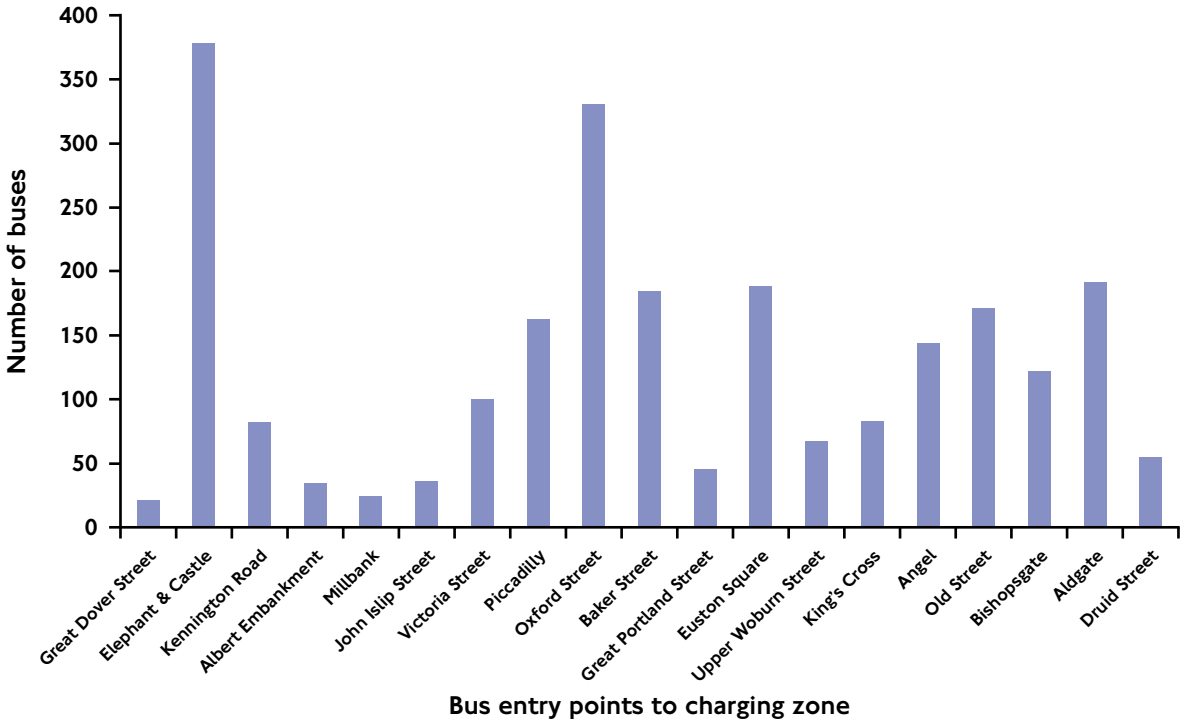
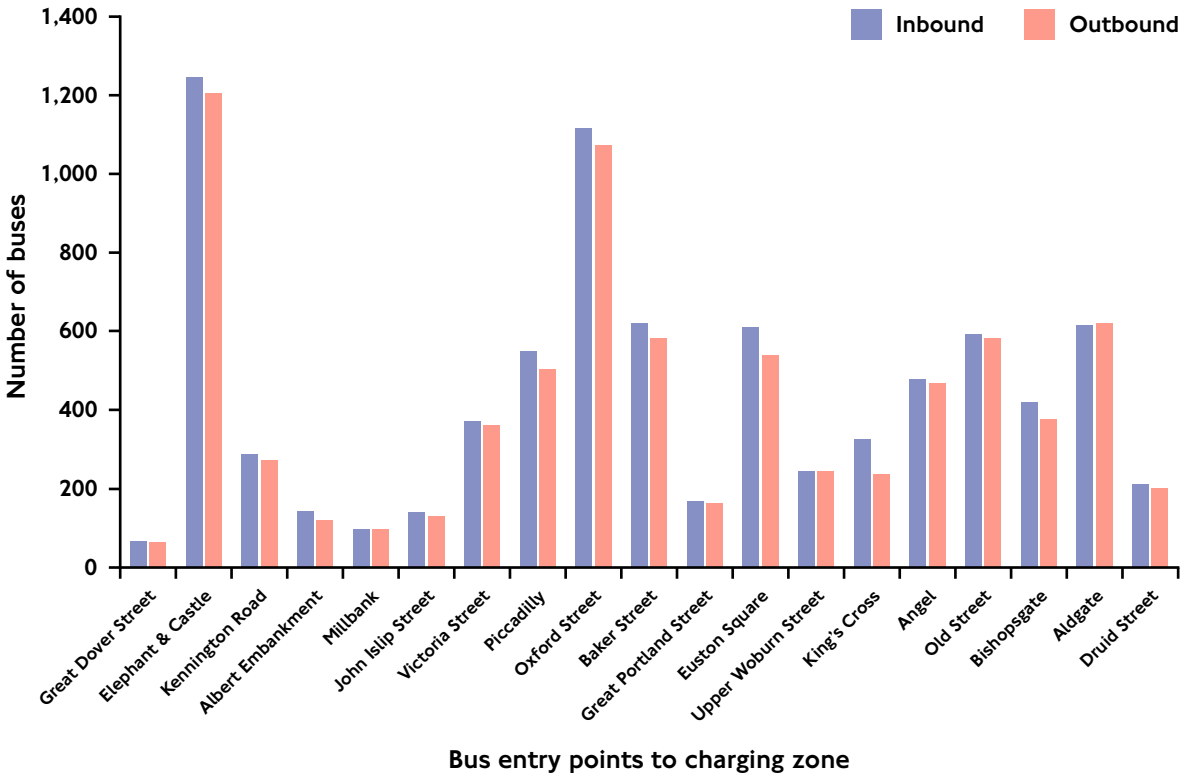


Figure 5.6. Number of buses crossing the congestion charging boundary 07:00 to 18:30, Autumn 2002.



The level of service provided is also monitored in terms of 'scheduled bus mileage'[3]. Changes in mileage can be as a result of changes to frequency, route structure or the introduction of completely new routes.

For the purposes of congestion charging monitoring, routes that either cross the boundary or operate wholly within the zone are grouped together as the 'Central (CZ) Group'. Routes that operate up to or along the Inner Ring Road, but not within the charging zone are grouped separately as the 'Central (IRR) Group'.

Between January 2002 and January 2003 there was an increase in scheduled mileage from 5.1 to 5.6 million km per 4-week period for the 'Central (CZ) Group'. In the 'Central (IRR) Group' there was a smaller increase from 1.1 to 1.3 million km per 4-week period.

In total there has been an increase in scheduled mileage of 630,000 km (10 percent) per 4-week period on routes operating within or on the Inner Ring Road between January 2002 and January 2003.

Bus occupancy

The number of passengers on buses is another key measure of the performance of the bus network in determining if service supply is meeting demand. Capacities of different buses vary, in general the maximum capacity is 69 to 77 passengers for Routemasters, 85 to 90 passengers for other double-deck buses, 50 to 60 passengers for standard single-deck buses and approximately 140 for articulated single-deck buses.

Bus occupancy: charging zone boundary

The Autumn 2002 surveys provide occupancies as an average for all bus types at entry points to the charging zone, providing a benchmark for comparison with future surveys.

Across all entry points on the boundary there are 32 passengers on average per bus entering the charging zone in the morning peak. The average occupancy across the day tends to be higher on journeys into the charging zone than out of it, reflecting the pattern of passenger movements.

Figure 5.7. Average occupancies on buses entering the charging zone, between 07:00 and 10:00, Autumn 2002.

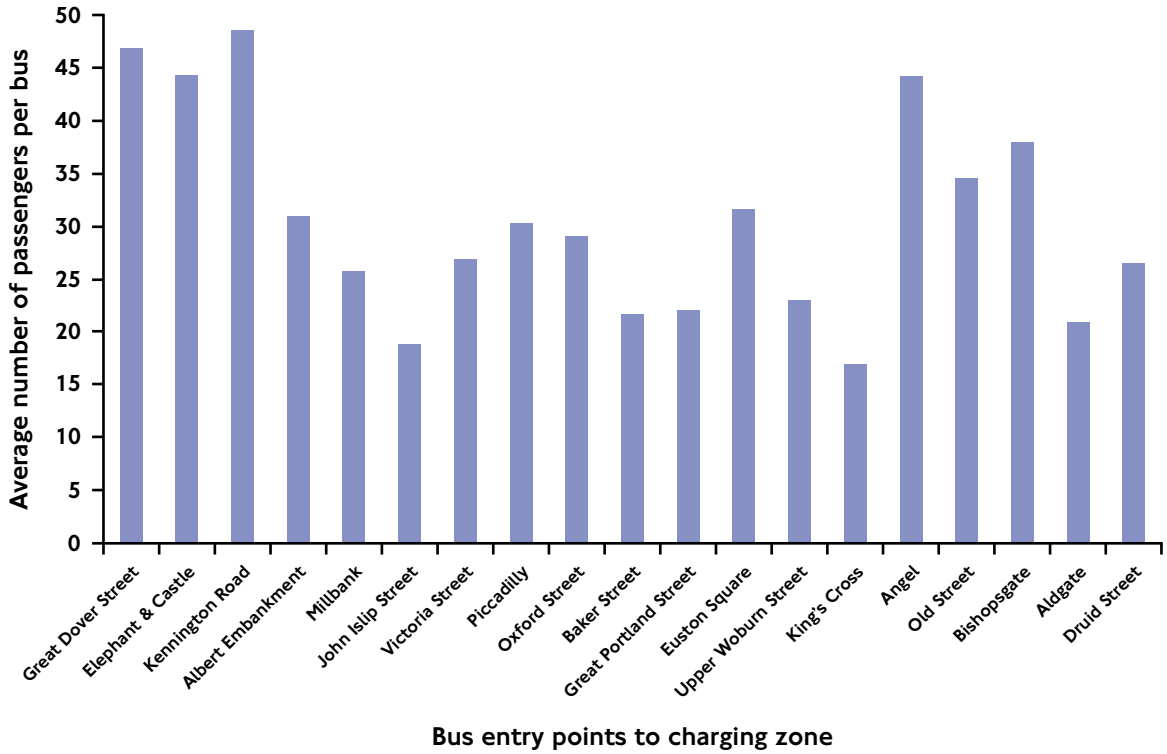
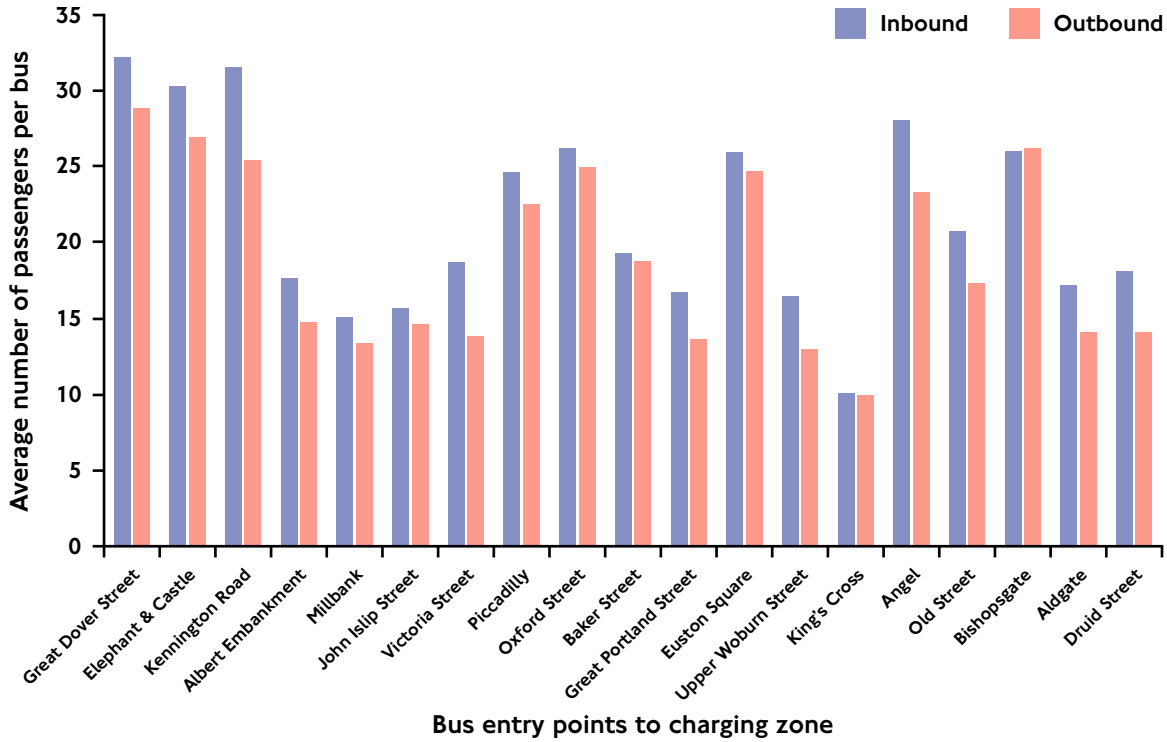


Figure 5.8. Average number of passengers per bus crossing the charging zone boundary between 07:00 and 18:30, Autumn 2002.



The occupancies of different bus types were recorded on buses entering the charging zone at five randomly selected sites during surveys completed in Spring 2002 and then as part of the Autumn 2002 counts.

The combined results for 2002 are shown as average occupancies in Figures 5.9 and 5.10. The same sites will be surveyed in 2003 for comparison.

Figure 5.9. Average number of passengers per bus by time of day, inbound, at a selection of sites on the charging zone boundary, Spring and Autumn 2002.

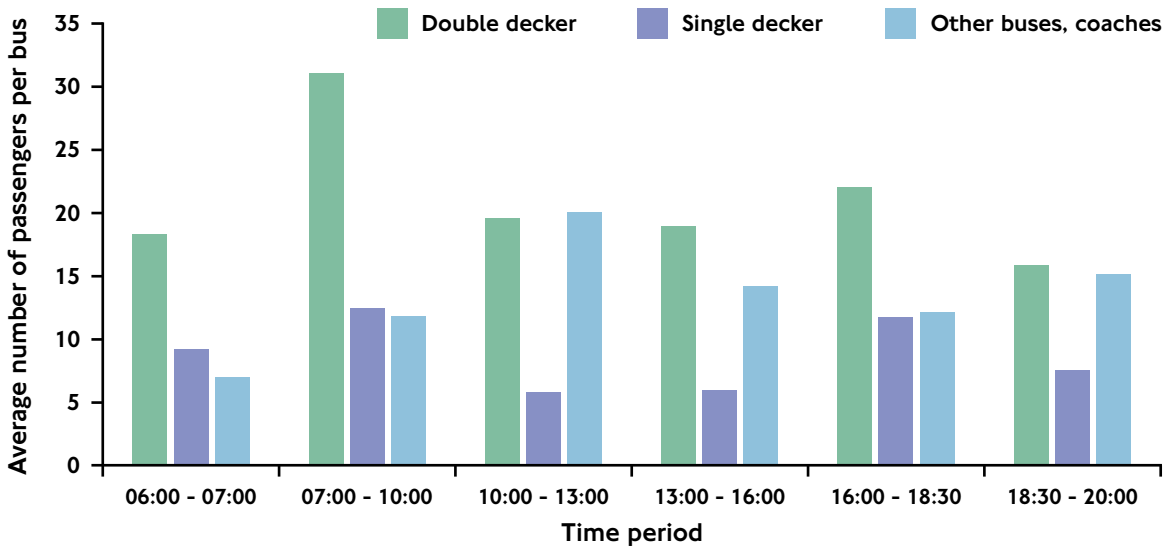
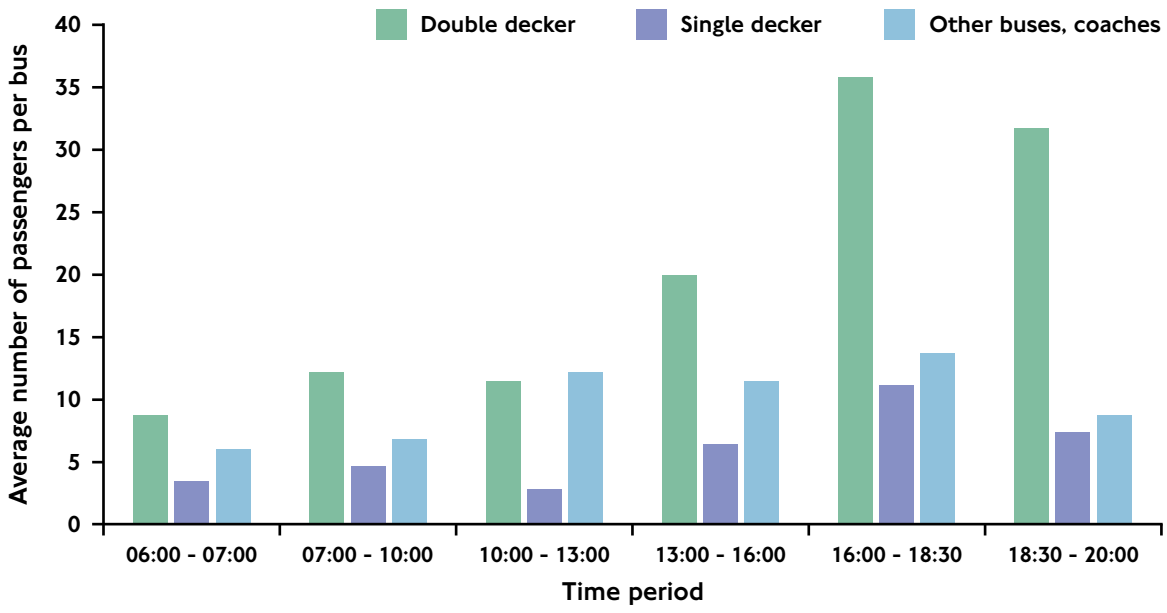


Figure 5.10. Average number of passengers per bus by time of day, outbound, at a selection of sites on the charging zone boundary, Spring and Autumn 2002.



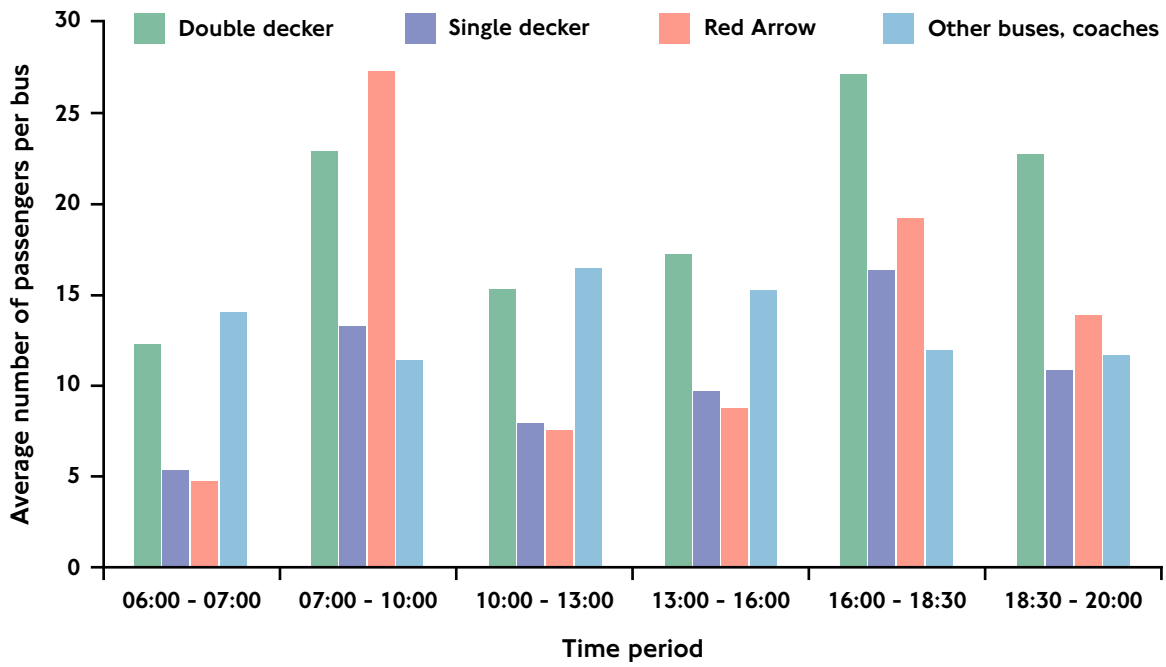
Bus occupancy: within the charging zone

Occupancy counts were completed at 13 randomly selected sites within the charging zone in Spring and Autumn 2002. These surveys also identify the average number of passengers on the different types of bus.

Where the sites are two-way roads both directions are surveyed, where they were located on one-way roads, only that direction was counted. They record average bus occupancy at those particular locations, not necessarily the points of highest occupancies and again the results are intended to provide a benchmark for comparison with future survey results.

The combined results of 2002 surveys are illustrated in Figure 5.11. On average there were 21 passengers on buses in the morning peak[4]. The same sites will be surveyed in 2003 for comparison.

Figure 5.11. Average number of passengers on buses at selected sites within the charging zone Spring and Autumn 2002.



Bus network speeds

If the level of congestion reduces as a consequence of charging, it is expected that overall traffic journey times will reduce and that average bus journey speeds will increase. London Buses monitor the progress of buses through a system called Marquis, comprising on-bus transponders interacting with a London-wide system of about 5,000 roadside beacons. This has a range of functions including route control by the operators, supplying information to Countdown screens and provision of data on bus journey times and speeds.

For the purposes of monitoring the future effects of congestion charging on bus movements, a sample of between 5 to 12 route sections have been selected in each of a range of geographical areas as follows:

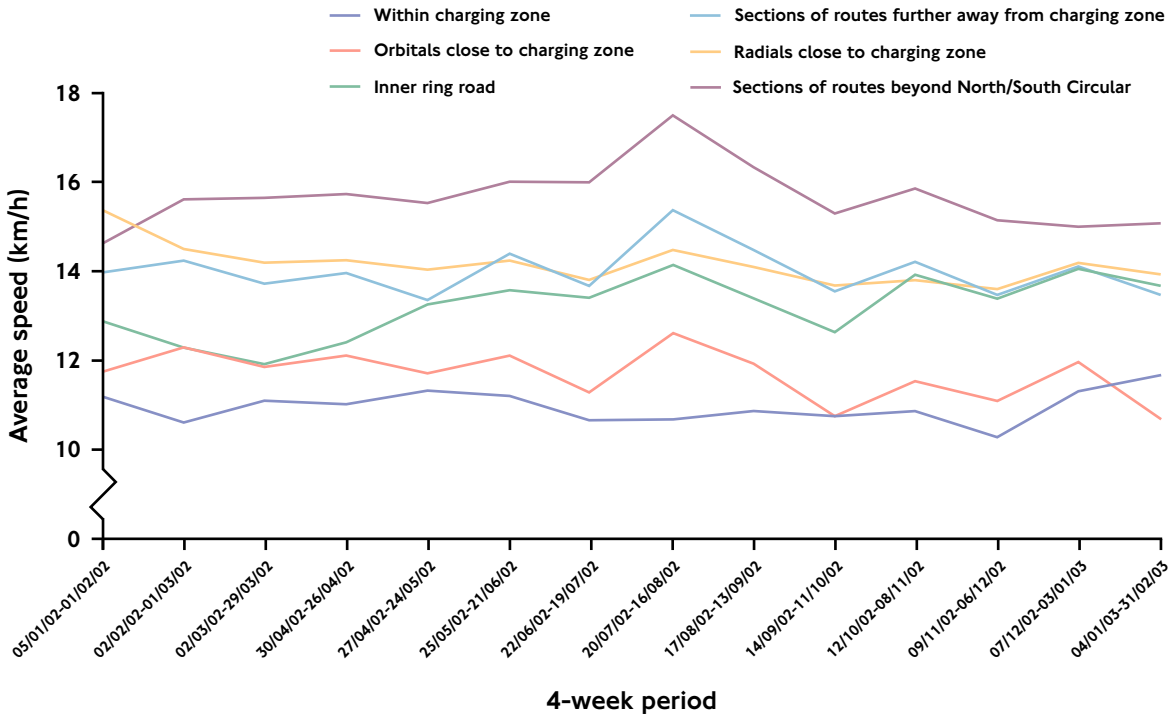
- inside the charging zone;
- on the Inner Ring Road;
- on the major approaches just outside the Inner Ring Road;
- on orbital roads just outside the Inner Ring Road;
- on the major approaches further away from the Inner Ring Road;
- outer London (beyond the North and South Circular Roads).

Average speeds are reported on a 4-week period basis and include all recorded journeys between the two selected beacons between 07:00 and 10:00 on weekdays. The speeds illustrated in Figure 5.12 include times when buses are stationary, for example at stops and junctions or in traffic queues[5].

In 2002 the average journey speed of buses travelling over the sampled sections within the charging zone remained broadly unchanged at around 11 km/h. This increased slightly to 11.6 km/h in January 2003, higher than the previous January. This may be as a result of the completion of the major roadworks that took place during 2002, which would have particularly affected routes in central London.

Average bus journey speeds over the sampled sections on the Inner Ring Road were slightly faster at around 12 to 14 km/h, and on sampled sections of radial routes just outside the Inner Ring Road speeds were generally between 14 to 15 km/h.

Figure 5.12. Average bus journey speeds for sampled sections of network, 07.00 to 10.00, weekdays, January 2002 to January 2003.



Bus reliability

Congestion increases bus journey times and adversely affects service reliability. Two main indicators are being reported; passenger's excess waiting time and data on scheduled and operated mileage, including the proportion of scheduled service which did not run due to traffic congestion.

Bus reliability: Excess Waiting Time (EWT)

A rolling programme of surveys conducted at bus stops observe intervals between buses compared with the schedule, the difference between the two being used to calculate an 'Excess Waiting Time' (EWT) indicator[6].

For high frequency routes (those scheduled to operate every 12 minutes or more during the day on weekdays) passengers are assumed to arrive at a bus stop randomly. The EWT is the difference between the actual wait time and the time passengers would wait, on average, if the service ran exactly as scheduled.

London Buses set standards for EWT based on the characteristics of the route. The minimum performance standards vary between 1.1 and 1.9 minutes. The difference between the actual EWT obtained from the on-street surveys and the standard is used as a key measure of reliability performance.

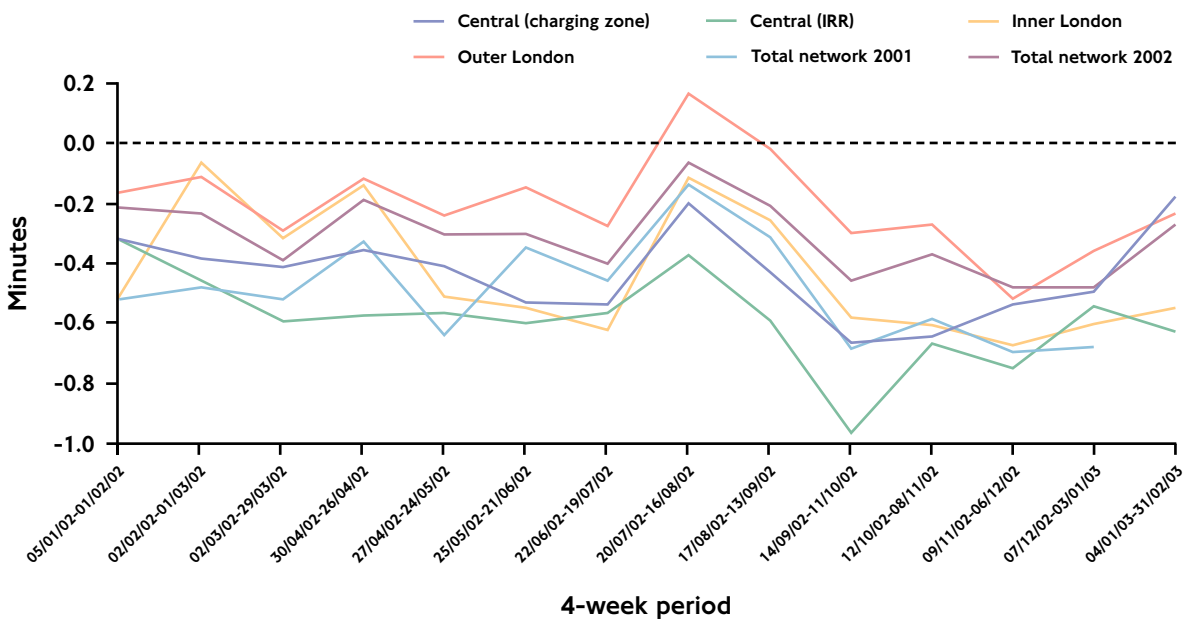
For the purposes of monitoring the impact of congestion charging on bus reliability, all high frequency routes are allocated to one of four groups:

- Central (CZ) – routes operating wholly within or crossing the charging zone boundary;
- Central (IRR) – routes operating along or up to the Inner Ring Road, but not within the charging zone;
- Inner London – routes operating mainly between the charging zone and the North/South Circular Roads;
- Outer London – routes operating mainly between the North/South Circular Roads and the Greater London boundary.

The results for routes during charging hours for each 4-week period are illustrated in Figure 5.13. All groups of routes were below minimum performance standards by up to 1 minute over the period shown, with routes in the central (IRR) group furthest below the standards .

The performance of the network as a whole is shown ('Total Network 2002') with the corresponding results for the previous year ('Total Network 2001'). This shows the seasonal effects, and that the performance in 2002 has improved on the corresponding results for the previous year.

Figure 5.13. Difference between EWT standards and actual EWT 07:30 to 18:30, January 2002 to January 2003.



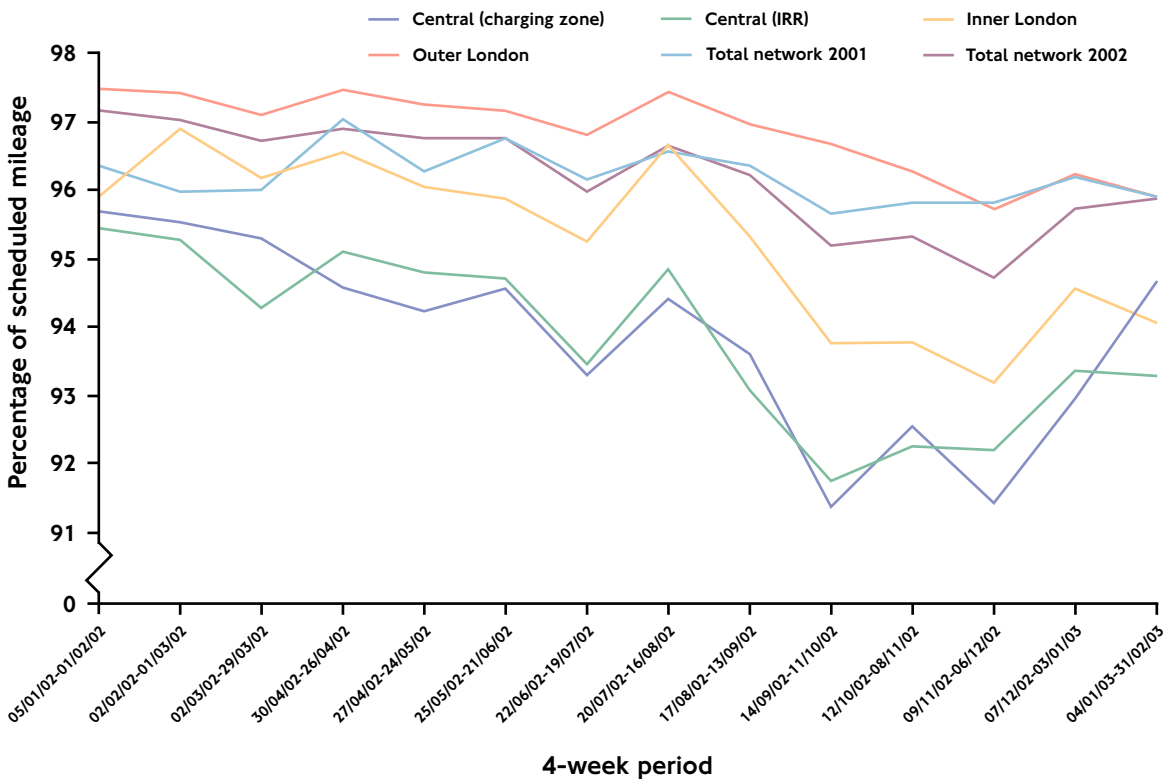
Bus reliability: operated mileage

The other key measure of reliability is the ability of a route to operate its 'scheduled mileage'. The scheduled mileage may not be achieved if a bus journey is not operated or if a journey is 'curtailed' short of its destination and is affected by all operating factors, including congestion. The operated mileage is expressed as a percentage of that scheduled and results for 2002/03 are illustrated in Figure 5.14.

Outer London routes operated the highest proportion of their scheduled mileage, with both the 'Central (CZ) Group' and the 'Central (IRR) Group' routes losing the most mileage. All groups of routes performed worse in January 2003 than in January 2002, although there was a marked improvement in the operated mileage results of routes in the 'Central (CZ) Group' since December 2002.

The trends for the whole network and the corresponding previous year reflected pronounced seasonal effects.

Figure 5.14. Percentage of schedule mileage operated, January 2002 to January 2003.



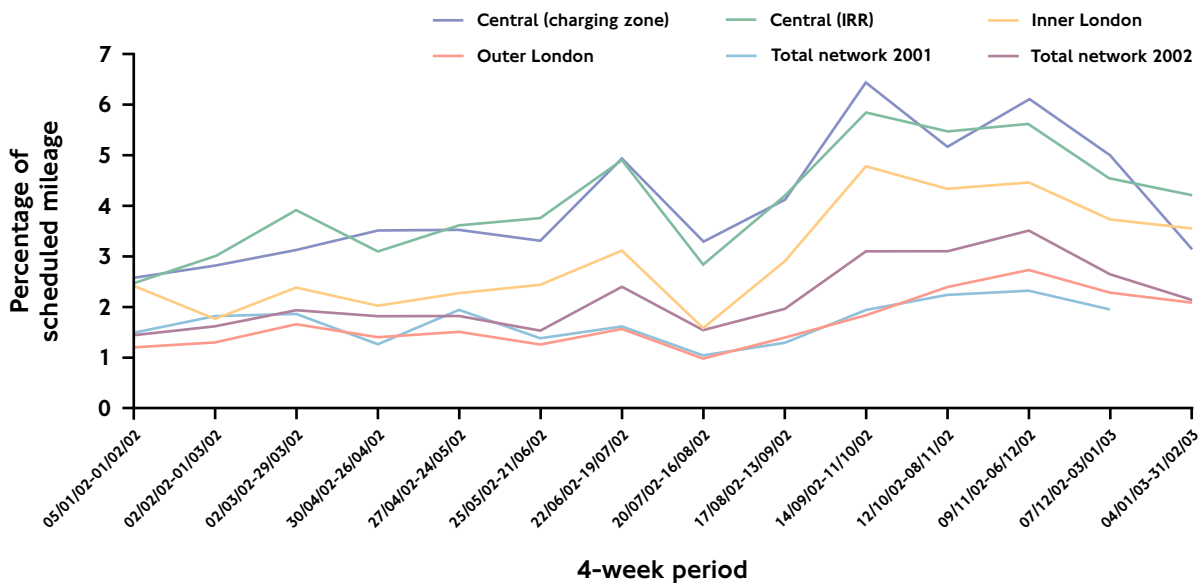
Bus reliability: lost mileage due to traffic delays

If scheduled mileage is not operated because of traffic conditions the route operators allocate this 'lost mileage' to 'traffic delays'. If there is a reduction in congestion along a bus route this should be reflected in a reduction in the proportion of mileage lost to traffic delays. This indicator should provide a direct measure of the impact of the charging scheme on bus operations. Results for 2002/03 are illustrated in Figure 5.15.

The recent trend shows an increase in traffic lost mileage even after seasonal factors are taken into account. On all route groups the results were worse in January 2003 than in January 2002. The proportion of scheduled mileage lost due to traffic delays increased from 2.6 percent to 3.1 percent for routes in the 'Central (CZ) Group' and from 2.5 percent to 4.2 percent for routes in the 'Central (IRR) Group'. This trend was also reflected in 'Inner London Group' and 'Outer London Group'.

In general it would appear that the routes most likely to be affected by the congestion charging scheme are, as a group, currently performing worst across the network as a whole.

Figure 5.15. Percentage of mileage lost due to traffic delays, January 2002 to January 2003.



Bus priority measures

Implementation of bus priority measures on a route is likely to have an effect on bus journey times and reliability.

There are individual 'on-bus delay' surveys of routes that have had extensive bus priority implementations. These will provide an indication of bus journey times before and after the enhancement measures, and will assist with distinguishing changes between congestion charging and other factors. Currently the post implementation surveys for bus priority rate are planned for Autumn 2003.

Table 5.2 shows the length of bus lanes implemented in London.

Table 5.2. Total length (kilometres) of bus lanes by area.

	August 2002	February 2003
Within the charging zone	20	21
On the Inner Ring Road	9	9
Rest of inner London	111	124
Outer London	42	48

5.5. Monitoring the Underground network

Congestion charging is expected to result in a small increase in passenger volumes on the Underground. Patronage will primarily be monitored through analysis of the Underground Ticketing System (UTS) gate data.

Other data collection programmes undertaken by London Underground that will provide useful information include: revenue (ticket sales) data, operational (service supply) quality-of-service data and attitudinal surveys.

Underground patronage

Traditionally Underground patronage has been monitored by LUL through a complex process of analysis of ticket sales and survey data. This is not considered adequate to monitor the potential effect of congestion charging on patronage levels, particularly within the charging zone.

To overcome this, LUL in conjunction with TfL have developed a process of analysis of the continuous UTS gate data to give numbers of passengers entering and exiting stations. It is still expected however, that it will be difficult to detect the small-scale changes to patronage that have been projected because of congestion charging against the normal variability in these data, resulting from seasonal and other factors.

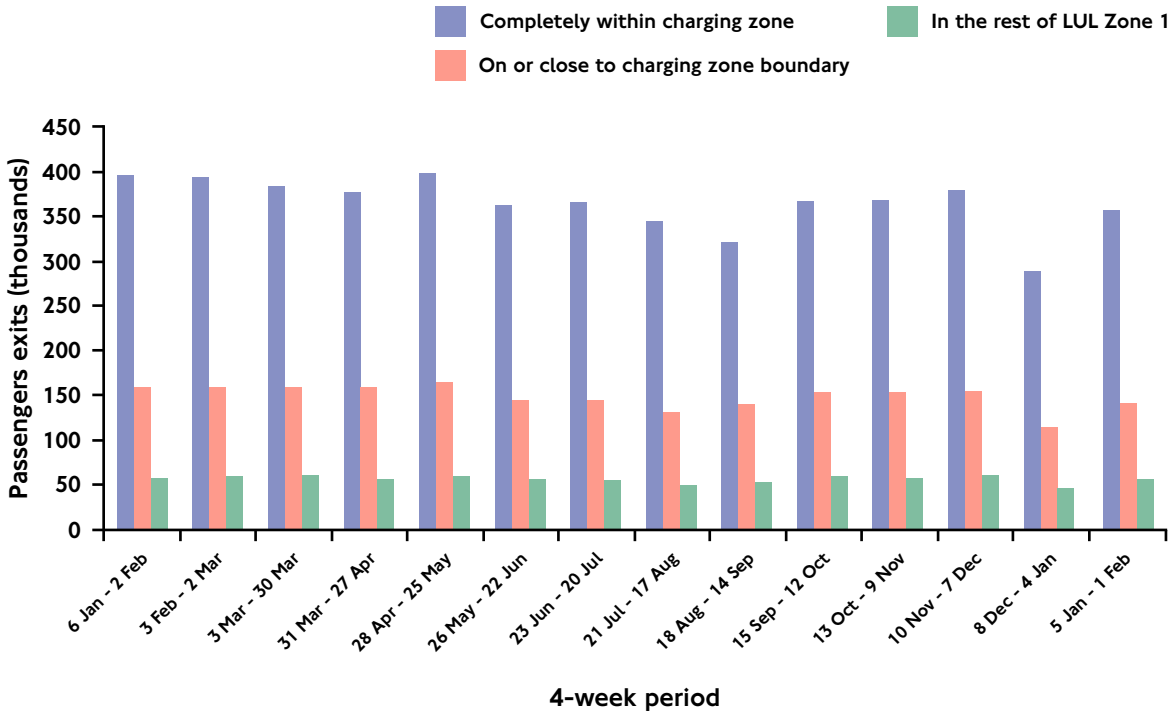
To minimise what can be considerable variation within the data, stations have been grouped into categories classified in terms of zones and their location relative to the future charging zone. These are then presented as a daily average for stations within that group within a 4-week period. The data excludes days, or stations, that are outside normal conditions, for example where there have been public holidays, disruptions or gates not working[7].

Figure 5.16. Map of Underground zones and classifications.

The most noticeable change in Underground patronage as a consequence of congestion charging is likely to be within the three areas within zone 1[8], as shown in Figure 5.16. In this area the most concentrated movements are passengers exiting stations in the morning peak period 07:00 – 10:00. Results of these are shown in Figure 5.17.

The reference period within the data below is considered to be the 4-week period in April/May 2002 when in total 547,000 passengers exited Underground stations in and around the congestion charging zone in the morning peak period: 382,000 from the 31 stations wholly within the charging zone and 164,00 from the 20 stations around the boundary.

Figure 5.17. Average Underground passenger exits per station during weekday between 07:00 and 10:00 by area, January 2002 to January 2003.

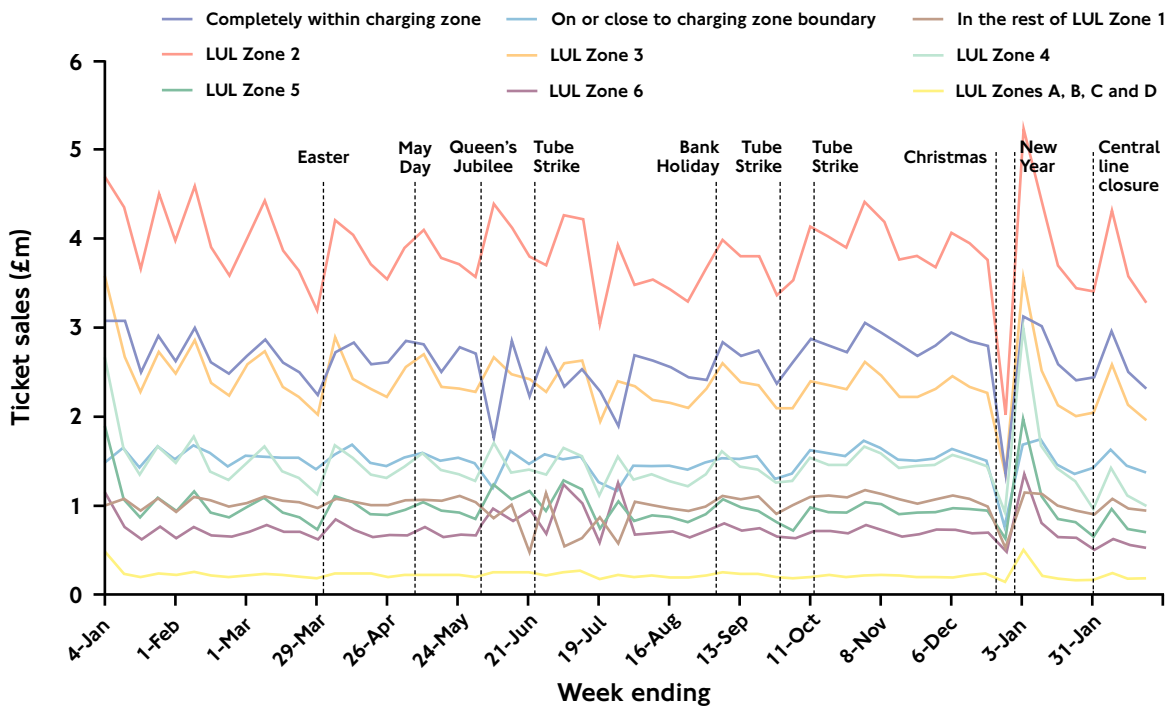


Underground revenue

In addition to gate data, ticket sales data has been provided by LUL. This is a reflection of revenue alone, and not the number of tickets sold, but does provide some evidence of change in trip patterns. This data is provided weekly and grouped into the same categories as for UTS gate data. Results are illustrated in Figure 5.18 and will have been affected by fare changes in January 2003.

Stations in Zone 2 collected the most revenue from tickets sales per week, £3.9 million in April/May 2002. Stations within the charging zone sold £2.7 million worth of tickets and stations around the charging zone boundary sold £1.5 million. However, travel associated with the congestion charging zone cannot be isolated.

Figure 5.18. Average total weekday Underground ticket sales per zone, January 2002 to January 2003.



Underground supply and reliability

Changes in patronage levels may be influenced by changes to the levels of service provided and reliability of the Underground. However, these are only available on a line or network basis and cannot be compared directly to any changes in patronage.

In 2002 there was an increase of nine trains in service in the peak period, between the District and Northern lines. There has been little variation in reliability, with 95 percent of mileage being operated on the whole Underground network in April/May 2002 as shown in Table 5.3. The closure of the Central and Waterloo and City lines will have contributed significantly to the poor results in January 2003 compared to the previous January.

Table 5.3. Underground network, operated kilometres as a percentage of scheduled, 2002.

6 Jan 2002 - 2 Feb 2002	3 Feb 2002 - 2 Mar 2002	3 Mar 2002 - 30 Mar 2002	31 Mar 2002 - 27 Apr 2002	28 Apr 2002 - 25 May 2002	26 May 2002 - 22 Jun 2002	23 Jun 2002 - 20 Jul 2002
94.4%	95.2%	94.3%	94.8%	95.2%	95.1%	90.4%

21 Jul 2002 - 17 Aug 2002	18 Aug 2002 - 14 Sep 2002	15 Sep 2002 - 12 Oct 2002	13 Oct 2002 - 9 Nov 2002	10 Nov 2002 - 7 Dec 2002	8 Dec 2002 - 4 Jan 2003	5 Jan 2003 - 1 Feb 2003
94.5%	94.7%	*95.8%	93.5%	*94.3%	95.1%	89.2%

*Excluding strike effects.

5.6. Monitoring the National Rail network

There are 22 National Rail stations that serve central London and the congestion charging zone.

Congestion charging monitoring utilises existing monitoring which provides a historic time series, undertaken by the Strategic Rail Authority (SRA) and the Train Operating Companies (TOCs).

National Rail patronage

Under settled conditions after charging is introduced a small number of former car-based trips to central London are expected to transfer to the National Rail network, resulting in increased travel by rail into the charging zone. This again presents difficulties in detecting a small-scale change against the backdrop of short-term fluctuations, seasonal change, medium-term changes to the pattern of service and longer-term change reflecting, for example, trends in employment.

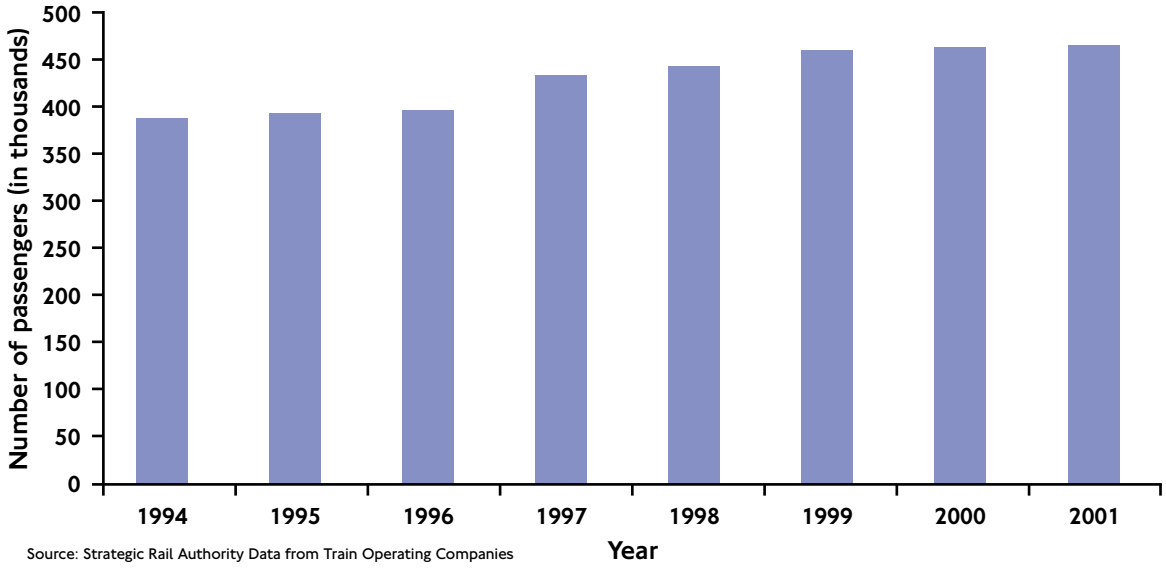
A new annual Spring count of rail passengers boarding and alighting at each station in and around the charging zone boundary has been implemented, first completed in Spring 2002 and will be repeated in 2003.

Previous to this there were counts undertaken for the SRA through:

- the 10-yearly London Area Travel Survey (LATS), of daily outbound counts at major central London stations, most recently in 2001/02. These are comparable to the relevant station outbound passenger counts of the new annual surveys, but not all stations are included. Results from the LATS rail surveys are considered provisional pending final release;
- the TOCs, with annual Autumn cordon peak period counts of surveys completed on-train. These can include through passengers that do not alight or board within central London, but generally can be considered comparable in terms of overall trends observed.

The results of the annual counts are illustrated in Figure 5.19. The total number of rail passenger arriving in central London in the morning peak has increased from 392,000 to over 461,000 between 1994 and 1999. This has remained steady between 1999 and 2001 with only a marginal further increase to 467,000.

Figure 5.19. National Rail passengers entering central London in the morning peak period, 1994 to 2001.

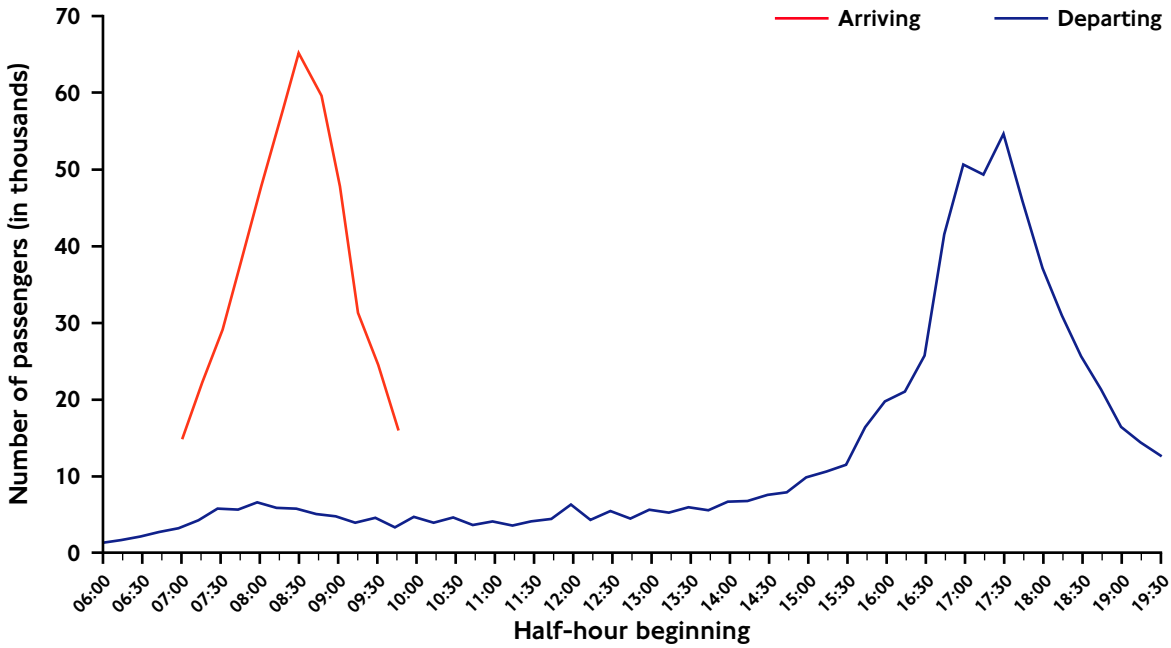


Source: Strategic Rail Authority Data from Train Operating Companies

Results of the Spring annual count of 2002 are shown in Figures 5.20 and 5.21. A total of 451,000 rail passengers entered central London in the morning peak period, within about 3 percent of the SRA sponsored survey the previous Autumn. However, considering the difference in survey methodologies it can be inferred that there has been relatively little change in rail patronage usage since 2001. Outbound there were 691,500 rail passengers between 06:00 and 20:00, and 564,000 within the charging hours.

The number of inbound rail passengers across all stations peaked at 08:30 to 08:45 in Spring 2002, and the busiest hour was 08:00 to 09:00 with 229,000 passengers. This is 50 percent of the total morning peak. The number of outbound rail passengers across all stations peaked at 17:45 to 18:00, and the busiest hour was 17:15 to 18:15 with 200,500 passengers.

Figure 5.20. National Rail passengers arriving at and departing from central London stations by time of day, Spring 2002.

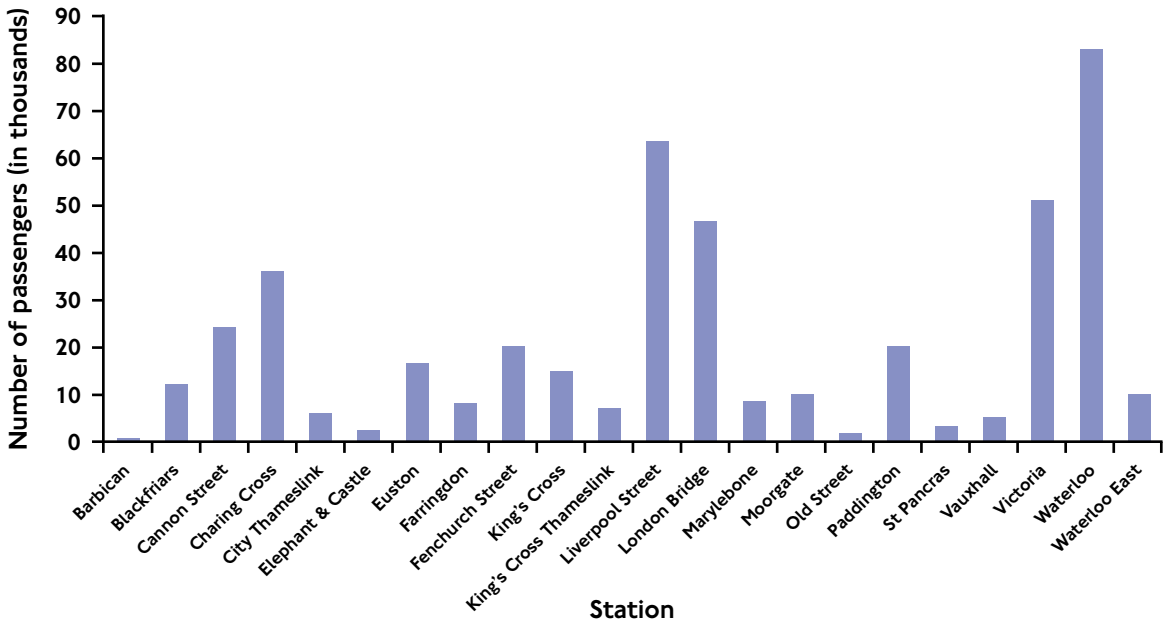


Analysis of the Spring 2002 counts at station level indicates Waterloo is the busiest station with 82,500 rail passengers arriving in the morning peak. This may have been higher than usual due to two platforms being closed at Vauxhall station at the time of the survey with some trains not stopping there but continuing direct to Waterloo. Nevertheless the 2001 inbound count was 72,000 in the morning peak, which confirms that Waterloo is the busiest station.

The next busiest station in the morning peak is Liverpool Street with 64,000, followed by Victoria with 51,000 inbound rail passengers in the morning peak. Again, it is likely that Victoria counts may have been affected by the closure of platforms at Vauxhall, the 2001 SRA count of inbound rail passengers was 59,000.

Waterloo remains the busiest station when considering daily outbound flows with 121,000 rail passengers. However, total outbound counts indicate that Victoria has a higher passenger flow than Liverpool Street, 91,000 with compared to 88,000. The difference between the peak and all day counts at Liverpool Street and Victoria indicate that travel into Liverpool Street is more peaked in the morning period than at Victoria.

Figure 5.21. National Rail passengers arriving in central London during the morning peak period by station, Spring 2002.



5.7. Monitoring the Docklands Light Railway (DLR)

There are two stations on the DLR within the charging zone, Bank and Tower Gateway. The network can be seen in Figure 5.16. The DLR is operated and monitored by TfL, and is separate to LUL.

DLR patronage

Docklands Light Railway counts are completed at the access-ways of passengers exiting and entering using a video recorder. These are validated by manual counts[9].

Passenger count results for exits and entries are daily averages for each station within a 4-week period and illustrated in Figure 5.22 and 5.23. In April/May 2002 there were on average 7,800 exits in the morning peak period from Bank station and 2,100 from Tower Gateway.

The number of passengers exiting these stations for the whole of the charging day, show similar variations because of seasonal effects. Across the future charging day around 23,000 passengers exited both DLR stations within the zone in January 2002, the same as in January 2003.

Figure 5.22. Average weekday passenger exits within the charging zone from the DLR between 07:00 to 10:00, January 2002 to January 2003.

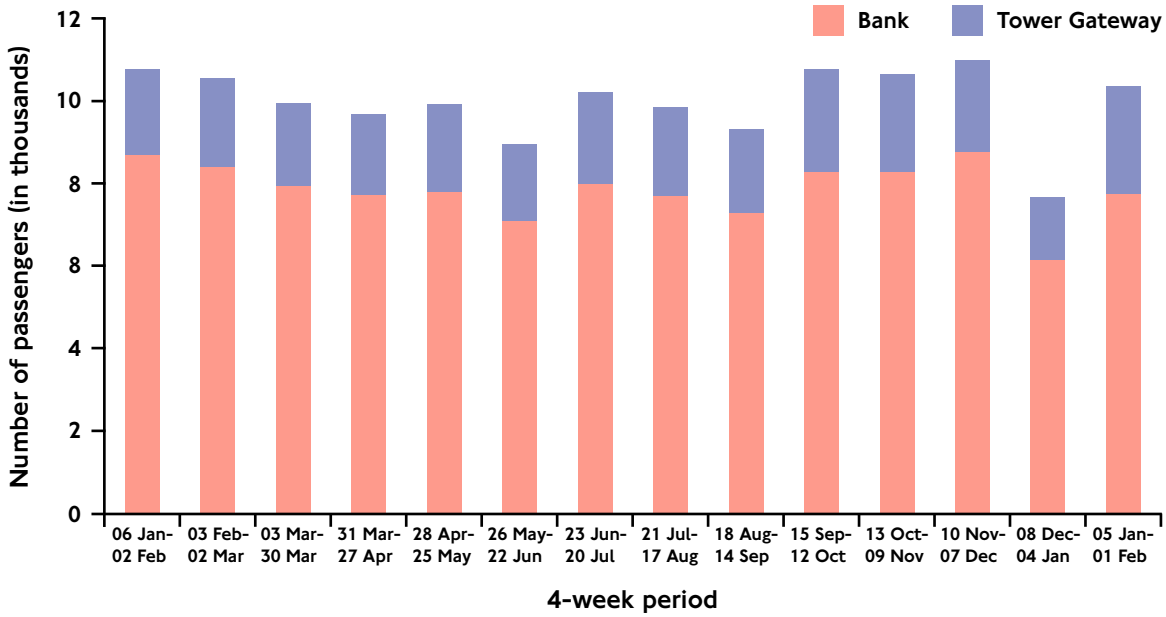
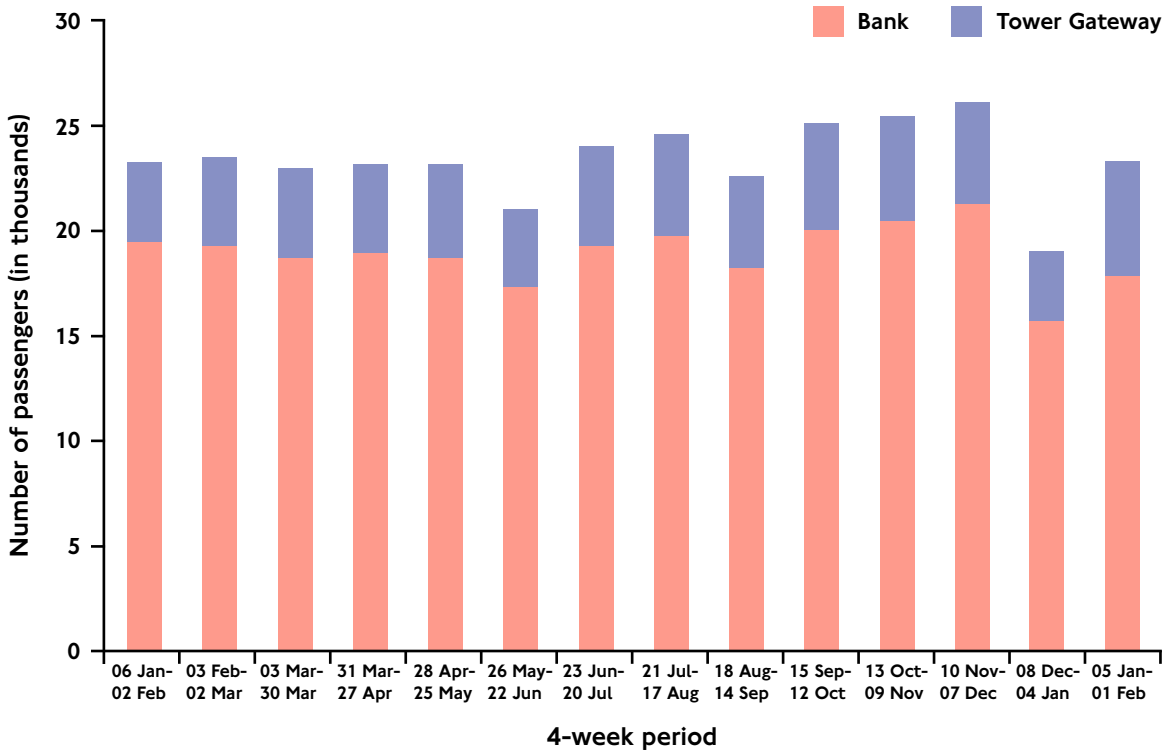


Figure 5.23. Average weekday passenger exits within the charging zone on DLR between 07:00 and 18:30, January 2002 to January 2003.



DLR service level

The increase is passenger usage could be influenced by improvements in service level.

In August 2002:

- services terminating at Bank were increased from every 4 to 5 minutes to every 3 to 4 minutes during the peak periods;
- services terminating at Bank and Tower Gateway had both the morning and evening peak periods extended by up to an hour, now 06:30 to 10:00 and 16:00 to 19:00 in the peak direction.

5.8. Public transport passenger views

If the public transport network is affected by congestion charging it is likely that the views of public transport users may change. There are a number of passenger surveys considered to be reasonably representative of the users of London's public transport networks. Generally they aim to measure passengers' satisfaction of different aspects of the journey they are making at the time of the survey and to gain a deeper understanding of their travel patterns.

Data for buses, Underground and DLR is included here. Indicators for rail services cannot be identified at a London level.

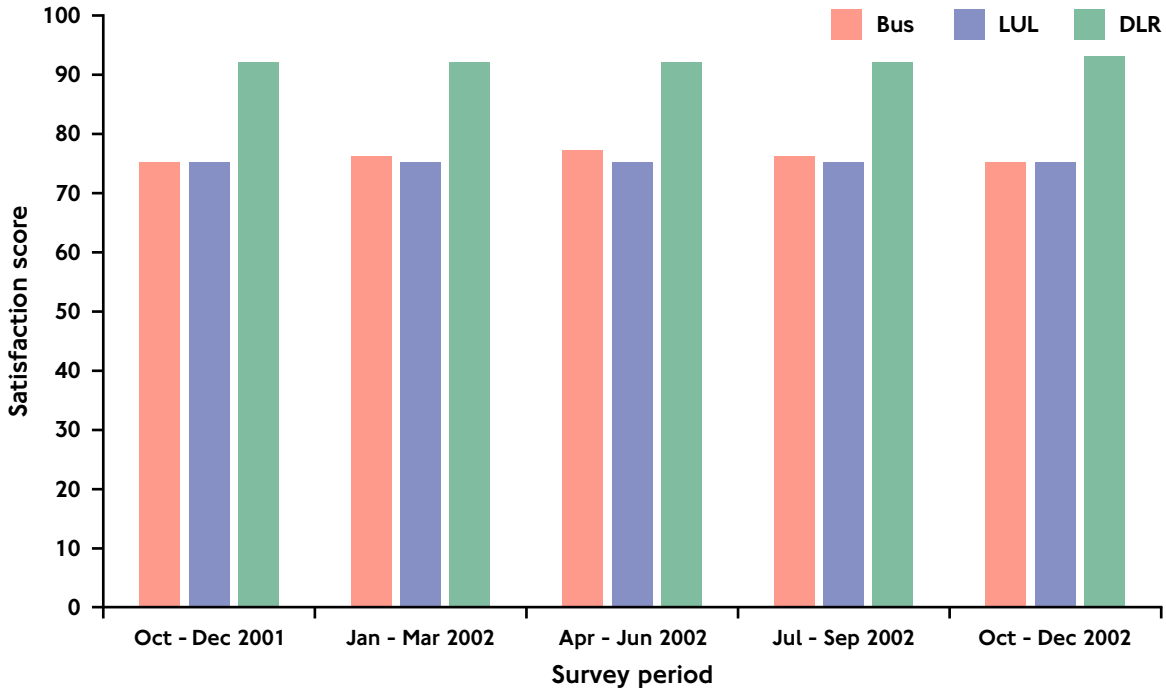
Levels of satisfaction across the whole of the Greater London public transport network give an indicator of general trends. Generally customers are asked to score aspects on a scale of 0 to10, which is then aggregated to an overall index score.

It is important to note that the evaluation system on the DLR varies from that used on bus and Underground surveys. Initial trials of evaluating the DLR on a comparable system have indicated similar levels of satisfaction between all public transport modes.

Overall satisfaction

Between October 2001 and December 2002 the overall evaluation of public transport services increased marginally on the DLR from a score of 92 to 93, varied on buses from between 75 to 77 with October to December the same in 2002 as in 2001, whilst the Underground has remained stable at 75.

Figure 5.24. Overall customer satisfaction with public transport in London, October 2001 – December 2002.



Bus passenger satisfaction

It is likely that aspects of bus travel are more likely to be affected by congestion charging than those made on the Underground or DLR.

Satisfaction with various elements of a bus journey made by passengers alighting within the charging zone can be identified separately from those passengers that alight elsewhere on the network.

The score given by passengers surveyed alighting within the charging zone of their overall bus journey has further improved from 77 to 79 between January 2002 and February 2003.

Passengers alighting within the charging zone were less satisfied with the time they had to wait for their bus, than the time their journey on the bus took.

Choice of public transport over car

A question used in the bus and Underground passenger surveys identifies if a car was available as an alternative mode of transport for that journey. The bus survey probes if a car was a practical alternative whilst the Underground survey asks if a car was available. The significance of the difference between these is open to interpretation, but for these purposes we will consider them comparable.

To identify the reasons why public transport users do not use their car where it is a practical alternative an additional question has been included specifically to monitor the impact of congestion charging with regard to this:

'Why did you choose to use the bus/Underground over the car?

Bus/Underground is more convenient
Do not need to worry about parking
Do not want to pay congestion charge*
Bus/Underground is cheaper
Bus is more relaxing**
Party is too large for the car
Do not need to worry about alcohol consumption
Car was not available for whole period
Other'

*(only included after charging introduced on 17 Feb 2003)
**(only included on Bus Passenger Survey)

This question, without the congestion charging option, was included on the Underground Users Survey between May 2002 and February 2003 and on the Bus Customer Satisfaction Survey between October 2002 and February 2003. Available results of questions relating to choosing public transport over car are illustrated in Figures 5.25 to. 5.27.

The majority of Underground users surveyed responded that a car was not available for that journey.

The majority of bus users surveyed alighting from buses within the charging zone also responded that a car was not a practical option for that journey.

Users who felt a car was available to use for that journey were then asked why they chose the Underground over the car. The majority of respondents, 59 percent, felt that the Underground was more convenient, and the majority of the rest, 34 percent, because it avoided the need for parking.

Figure 5.25. Bus passengers whose destination was within the charging zone: 'Would making this journey by car have been a practical option for you?' (October 2001 to October 2002).

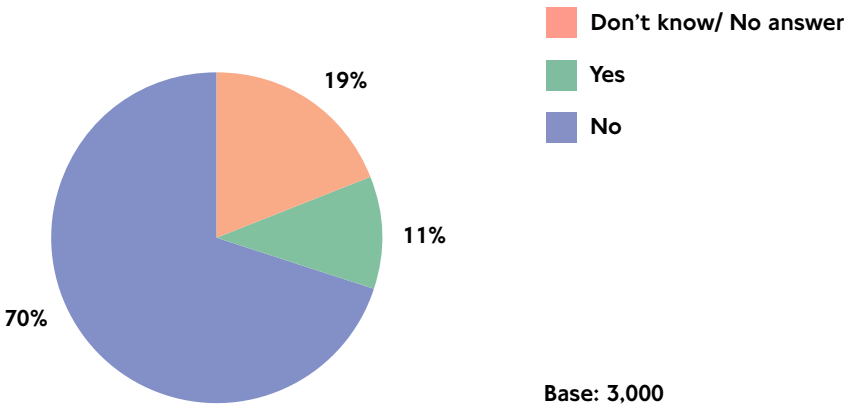


Figure 5.26. Underground passengers whose destination was within the charging zone: 'Was a car available for you to use to make this particular journey?' (January to August 2002).

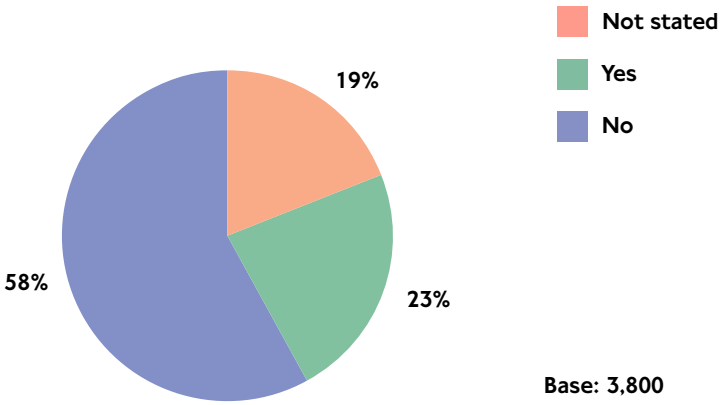
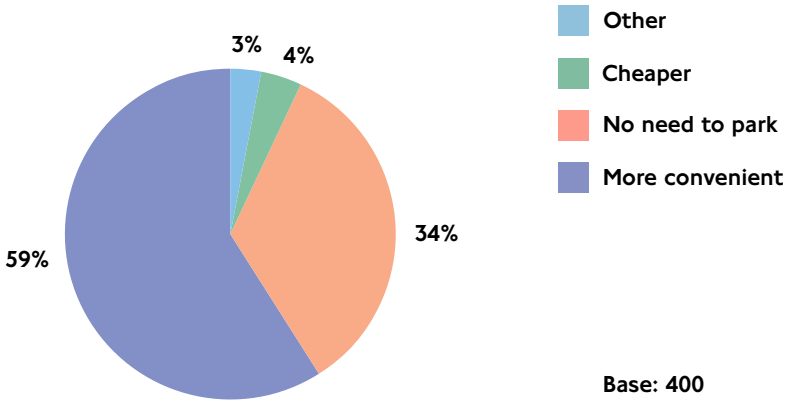


Figure 5.27. Underground passengers who felt a car was available and whose destination was within the charging zone: 'Why did you choose to use the Underground over the car?' (May to August 2002).



Technical notes

1 The data from Keypoints Surveys are factored up for a 45 minute break in the surveys in the morning inter-peak period.

2 **Table 5.4. Bus routes included in the Autumn 2002 boundary counts.**

Site	Routes included Autumn
Great Dover Street	21
St George's Rd / London Rd / Newington Causeway	1, 12, 35, 40, 45, 53, 63, 68, 133, 171, 172, 176, 188, 343, 468
Kennington Road	3, 59, 159
Albert Embankment	77, 344
Millbank	77A
John Islip Street	88, C10
Victoria Street	11, 24, 211, 507
Piccadilly	8, 9, 14, 19, 22, 38
Oxford Street	2, 6, 7, 10, 12, 15, 23, 73, 74, 82, 94, 98, 137
Baker Street / Gloucester Place	2, 13, 30, 74, 82, 113, 139, 189, 274
Great Portland Street	88, C2
Gower Street / Tottenham Court Road	10, 24, 29, 73, 88, 134
Upper Woburn Place	59, 68, 91, 168
Gray's Inn Road / King's Cross Road	17, 45, 46, 63, 259 (Southbound only)
Rosebery Ave / St John St / Goswell Road	4, 19, 38, 56, 153, 341
Old Street / City Road	43, 55, 76, 141, 205, 214, 243, 271
Bishopsgate	8, 26, 48, 149, 242
Aldgate High Street / Tower Hill	15, 25, 42, 67, 78, 100, 115, 205, 253
Druid Street / Tooley Street	47, 381, RV1

Note: at Bishopsgate routes 35, 47 and 78 were not included in the count as they were terminated at Shoreditch Triangle from the north due to roadworks for the duration of the surveys. It is expected that passengers would have transferred to alternative routes.

3 Bus route mileage figures are based on Monday to Friday, excluding Public Holidays – broken down into 4-week periods.

4 Red Arrow Routes, a small network of routes serving National Rail stations, have an average of 27 passengers on a bus in the morning peak period. It should be noted that occupancies may have been affected by a change in the bus types operating on these routes from single deck buses in the Spring counts, to articulated vehicles in the Autumn counts. In the Spring on average there were 21 passengers per bus and in the Autumn this rose to 34 passengers on Red Arrow Routes in the morning peak period.

5 The overall speeds supplied by London Buses for a given group of routes is based on a weighted average, whereby the result for each individual route is weighted by its scheduled frequency (buses per hour in the AM peak). This has been done with the aim of providing a better representation of average experience within the route group, on the assumption that scheduled frequency is a broad proxy for volume of passengers carried.

6 Bus route EWT figures are based on Monday to Friday, between 07:30 and 18:30, high frequency routes only. Low frequency routes (those operating at four buses per hour or less) tend to be concentrated in outer London and are therefore excluded from this analysis. The network figures represent data across the whole week.

Table 5.5. Number of high frequency routes in Excess Waiting Time (EWT) data, September/October 2002.

	Number of high-frequency routes
Charging Zone	83
Inner Ring Road	17
Inner London	32
Outer London	192

7 If the standard deviation of patronage in an Underground station, or a day within the period, is outside 10 percent of the mean, the station, or day, will be excluded. The data is presented in terms of average per station as the number of stations included in a period can vary. The 95 percent confidence limits for the resultant average daily total for all stations have been assessed for Zone 1 in a 4-week period to be plus/minus 5 percent. Stations in the patronage data do not include stations that do not have automatic gates. These, however, are counted manually every November.

Table 5.6. Number of Underground stations in each group.

	Number of stations per group
Completely within the charging zone	31
On or close to the charging zone boundary	20
Rest of Zone 1	11
Zone 2	73
Zone 3	45
Zone 4	38
Zone 5	29
Zone 6	19
Zones A,B,C,D	7

8 The underground patronage data for the 4-week period 5 January – 1 February 2003 does not include data after the closure of the Central and Waterloo and City line, which occurred after an accident on 26 January.

9 The DLR passenger counts are reported in 20 minute intervals therefore to determine the number of passengers between 18:20 to18:30 the loads between the period 18:20 to 18:40 are divided by two. The system requirements are that the camera counts should not differ from the manual count by more than 3 percent. Overall the tests have actually shown less than 1 percent difference.

7. Business and economic impacts

7.1. Introduction

London's economy is extraordinarily complex and is subject to a wide variety of short- and long-run influences. It is also unique, particularly in central London, and has no equivalent that could be used as a 'control' to account for these influences in the absence of congestion charging. Disentangling any significant effects of the scheme on London's economy will therefore be a challenging task, but it is essential if the full implications of congestion charging for London are to be understood.

7.2. Expected economic impacts

At a general level, congestion charging in central London is not expected to affect significantly the overall economy or competitive position of London. Transport for London has produced estimates of the benefits in terms of quicker and more reliable journeys, offset by the costs of implementation, operations and the costs of complying with the scheme. It has examined, in broad terms, the financial implications on different categories of road user. These estimates can be refined as monitoring data becomes available. In overall terms, even with respect to individual businesses, these effects are expected to be marginal.

Indirect benefits to business might be expected from improved public transport and environmental amenity, but these and a whole host of other less tangible effects will take some time to feed through to any measurable effect on the 'attractiveness' of central London as a place to do business.

In considering the economic impacts of the scheme, we also include here a broad range of 'non-commercial' activities, ranging from the public services to the voluntary sector. These share many characteristics with businesses in terms of the need to recruit and retain staff, organise transport and logistical operations, and optimise financial performance, all of which could potentially be affected by congestion charging.

Within both of these groups there are a number of activities which, by virtue of their location, type of business or other characteristics, may be affected to a greater degree than the generality of activities, perhaps in quite specific ways. One of the ways in which these have been drawn to our attention has been through the consultation exercises that have been held for the scheme. It is therefore important that research into the general economic impacts of the scheme is complemented by specific studies of these activities.

7.3. Objectives of the monitoring programme

The objectives of the business and economic monitoring programme can be defined as:

- to take account of longer-term underlying trends and influences upon the London economy, and to consider the impact of congestion charging on these influences and trends;
- to understand how the business community perceives, responds to and is affected by congestion charging;
- to measure the range and intensity of impacts upon businesses and other organisations at the general level;
- to monitor the effects of the scheme on those activities that are of specific stakeholder or technical interest.

The work outlined below aims to meet these objectives through tracking a mixture of strategic and specific economic indicators in conjunction with attitudinal surveys that examine the expectations and experiences of businesses and organisations in and around central London.

7.4. Summary of the programme

A summary of the components of the economic monitoring programme has been given in Section 2.1. Each of the components has specific objectives, but all are designed to be complementary.

Strategic economic trends and influences

This consists of essentially desk-based research that will, over time, enable an understanding of the role of congestion charging in the economic evolution of London. There are two elements to this work:

- top-level economic indicators will be assembled, ranging from gross domestic product, employment, and business turnover, to sector-specific data such as indices relating to tourism, health service operations and commercial and residential property prices; and any emerging 'background' trends will be identified. Transport for London will work with the originators of these data to understand the trends, their significance, and the relative impact of congestion charging on these indicators;
- economic modelling techniques will be used to attempt to determine the economic consequences of behavioural change by businesses. This will use the strategic data described above, the more micro-scale information arising from the specific surveys described below, and the wealth of transport-related data arising from elsewhere within the monitoring programme e.g. to estimate the 'value' of decongestion effects.

An overview of some of the main economic trends prior to charging is given in Section 7.5.

General business surveys

Three general surveys of businesses and other organisations have been put in place. These surveys aim to measure, within the limitations imposed by attitudinal-based interview surveys, the range of attitudes, experiences, adaptations and outcomes experienced by a representative cross-section of central London businesses.

- The first survey consists of in-depth face-to-face interviews with strategic business decision-makers in a sample of 100 organisations within the charging zone. A sample of this size (or indeed of any size within a reasonable budget) will not be 'representative', in the strict statistical sense, but the sample has been stratified by size and sector so as to be generally reflective of the London business community.
- Secondly, an essentially similar, telephone-based survey of 500 businesses located inside the charging zone and up to 500 metres outside its boundary was implemented to extend the range of employer surveys.
- Finally, in recognition of specific issues affecting businesses (particularly small and medium-sized enterprises) located in the vicinity of the charging zone boundary, a separate depth-interview survey of over 50 organisations is being undertaken within the Boundary Case Study Area (see Appendix 6).
- In addition to the above surveys, employee travel surveys among a sub-set of respondents to the in-depth business surveys are being conducted. These will not generate robust estimates of overall travel-to-work, travel-for-work or mode share patterns, but will enable identification of changes in the context of surveyed organisations, and some exploration of the reasons behind them, to complement the more robust estimates of travel change derived from elsewhere in the monitoring programme.

Collectively, assessment of these impacts will draw on data from over 650 organisations, the intention being to re-visit the same organisations at intervals over the next four to five years.

Initial rounds of all three surveys were carried out in the Autumn of 2002 and will be repeated on an annual basis for the next four to five years. Findings will be useful in their own right in tracking the key impacts on London business, but it is also expected that insights gained will feed into the higher-level strategic work described above, in terms of guiding this analysis and 'measuring' the scale of influence.

Some illustrative results from the first round of these surveys are discussed in Section 7.6.

Organisations and activities of specific interest

General surveys of the type described above will only incidentally include businesses or other organisations that have been identified as requiring specific, in-depth monitoring. These activities crystallise around the essential public services such as health and education, but also encompass a diverse range of subjects either reflecting location- or activity-specific concerns, or issues of a more general interest.

The business and economic monitoring programme therefore includes a series of 'case studies'. The case studies all aim to explore in detail the effects of the scheme on a particular area of economic or public service activity, using techniques appropriate to the issues under study. Studies for which comprehensive pre-scheme data have been collected include:

- central London hospitals;
- the wholesale market at New Covent Garden;
- commercial and local authority parking;
- schools in and around the charging zone.

Additional work is also being undertaken on aspects of the motorcycle market and the voluntary sector.

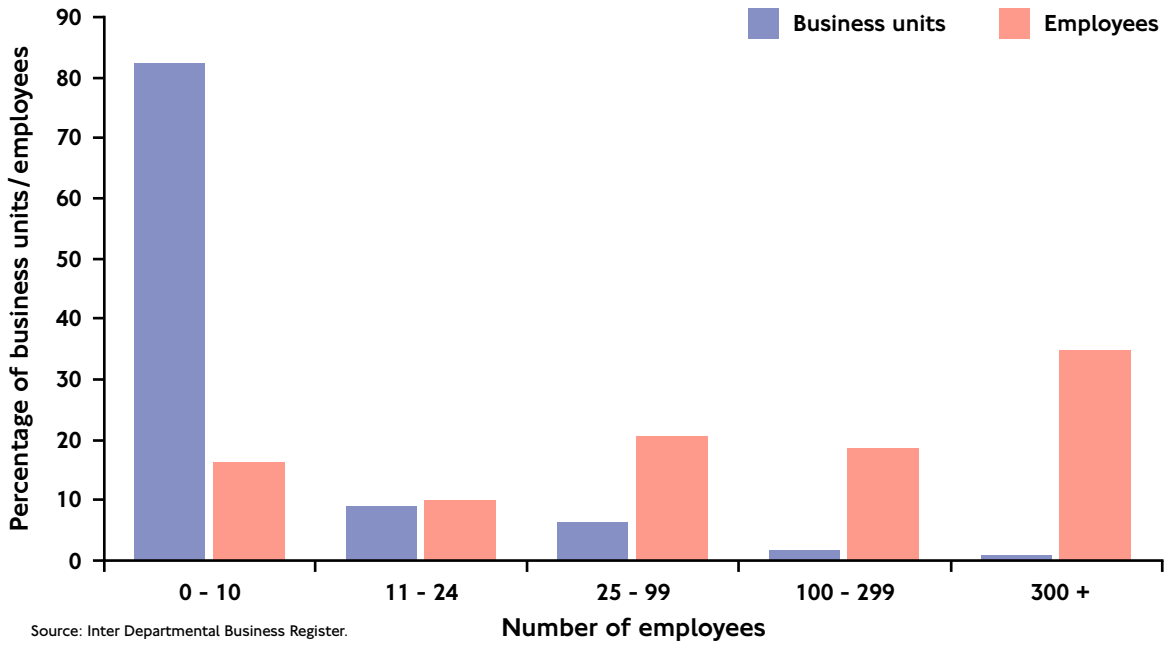
7.5. The central London economy

Central London is the 'powerhouse' of the British economy and a key location for attracting global investment and tourism. This section presents a selection of recent statistics describing the role and character of businesses inside the charging zone. It also sets out some recent trends in key economic indicators, and introduces some of the issues that must faced when looking to monitor the effects of congestion charging on the economy. It is not expected that future changes in any of these indicators will reflect, either directly or indirectly, the effects of congestion charging. Nevertheless, an understanding of prevailing economic trends in central London is essential if the overall economic impacts of the scheme are to be understood.

Profile of businesses in the charging zone

Figure 7.1 shows the distribution of businesses and other organisations in the charging zone in terms of their size (number of employees on site). The majority are relatively small, with 82 percent employing 10 people or less. However, a small number of large organisations (i.e 300 plus employees) in the charging zone account for 35 percent of employees. This reflects the presence of many large offices of multi-national companies, particularly in the financial services industry, and some large government establishments.

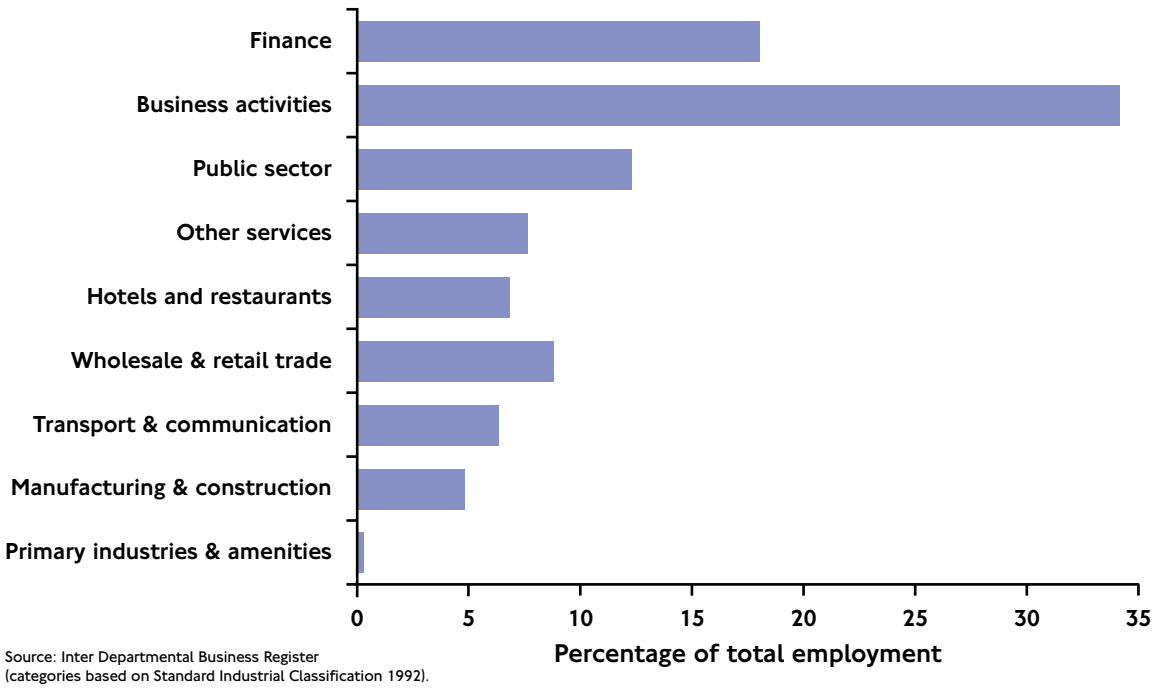
Figure 7.1. Organisations and businesses within the charging zone, 2001.



Source: Inter Departmental Business Register.

Figure 7.2 shows the balance of employment by industry sectors in the charging zone. The service sector clearly accounts for the bulk of employment, particularly the business services and finance sectors.

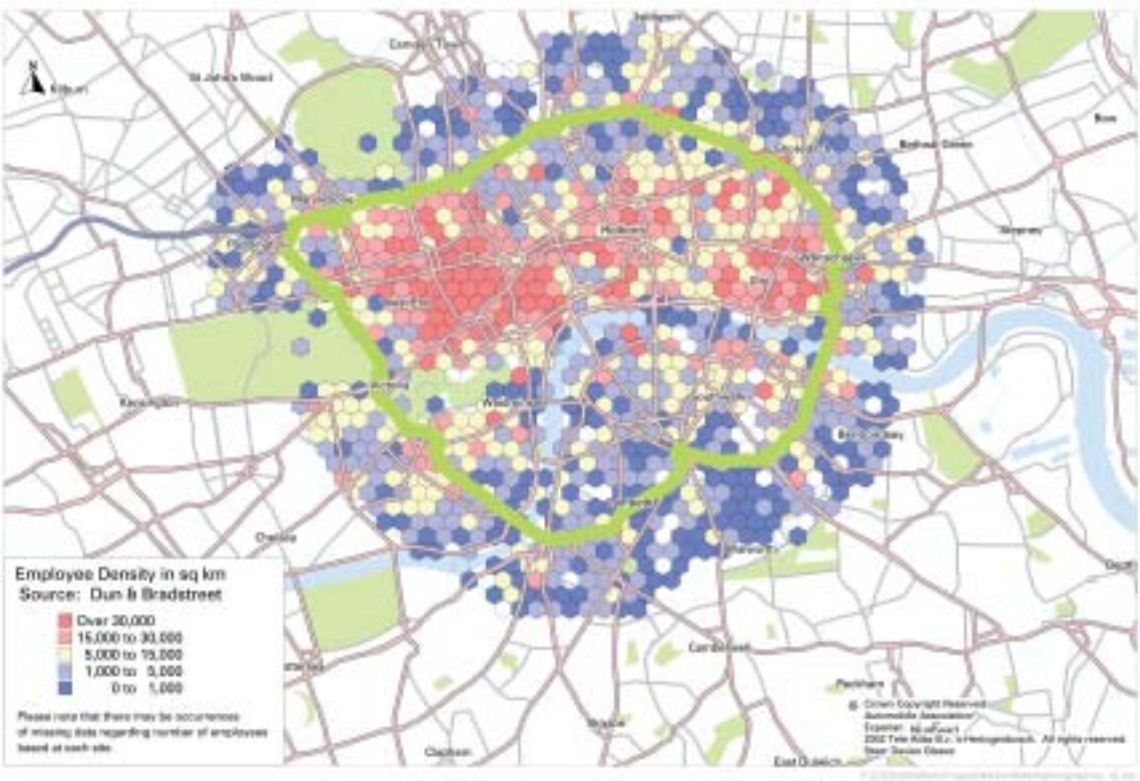
Figure 7.2. Employment in the charging zone by industry sector, 2001.



Source: Inter Departmental Business Register
(categories based on Standard Industrial Classification 1992).

Businesses are not distributed evenly across the charging zone, but are more concentrated in the City and West End areas and less so south of the river. This is illustrated by Figure 7.5, an employee density map that shows the relative number of employees per hectare.

Figure 7.5. Employment density in the charging zone, 2002.



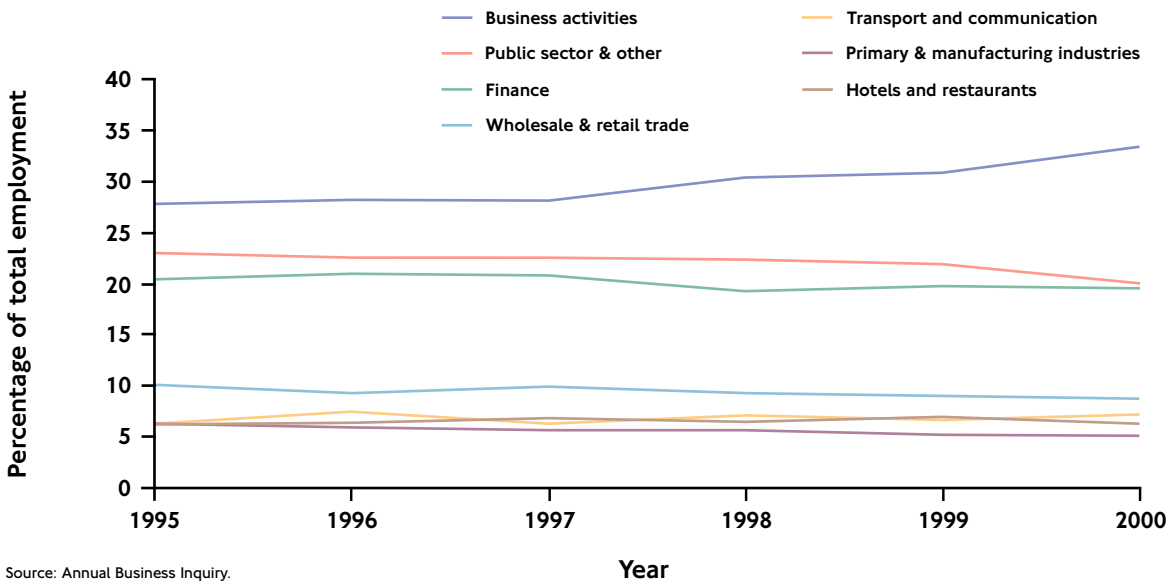
Turnover

Each year around one in 12 businesses in the charging zone closes down, but in recent years these have been replaced by an equivalent or larger number. In fact, over the last few years the net number of businesses has been increasing by around 2 percent per year. However, 2000 did see a higher than average number of business closures (based on VAT 'deregistrations'), which was almost as high as the number of new start-ups (see Figure 7.6).

Employment

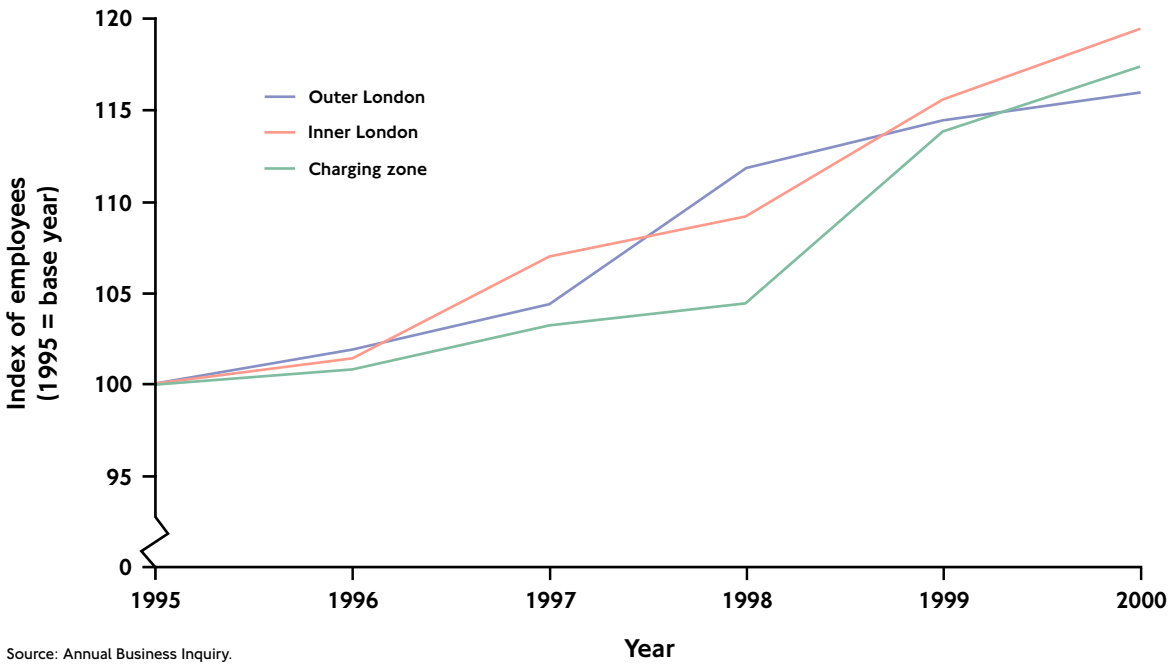
One of the trends in recent years has been a steady increase in the number of service sector businesses in the charging zone, as illustrated in Figure 7.3. Comparative trends in total employment, for the charging zone, the rest of inner London and outer London are shown in Figure 7.4.

Figure 7.3. Trends in charging zone employment by business sector, 1995 to 2000.



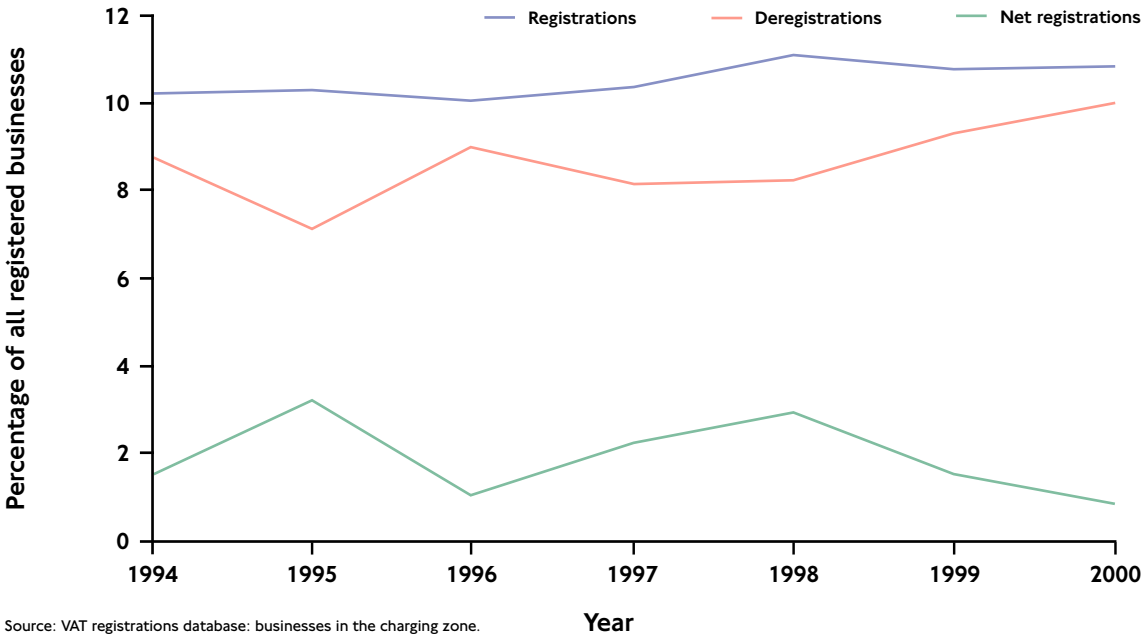
Source: Annual Business Inquiry.

Figure 7.4. Comparative employment trends, 1995 to 2000.



Source: Annual Business Inquiry.

Figure 7.6. Business start ups and closures in the charging zone, 1994-2000.

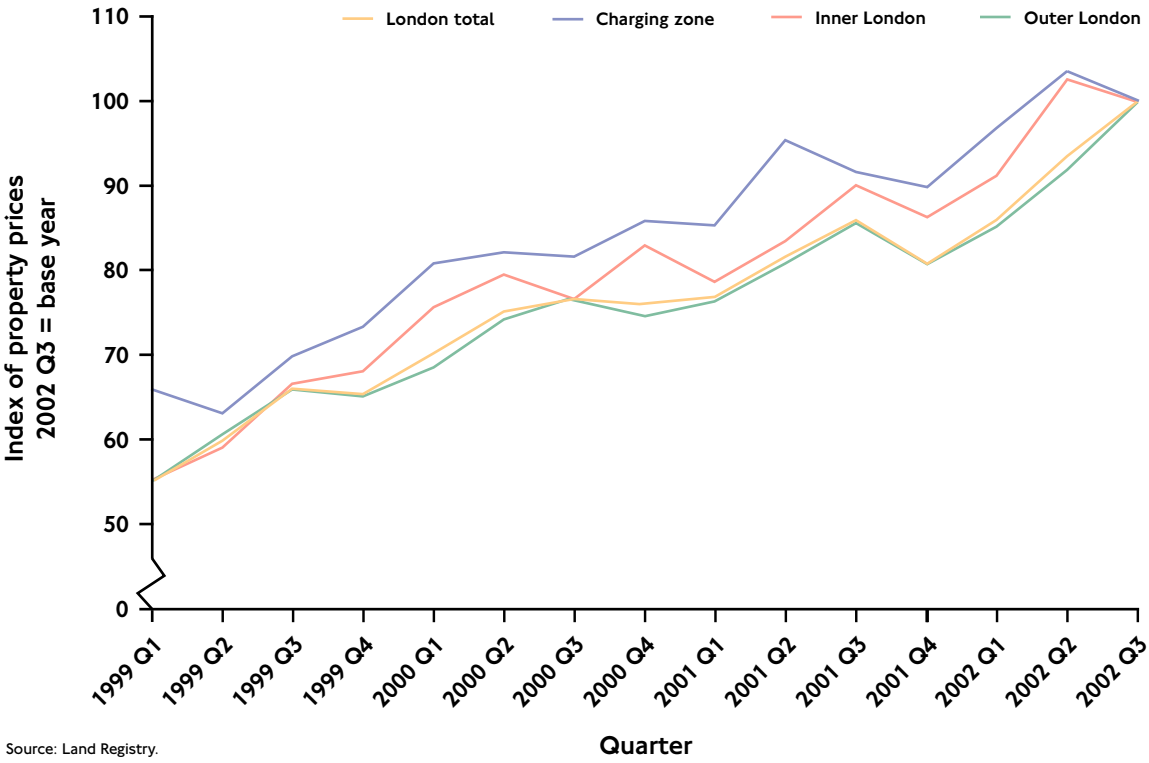


Source: VAT registrations database: businesses in the charging zone.

Residential property prices

Property prices in general, and residential property prices in particular, are of interest because of possible differential effects inside and outside, or around the charging zone boundary. Recent trends in prices are shown in Figure 7.7. The fact that these data are available quarterly and at postcode-sector level should provide an early means of identifying any differential effects.

Figure 7.7. Residential property prices, 1999-2002.



Source: Land Registry.

Limitations of macro-economic indicators

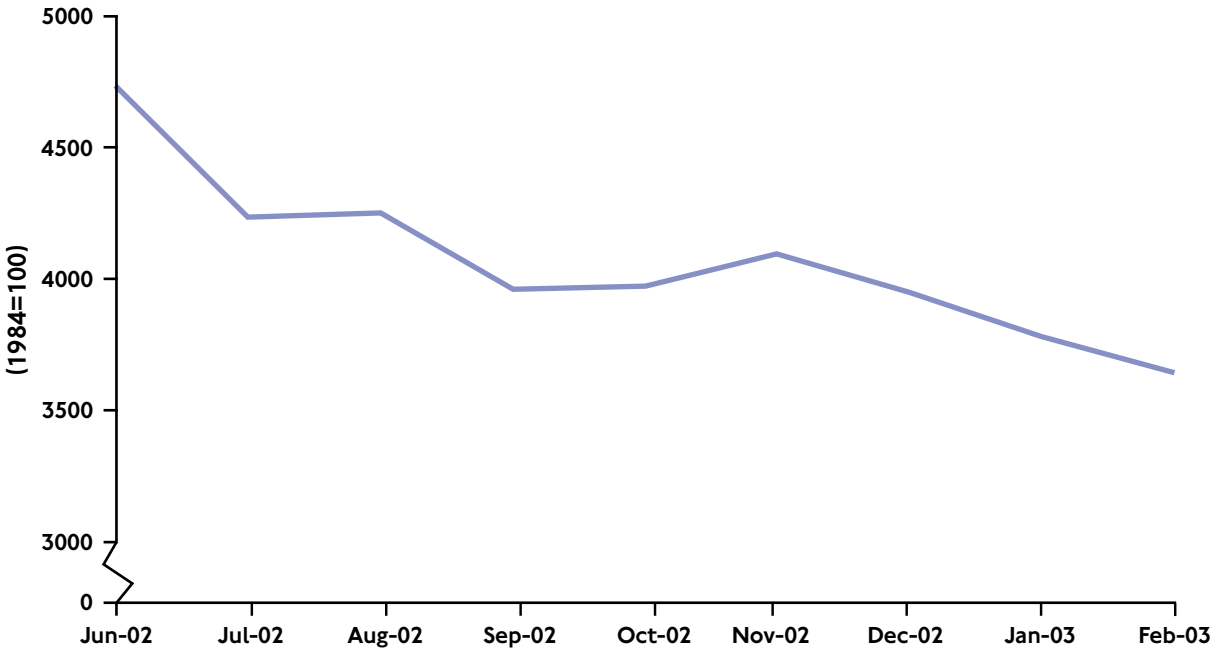
Two important constraints when using these data are that it is often difficult to disaggregate macro-economic data to reflect the geography of congestion charging, and that published data are often only available a year or more after the event. Data describing sub-regional GDP, for example, has a 3-year time delay, and the lowest level of disaggregation is only a partial match for the charging zone. Employment data comes through somewhat more quickly, but there will still be an approximate 18-month delay and the data are only available at borough level. Further work is being undertaken with the data providers to enhance the usefulness of their data for congestion charging monitoring.

National economic trends

The introduction of congestion charging on 17 February 2003 coincided with increasing evidence of significant economic downturn affecting the UK economy, coupled with a period of uncertainty created by the international situation. Any localised effects of congestion charging on the central London economy need to be interpreted in the context of these wider trends, some of which are illustrated below.

The decline in the perceived health of the economy is well demonstrated by the slide in share prices, shown in Figure 7.8.

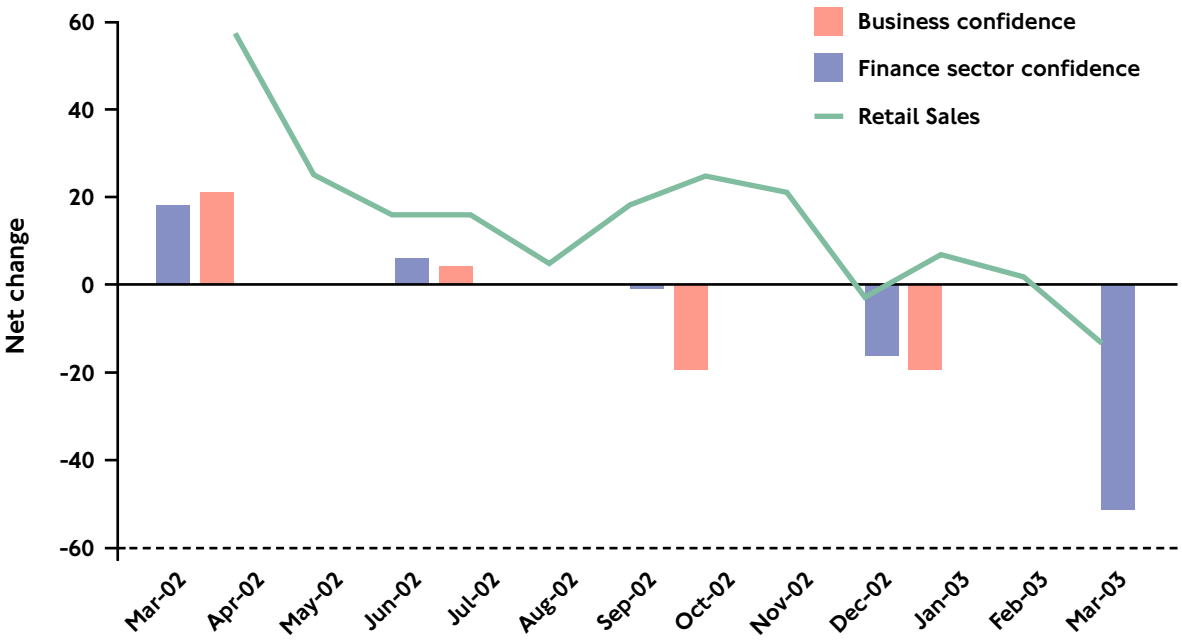
Figure 7.8. Recent trends in share prices: FTSE 100 Index monthly average values.



Source: The Confederation of British Industry.

This trend is reflected in the various Confederation of British Industry surveys, which show that business confidence is down, as are retail sales. In fact, to quote the CBI, the March 'Distributive Trades Survey' showed the 'first significant fall in high street spending for four years'. This fall is put down to the war in Iraq, impending tax rises and concerns over the housing market. Similarly, the March 'Financial Services Survey' demonstrated that 'In the face of declining business, stock market weakness and global tensions, optimism fell more quickly than at any time since September 1998'.

Figure 7.9. Business confidence, finance sector confidence and retail sales.

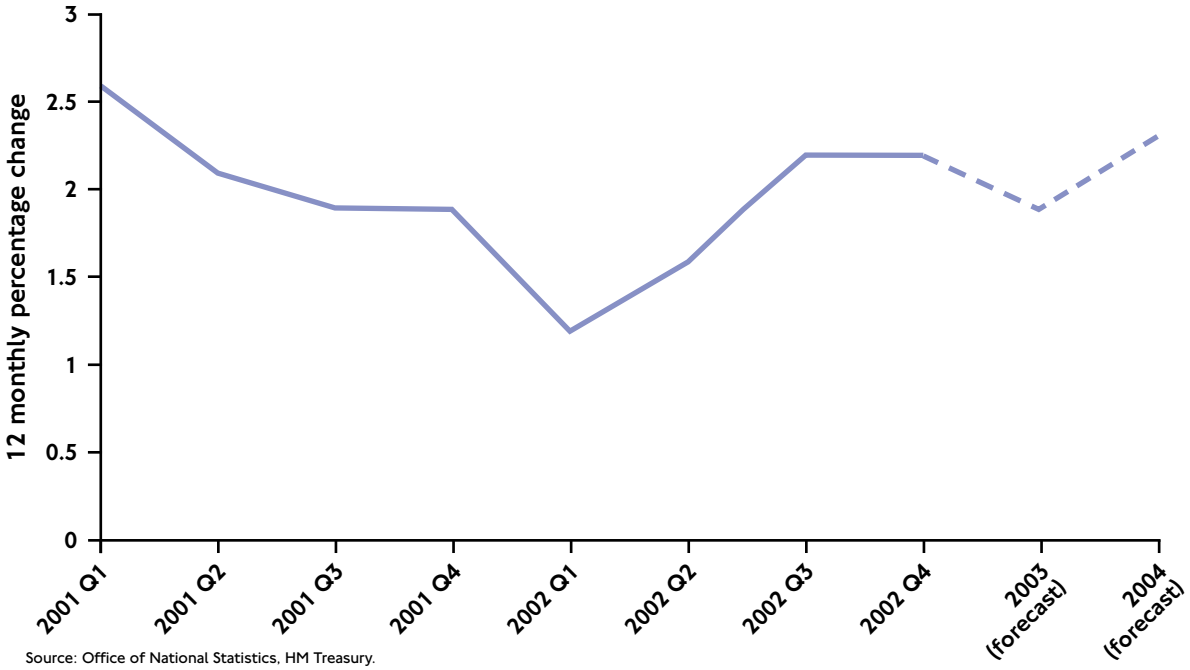


Source: The Confederation of British Industry/PricewaterhouseCoopers Financial Services Survey.
The Confederation of British Industry Distributive Trades Survey.
The Confederation of British Industry Industrial Trends Survey.

The latest forecasts for the UK economy (those produced in March 2003) show that prospects have been down-graded to an annual GDP growth rate of 1.9 percent, compared with growth of 2.5 percent forecast as recently as November 2002 (figures based on HM Treasury's average of independent forecasts).

In the initial months of 2003, forecasting is hampered by some major uncertainties: the war in Iraq, the speed and extent of an economic recovery in the U.S, and closer to home, the impact of increases in National Insurance, and the state of the housing market. However, by next year the economy is expected to have recovered somewhat with growth currently forecast at 2.3 percent for 2004.

Figure 7.10. Gross domestic product (2001/2 actual, 2003/4 forecast).



Source: Office of National Statistics, HM Treasury.

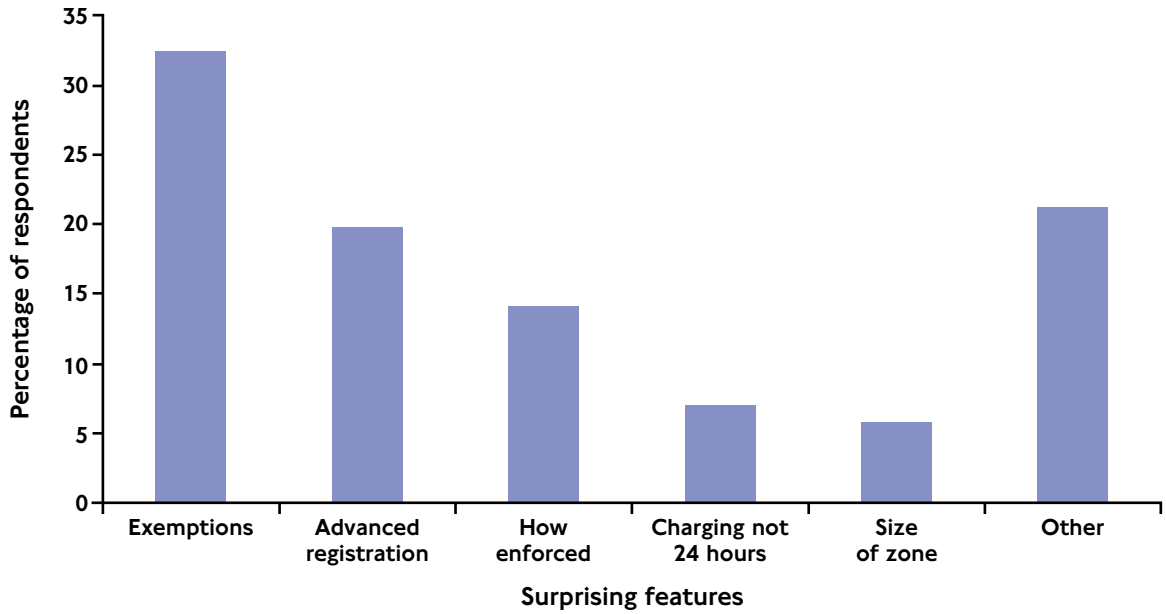
7.6. General business surveys

The general surveys of businesses and organisations will help to understand the role of congestion charging in contributing to economic change. The results here relate to the first round of surveys, conducted in the Autumn of 2002. It is important to realise that responses will reflect the state of knowledge of organisations at the time of the surveys, which in particular pre-date the public information campaign for the scheme (see Appendix 9). Further, these surveys are designed to detect changes in behaviour among sampled organisations. In the pre-charging surveys, it is not of course possible to gather information on actual (as opposed to expected) responses to the scheme.

Therefore, this presentation focuses on attitudes, awareness and expectations in relation to the scheme at Autumn 2002. Further surveys in this series, commencing with those to be undertaken in the Autumn of 2003, will gather information on the scale and scope of actual responses, and will take the opportunity to gather information to allow a comparison between expectations and actual outcomes, after charging has been implemented.

The following illustrates the coverage of these surveys, selectively focusing on: awareness of the scheme, attitudes towards congestion, anticipated effect of the scheme on congestion, other impacts of the scheme and anticipated responses to the scheme. Results from the in-depth survey (100 respondents) and the telephone survey (500 respondents) are separately identified.

Figure 7.11. Features of the scheme that came as a surprise.



Awareness of the scheme

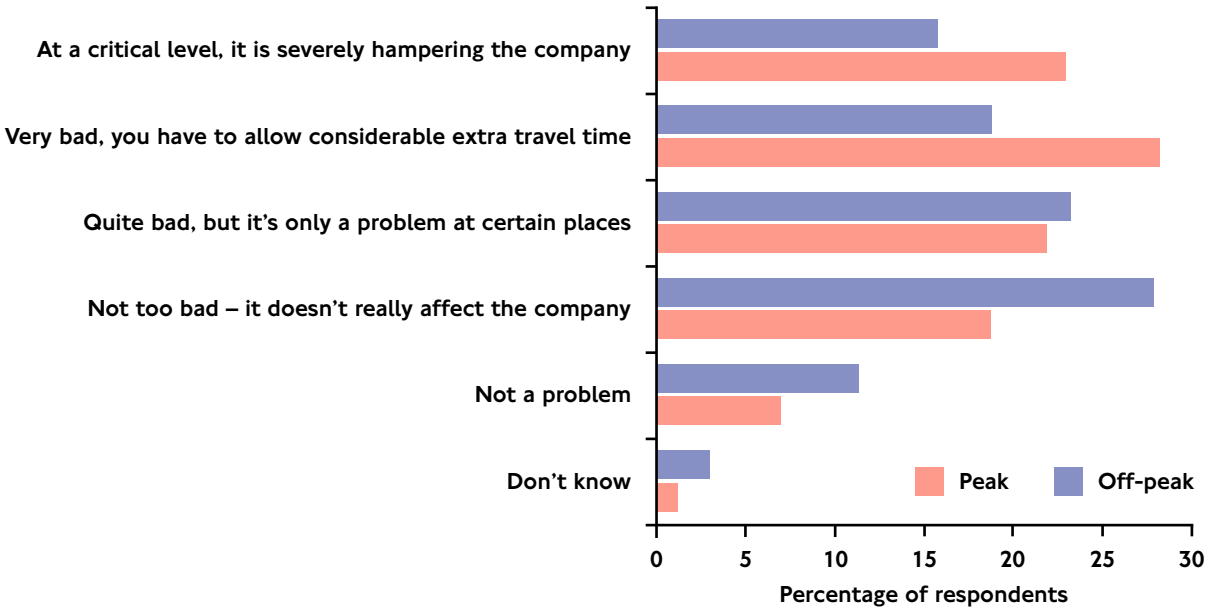
At Autumn 2002, the overall level of awareness of the scheme was relatively low, with only one-quarter of respondents to the in-depth survey feeling that they 'knew quite a lot about it'. Amongst telephone survey participants, the most widely known attribute at this time was the cost of the charge (£5). Whilst there was some awareness (37 percent) that the money to be raised was to be spent on improvements to transport, there was very little (9 percent) awareness of what the actual improvements might be.

Respondents to the depth interview were shown a card summarising the main features of the scheme, and were asked to identify elements that came as a surprise to them. Results are shown in Figure 7.11. A direct use of this information was to provide input into the public information campaign for the scheme. However, the clear (and understandable) limitations on the knowledge base of the business community at this time will clearly have influenced their responses to the other questions in these surveys.

Attitudes towards congestion

The views of organisations towards the scheme will have been influenced by a number of underlying attitudes about transport in London and congestion in particular. Figure 7.12 shows the degree to which respondents (located in and immediately around the charging zone) to the telephone survey considered congestion to be a problem.

Figure 7.12. Perceived impacts of congestion in central London on organisations during peak and off-peak times.



Given this starting point, it is of interest to understand whether respondents (in this case, to the depth interview survey) felt that the scheme would be effective in reducing congestion. Figure 7.13 considers responses by size of organisation (employees), whilst Figure 7.14 shows responses by location. It is worth noting at this point that, within the charging zone, the intensity of congestion can vary.

Figure 7.13. Expectation that the scheme would effectively reduce congestion by organisation size.

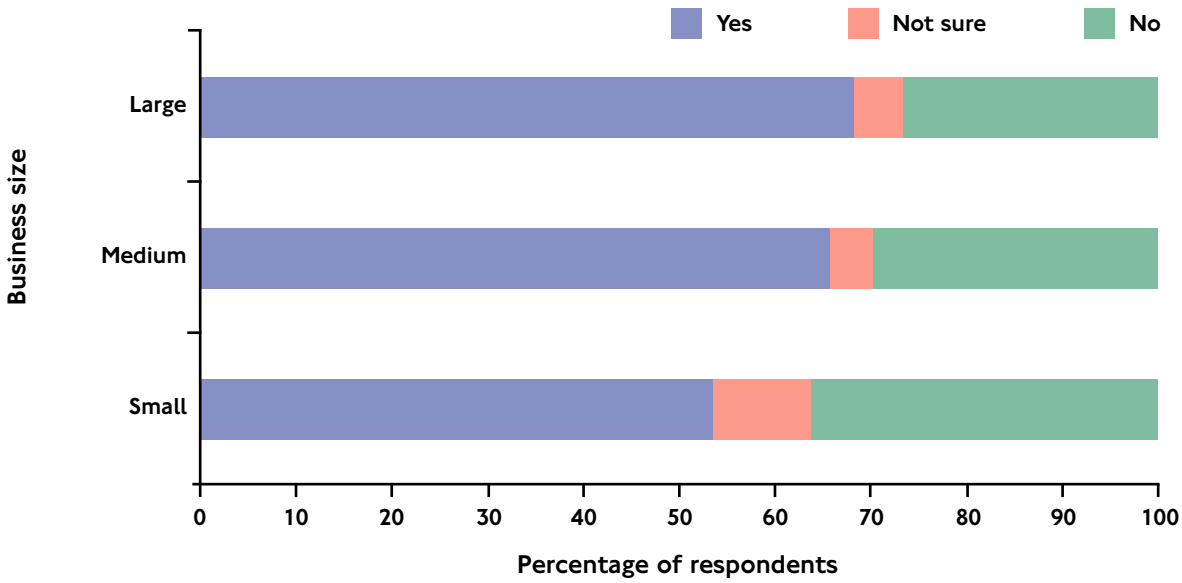
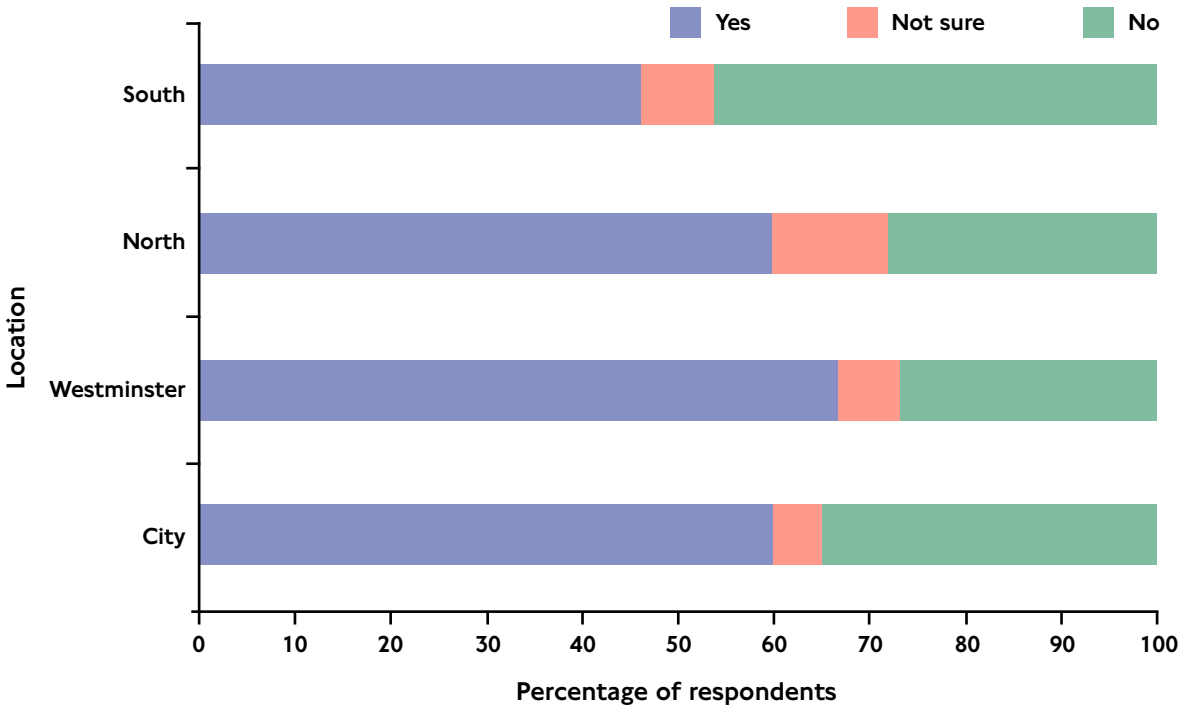


Figure 7.14. Expectation that the scheme would effectively reduce congestion by location of organisation.

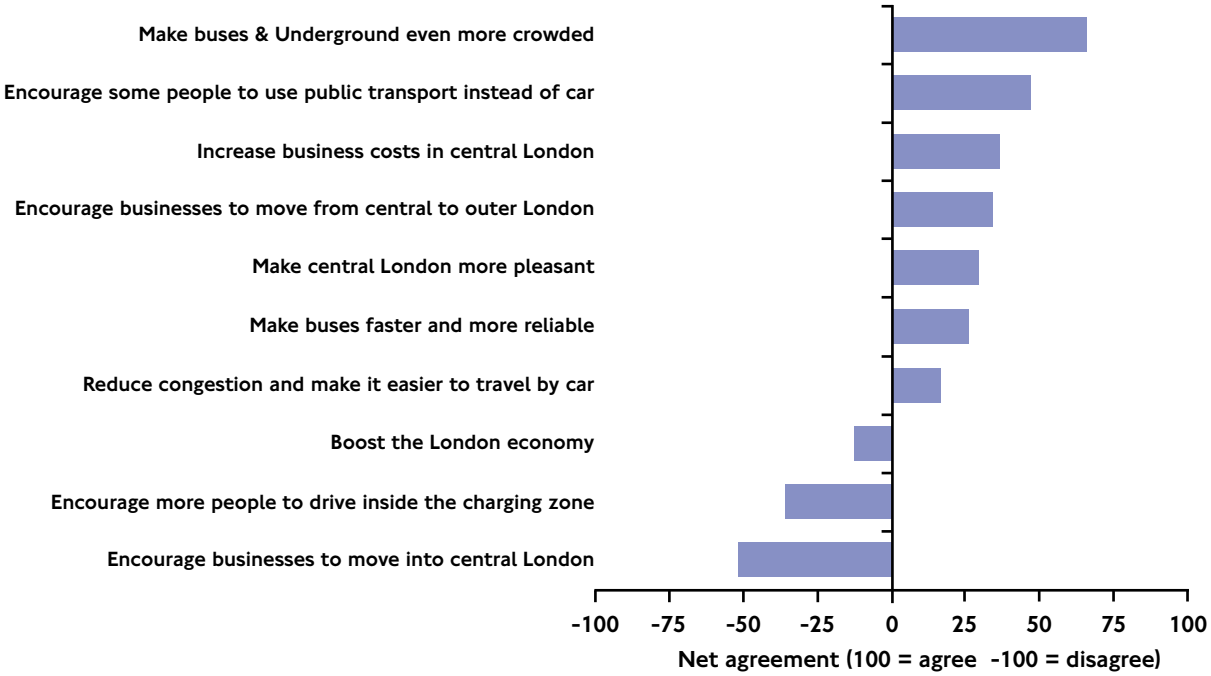


Large organisations are more likely to expect congestion charging to be effective in reducing congestion than smaller ones, and organisations based in the south of the charging zone appear to be rather more sceptical of the success of the scheme than those in Westminster.

Other effects of the scheme

Both the in-depth and telephone surveys explored attitudes to a range of possible consequences of congestion charging. Figure 7.15 sets out scores for a range of possible outcomes, where a positive score indicates a tendency towards net agreement with the proposition, and a negative score a tendency towards net disagreement. The value of indicators such as these will be fully realised when comparable measurements are taken once congestion charging is in place, when experiences can be directly compared to prior expectations. However, for the pre-charging, pre-public information campaign position, Figure 7.15 presents an interesting cross-section of views.

Figure 7.15. Anticipated outcomes of congestion charging. Net level of agreement scores.



Impact on business costs

The biggest concern that surveyed organisations had in Autumn 2002 was that their costs would be increased because of the charge. This can be a direct effect, such as having to pay the charge for vehicles operated, or a secondary effect caused by suppliers and delivery companies putting up their prices. There was also, of course, expected to be an offsetting gain from reduced congestion.

The likely scale of the cost implications was difficult to predict, but two things are clear:

- for most organisations in the charging zone the effect will be small because most employees use public transport and the type of deliveries affected make up a only a fraction of the costs of doing business;
- the effects will be felt very differently depending on the nature of the company - as shown in Figure 7.16. Those organisations in the retail or distribution sectors could be affected to a much greater degree unless they can find a way of taking full advantage of the decongestion benefits.

Figure 7.16. Expected impact on overall business costs.

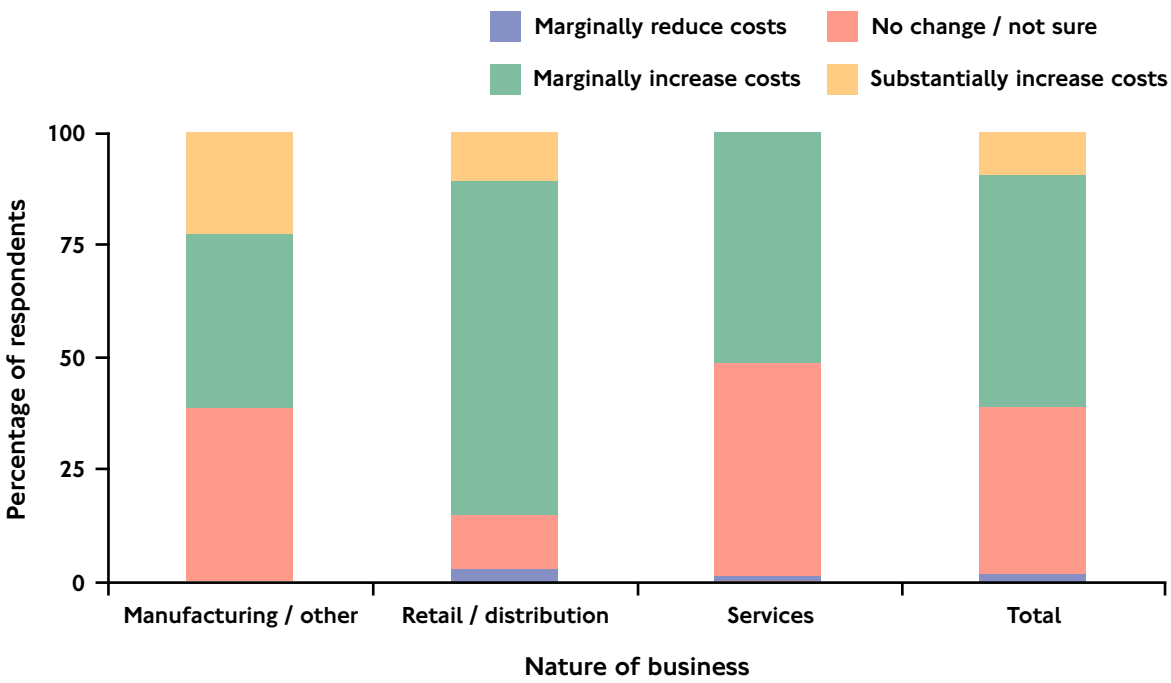
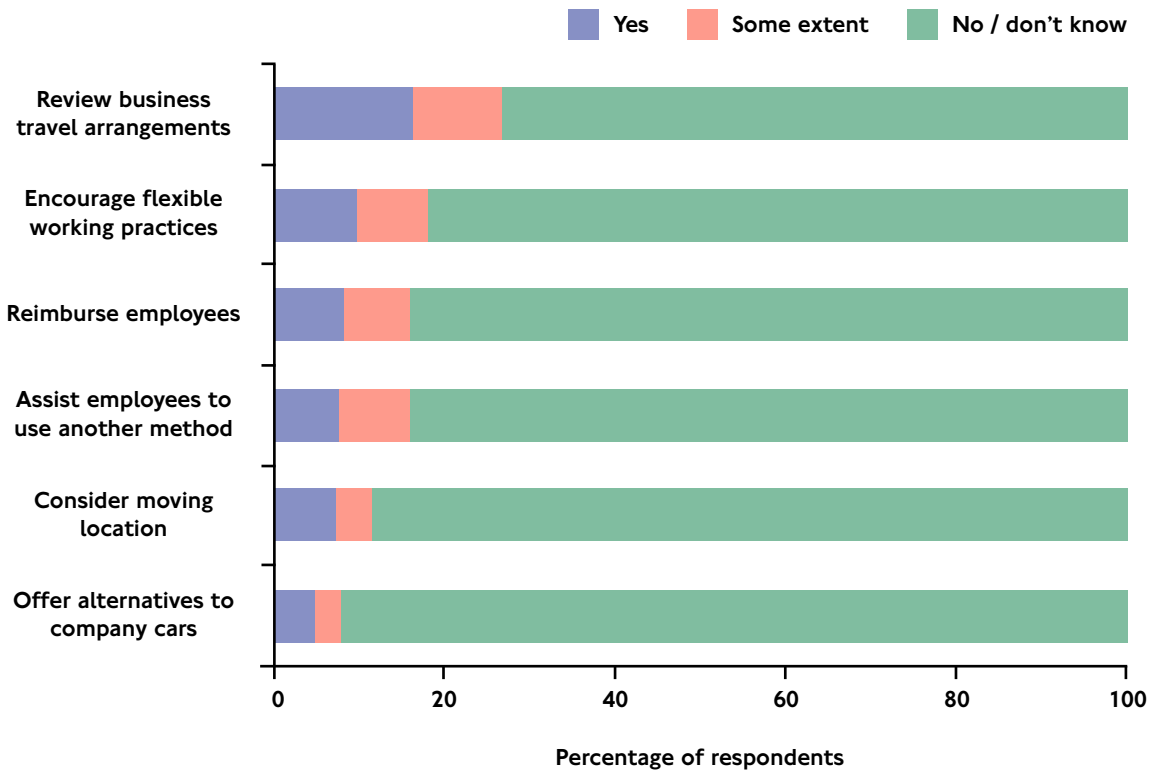


Figure 7.17. Expected policy actions in response to congestion charging.



Expected business responses

At the time of the first round of surveys in Autumn 2002, most organisations had not yet started to consider seriously their responses to the challenges and opportunities presented by congestion charging. Given this limitation, Figure 7.17 shows the extent to which different possible responses were being considered by respondents to the in-depth interview survey. The business areas most likely to be reviewed are the arrangements for deliveries and company cars. There is an indication that some organisations will at least consider moving their location, although it remains to be seen what the outcome of such a consideration might be.

Scope and forward programme

The foregoing provides only a snapshot of the information that is available from the pre-charging surveys. Other areas covered by these surveys include:

- profile of sampled organisations;
- travel to and from the site;
- deliveries;
- use of cars by employees;
- customer/supplier relationships;
- working practices (employee travel);
- perceptions of current transport arrangements and difficulties;
- concerns about congestion charging;
- financial implications;
- anticipated responses to the scheme.

At the time the first round of surveys were done, most businesses were not yet fully aware of the details of the scheme, much less being in a position to accurately judge likely effects and the responses of their organisation. This was 'controlled for' in the first round of surveys by providing participants with explanatory material prior to interview. The emphasis of future surveys in this series will be to track the impacts of actual effects, as opposed to expectations, and to gather both general and specific information on how the scheme is being received by business, and the kinds of responses that it has prompted. The next round of surveys are planned to be held in Autumn 2003, at which time it is expected that sufficient time will have elapsed to enable some firm indications of change to be detected.

7.7. Businesses on the boundary of the charging zone

Businesses located in the vicinity of the charging zone boundary may be affected in particular ways because of their location. It has been suggested for example that small retailers just inside the boundary could suffer the dual effects of reduced passing trade and increased transport costs. If this were the case then presumably comparable businesses just outside the boundary might be the beneficiaries.

The interview surveys of businesses and organisations described above have been extended to specifically monitor these kinds of potential impact among 50 businesses. This work has taken place in the boundary case study area, which is more fully described in Appendix 6. An initial round of surveys was conducted in late Autumn 2002. This is planned to be repeated annually, as far as possible with the same participants, again allowing the evolution of specific experiences and responses to be followed. The content of these surveys is similar to the general depth interview described above, with the addition of specific, boundary-related questions.

Figure 7.18. Attitudes towards boundary issues; 50 businesses located near the boundary of the future charging scheme.

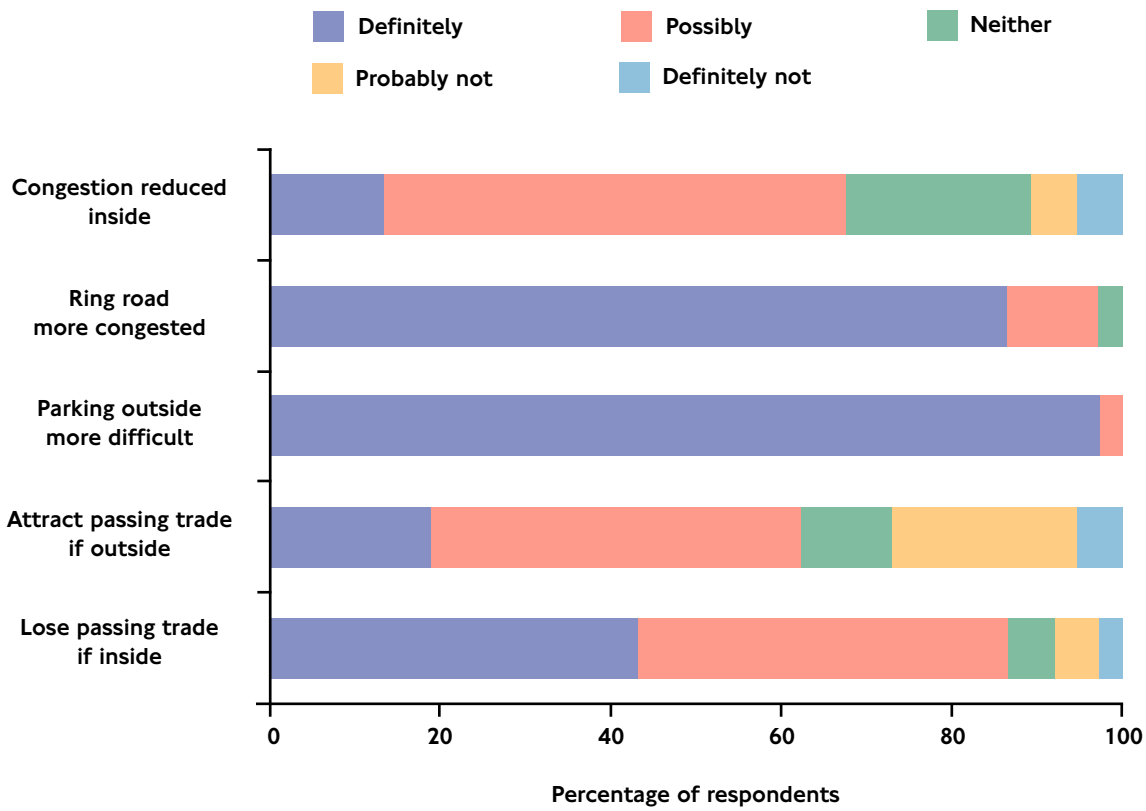


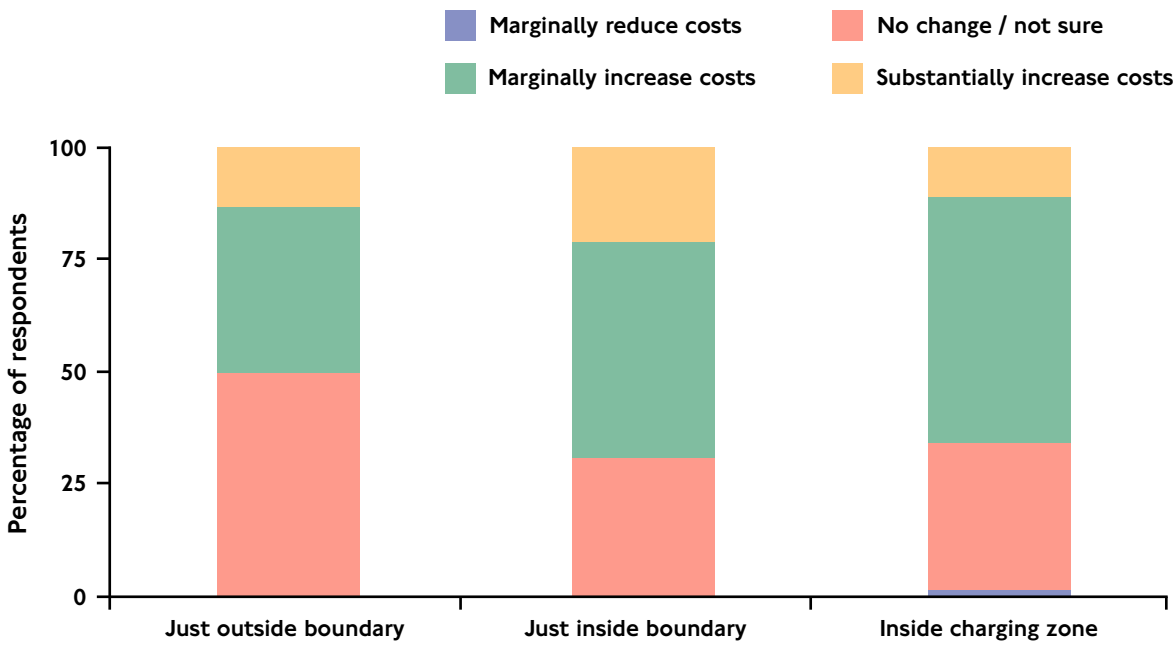
Figure 7.18 shows the extent to which survey participants agreed with selected propositions describing possible scheme effects. From this it is apparent that:

- more participants think it likely that congestion just outside of the boundary will get worse than think congestion inside the boundary will improve;
- similarly, it is felt to be more likely that businesses immediately inside the boundary will lose passing trade than those immediately outside will gain;
- almost universally, it is considered that parking just outside of the boundary will become more difficult.

Such predominantly negative expectations were perhaps to be expected at the time of the surveys. Future surveys will reveal the extent to which it is perceived that these expectations have been met.

The relatively negative attitudes of businesses near the boundary appear to be reflected in their expectations for overall increases in costs. Comparing the results from the general business survey with those from the boundary sample (Figure 7.19) shows that those just inside the charging zone (i.e. boundary sample) are more likely to foresee a substantial increase in overall costs.

Figure 7.19. Expectation for overall increase in costs; 50 businesses located near the boundary of the future charging scheme.



7.8. Organisations and activities of special interest

It has been suggested that congestion charging has the potential to affect specific organisations and activities in unique ways. This may be because of their location, the nature of business or service provided, or some other operational characteristics (e.g. low-paid 'essential' workers). This section outlines the scope of the case study work that is being undertaken as part the economic monitoring programme.

The purpose of this work is to gain a greater understanding of the effects of the scheme on these activities than would be possible through general surveys of the type described above. A before and after approach to this work is planned over an initial 2-year monitoring period. Data relating to conditions before charging started is currently being assembled. The scope of future work in each case will depend partly upon the findings of the comparisons to be made towards the end of 2003, when the first effects of the scheme should be clear. The following section provides an illustrated description of the scope of work in each case.

Central London hospitals

Hospitals are uniquely complex organisations that interact with an extraordinary range of people, many of whom have particular transport needs (e.g. patient transport, shift-working by employees). Congestion charging may present challenges, such as imposing a charge on certain types of access for which the private car is most suited (patients and lower-paid shift-workers).

It may also provide opportunities, such as making essential hospital transport quicker and more reliable, and by improving public transport (e.g. buses during the evening). Overlaying this is the effect of the NHS related discounts and exemptions that will apply as part of the congestion charging scheme.

Two central London hospital trusts have been selected for case study work. These are Guy's, and St Thomas', Barts and The London NHS trusts. The scope of work at each site consists of the following:

- Travel surveys of various kinds, including staff, visitors and hospital transport.
- Attitudinal surveys among employees probing reactions to congestion charging.
- Data-sharing and partnership working with hospital management, to understand aspects such as the effects of the scheme on staff recruitment and retention, hospital transport policies and strategic decision making affecting the hospitals.

The wholesale market at New Covent Garden

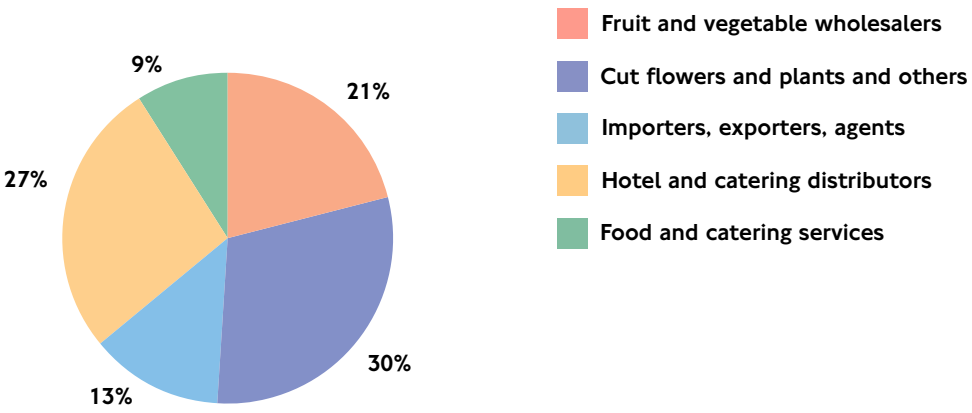
Wholesale markets such as New Covent Garden are an important part of London's history and character. For markets either within the zone or - like New Covent Garden – where much of the primary customer base is within the zone, congestion charging has implications for their ability to compete with other suppliers who are not so directly affected.

Employees, who often work at night and may be relatively low-paid, may have little in the way of practical alternatives to the private car. The patterns of working, which sees many shifts ending at around the time that charging hours will start, may see employees charged for their homeward journeys at the very start of the charging day. To set against this are the gains to the operational efficiency of the markets from reduced congestion, in terms of goods transport in and around the charging zone, and improved public transport during 'anti-social' hours.

Work being undertaken at New Covent Garden includes a range of traffic and interview surveys, with employees and market management, with the aim of understanding how actual experiences with the scheme compare with these prior expectations.

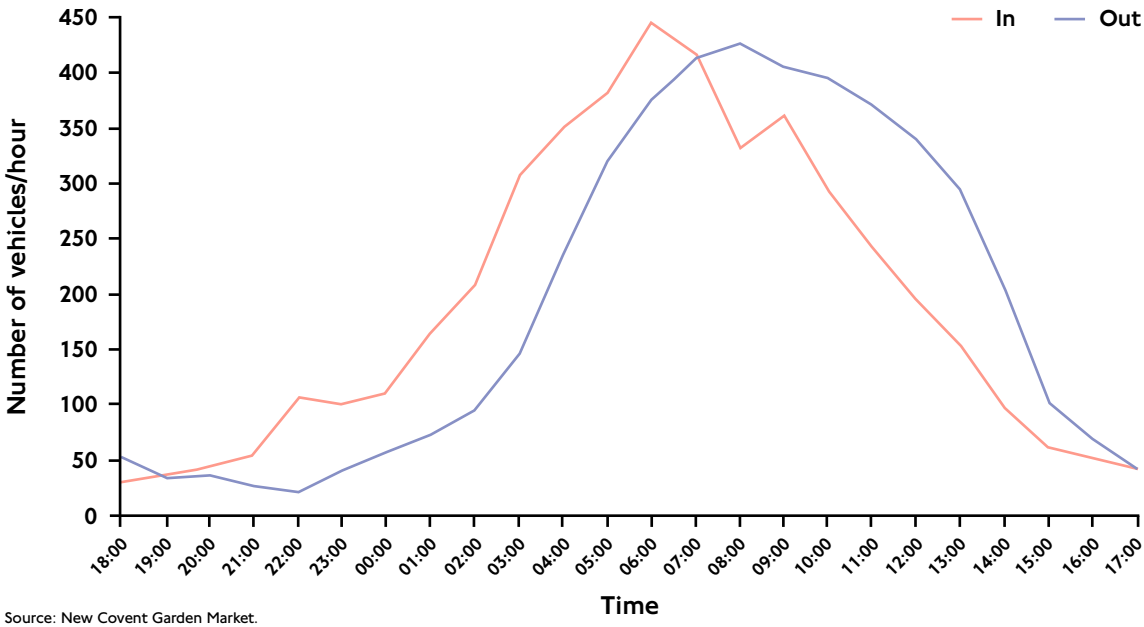
As of Autumn 2002, there were approximately 230 tenants at New Covent Garden (Figure 7.20), with an average of 4,500 vehicles entering and leaving the site during the course of a typical 24-hour day (Figure 7.21).

Figure 7.20. Mix of tenants at New Covent Garden Market, Autumn 2002.



Source: New Covent Garden Market.

Figure 7.21. Vehicle movements into and out of New Covent Garden Market, Autumn 2002.



Source: New Covent Garden Market.

Commercial, private and local authority parking

Congestion charging is projected to reduce parking demand inside the zone. Up to 40,000 fewer car trips are predicted to terminate in the charging zone during charging hours, resulting in a significant reduction in the need for car parking spaces. The reductions are likely to be spread across all three of the main categories of parking: private non-residential, public off-street, and public on-street.

Table 7.1. Estimate of parking spaces in inner London, 1999 to 2000.

	Inside the charging zone	Remainder of nine inner London boroughs
Public off-street	25,000	16,000
Private non-residential	34,000	91,000
Private residential	25,000	193,000
On-street non controlled (includes partial restrictions)	52,000	348,000
On-street metered	9,000	26,000
On-street residents	5,000	60,000
Total	150,000	734,000

Source: London Parking Supply Study, Government Office for London, 1999-2000.

There may also be more complicated effects resulting from changes in the profile of car drivers in the charging zone which may in turn lead to changes in who uses car parks and how they use them. This could, for example, result in a different mix between short and long stay users.

Transport for London are undertaking research with the major car park operators in order to monitor the effects on them and any actions they may be initiating to offset the effects of the scheme or in response to its impact. As well as collecting data on parking revenues, surveys will also focus on nine specific car parks (including two just outside the charging zone) to monitor the attitudes of customers towards the scheme and any changes in behaviour resulting from the congestion charging scheme.

This work will also examine the impact of the scheme on local authority parking revenues.

Schools in and around the charging zone

As with hospitals, congestion charging may present schools with several significant operational challenges. These are:

- teachers often drive to and from work and many are relatively low paid;
- some parents take their children to school by car;
- schools located just outside of the charging zone fear being adversely affected by displaced traffic, with a possible adverse effect in terms of road safety.

One potential positive effect that we are interested in is whether the scheme and its complementary measures provide an added incentive for school Travel Plans and an increase in use of public transport, walking and cycling by pupils.

Four schools have been selected for this work, including a junior/infants school, a secondary school and a special needs school (all inside the zone), together with a junior/infant school just outside of the charging zone boundary. Work includes collecting before and after data describing staff, parent and pupil travel behaviour, complemented by research among staff and school management to understand prevailing trends in matters such as teacher recruitment, and the contribution of congestion charging to any recorded changes.

7.9. Behavioural change and economic consequences

During the course of discussions with representatives of the business community a large number of potential impacts of congestion charging have been identified, some of which could result in a change in behaviour by businesses or their employees. At the same time, potential wider or macro-economic impacts have also been postulated, such as increased business costs, price inflation, a fall in margins and profitability, and a reduction in sales volumes. It is also possible that these effects could work in a positive direction, although it is perhaps easier for businesses to see a down-side in advance of the implementation of the scheme.

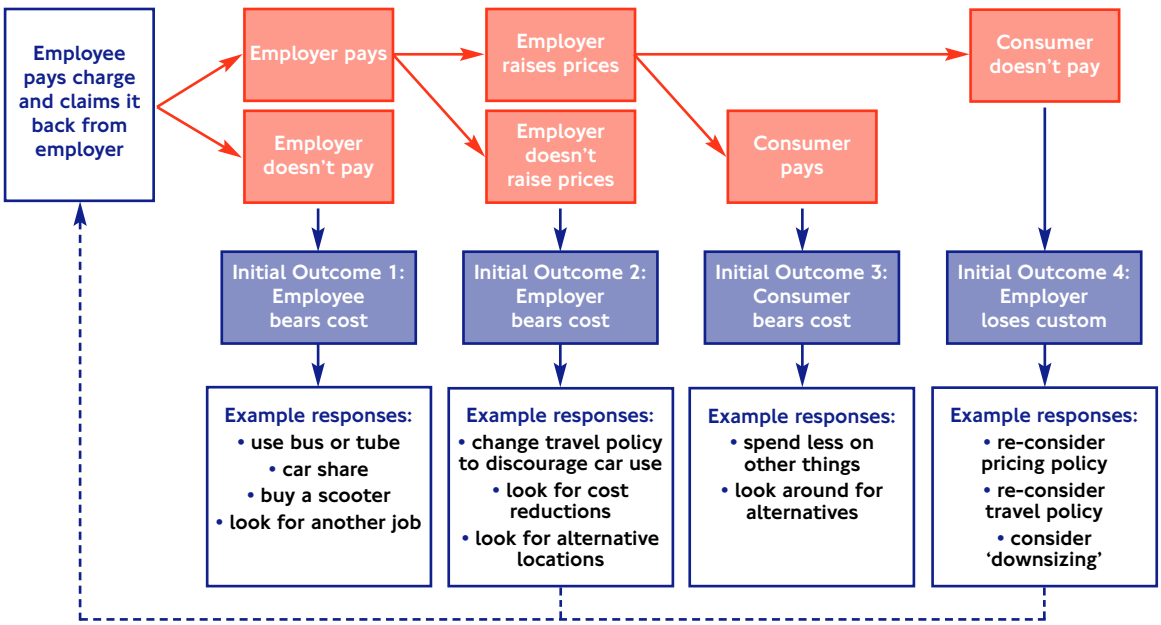
The challenge that TfL have is first making the link between 'bottom up' micro-economic indicators and 'top down' macro-economic measures (with the extra complication that there is a substantial time delay in obtaining the higher level data), and secondly to distinguish the impacts of the congestion charge from all the other influences, most obviously the state of the wider UK and international economies, but also any underlying structural changes.

This section provides a few insights into this challenge and how it is being approached. It starts by considering the process of change, then the kinds of changes which employers and employees are expecting to make. It then goes on to consider how we are looking to relate the survey data we obtain (which identifies the types of changes being made 'on the ground') to the wider economic indicators such as GDP and unemployment. Illustrated data are drawn from depth interviews in and around the charging zone conducted during Autumn 2002.

Causal Chains

Congestion charging will have some obvious short term impacts, but these can also lead to a variety of longer term changes. This concept is illustrated below in Figure 7.22.

Figure 7.22. Example causal chain diagram.



The causal chain illustrated starts with an employee driving into work and facing the choice of paying the charge or trying out an alternative way of travelling. Their starting point in this example is that they will look to carry on using their car and claim the cost back from their employer. However, their behaviour is likely to be modified by their employer's policy on reimbursing the cost, and the taxation implications for the individual.

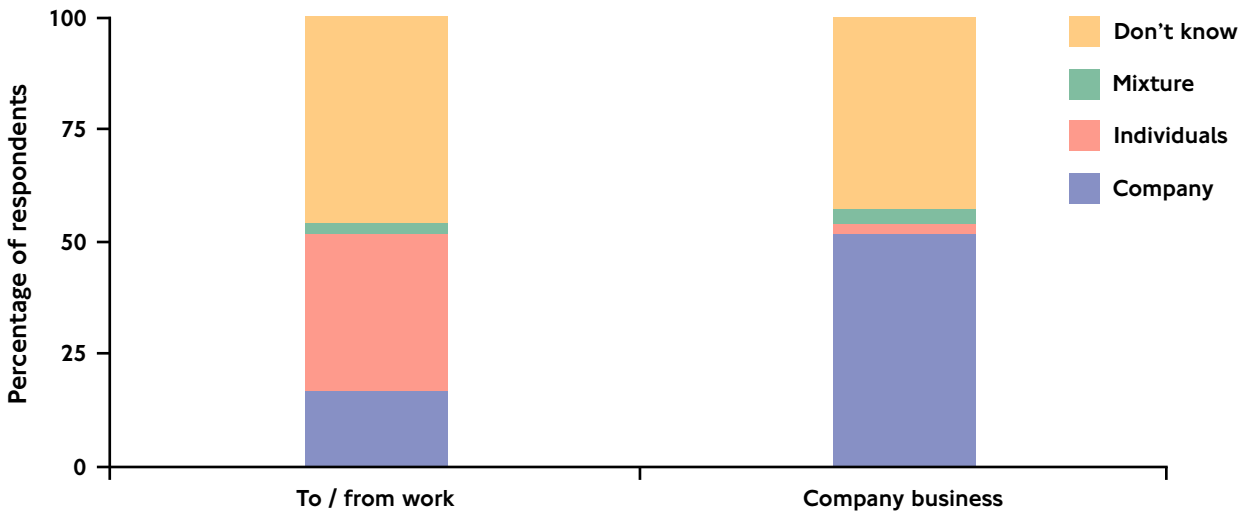
If the employer does not pick up the cost then the employee could be forced to look at alternatives such as using public transport, working at home, looking for another job, or simply carry on using the car but cutting down expenditure on something else.

On the other hand if the employer at least partially reimburses the cost there are consequences for them and decisions to make concerning how they will cover the cost. For example, they may try and pass their additional costs onto their customers, potentially leading to a knock-on change in their customers' behaviour. However, if this leads to a loss in business it could force the employer to subsequently re-think their policy, or perhaps to introduce policies which encourage employees to travel by public transport.

One of the difficulties in forecasting the outcomes from this chain of events is the dynamic nature of it combined with the high level of uncertainty. Until congestion charging starts the employer is unlikely to have an accurate picture of the cost implications if they decide to reimburse employees travel costs, or the costs of not doing so in terms of, for example, staff retention and recruitment. This makes it difficult to set policies and also means that they will be modified over time. Figures 7.23 and 7.26 show how employers who took part in the depth interview expected the scheme to impact upon company policy and employee travel behaviour.

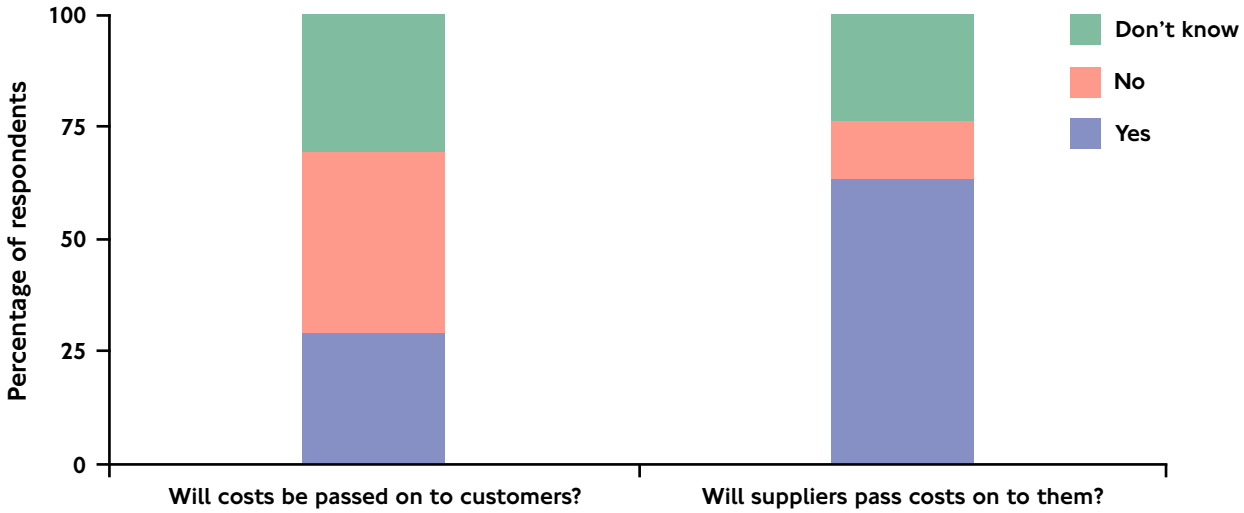
On the issue of 'who is going to end up paying', employers generally expected to reimburse employees for congestion charges incurred on company travel, but only a minority expected to pay for charges incurred by employees travelling to work (Figure 7.23).

Figure 7.23. Who will bear the cost of the charge?



Similarly, most employers expected their suppliers to increase their costs (Figure 7.24), while a minority expected to be able to pass these onto their customers. The implication is that businesses are expecting to have to absorb some of the impact, though this is somewhat at odds with a frequently expressed view that 'it is the consumer who will end up paying'.

Figure 7.24. Will costs be passed on?



Change in travel method

Probably the most important aspect of behaviour change which the scheme is designed to bring about is a shift in travel from car to public transport or other modes. Transport for London projected that approximately 15 to 25 percent of those driving into the charging zone by car will no longer do so.

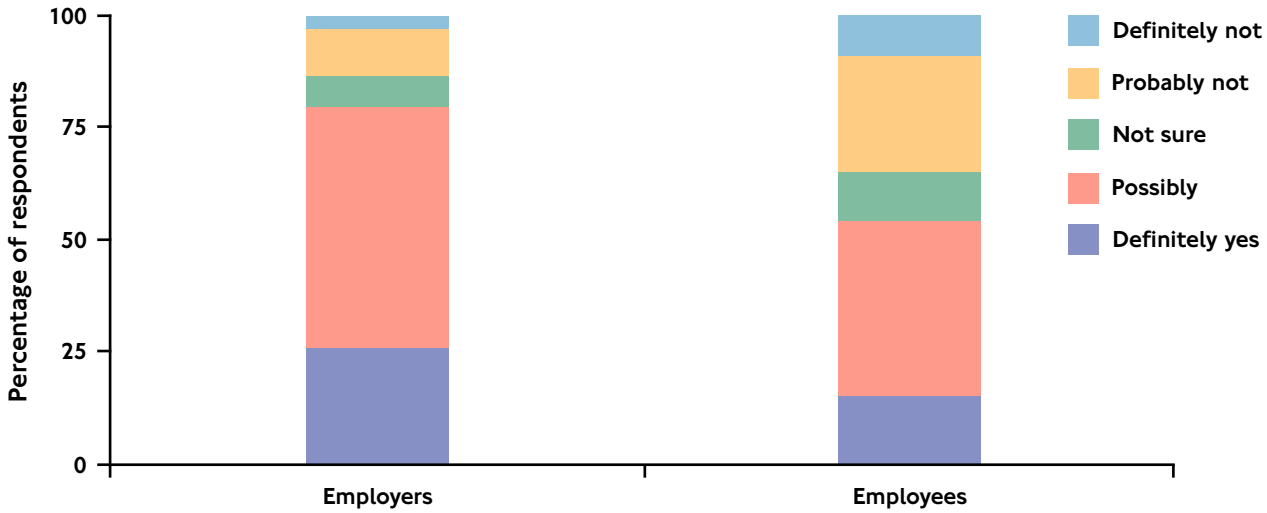
Opinions as to the impact of the scheme on the use of car range across the extremes and differ between groups of people. For example, as illustrated in Figure 7.25, employers appear to be more optimistic about the effects of the scheme in encouraging mode shift than are employees.

Change in operations

To set against the increased cost to vehicles is the reduction in congestion, which is forecast to be between 20 and 30 percent inside the charging zone.

How can businesses take advantage of this? Most obviously it will benefit companies in the business of transporting and delivering goods in central London. In theory, it could mean that more deliveries are squeezed into a day, vehicle running costs are reduced, and delivery times are made more reliable. In practice, realising decongestion benefits requires the operator to change their operations and this may not always be easy, though is facilitated by route-planning software and vehicle tracking technology.

Figure 7.25. Will the scheme encourage more people to use public transport instead of cars?

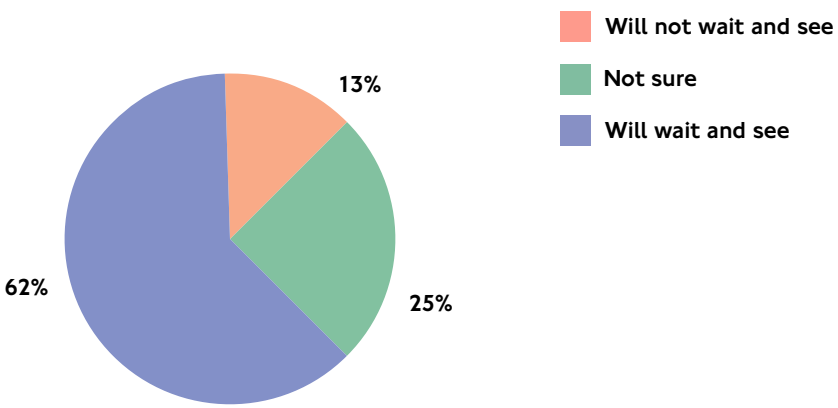


When will behaviour change?

The indications are that only a minority of businesses are likely to anticipate the introduction of the scheme and act before it actually starts, while most are taking a 'wait and see' attitude (Figure 7.26). This is largely because there was, at the time the survey was done, still a lot of uncertainty surrounding what is going to happen and how much it will affect businesses.

The implication is that it will be some time before it is clear what the longer-term changes have been. In the first few months we can expect employees and employers to consider and try out various alternatives. As conditions settle down and the extent of the various impacts becomes apparent, businesses may find the need to re-think their policies and processes leading to more gradual, longer-term change.

Figure 7.26. Approach to preparation for the congestion charging scheme, Autumn 2002.



8. Social Impacts

8.1. Introduction

Change by individuals will lie at the core of all impacts observed in relation to congestion charging. Social impacts can be more narrowly defined here as the effects that the scheme has on people's attitudes, perceptions, and abilities in relation to their travel patterns and daily lives, and their strategic response to it. An understanding of these effects is essential, so that trends observed elsewhere in the monitoring work can be more fully understood, and to allow informed judgements about the contribution of the scheme to the daily lives of Londoners.

Whilst the central London congestion charging scheme may affect all Londoners to some degree, it is clear from the design work and consultation exercises conducted by TfL that certain groups of people are thought more likely than others to be affected in specific ways. The social research programme therefore follows the approach adopted elsewhere in the monitoring programme, of combining general surveys giving an overall picture of change with specific case studies designed to probe selected issues in greater depth.

In general, work under this heading was not designed to robustly quantify the elements of social change in relation to the scheme for the population of London as a whole. Rather, the emphasis was on identifying, understanding and exploring social impacts amongst those groups most likely to be affected, to combine a general picture of their scope and intensity with the ability to answer specific questions.

The surveys reported here took place before congestion charging was introduced, and so people were asked how they anticipated responding to the future scheme and what consequences they expected these responses to have. A brief description of the main surveys used to record these expectations is set out below. These surveys will be repeated again in Autumn 2003 when actual responses to the scheme can be compared with prior expectations.

8.2. Scope of the work programme

General household and individual surveys

Two surveys, with essentially similar aims but necessarily different sampling methodologies, have been put in place to provide a general picture of the impacts of the scheme on different groups of Londoners and those from the rest of the UK. The first consists of a household-based in-depth interview survey of approximately 2,300 households in which all adult household members were surveyed[1]. The household survey focused on seven different 'neighbourhoods', three of which were in the charging zone and four in inner London (defined here as the area outside the charging zone and inside the North and South Circular Roads). The neighbourhood approach allows perceptions and implications of congestion charging to be set in the context of the different opportunities for transport access to or from the charging zone, and the availability of local facilities.

The household interview monitors perceptions of the scheme and the adaptations expected by people at different life cycle stages (e.g. age and family status), from different income groups, and who have varying levels of access to cars and public transport.

In this way, it will be possible to capture the variety of impacts and therefore get a sense of impact on both 'people in general', and also segments of the population that are of particular interest (e.g. the lower-paid living in these neighbourhoods, and those living on the boundary of the charging zone), as these segments were explicitly represented in the sample quotas being used.

A particular feature of this survey is the opportunity that it presents to capture the diverse ways in which impacts can appear. The whole household approach addresses the need to go beyond the individual as the unit of analysis and to examine trade-offs between household members. For example, if a car is no longer required for a journey to the charging zone, then who now has the opportunity to use it, and for what purpose?

For residents of outer London and beyond the M25, a telephone-based survey of approximately 2,100 individuals has been deployed, with recruitment undertaken on-street within the charging zone[2]. The segmentation of the sample according to socio-economic characteristics is similar to the main household survey, as is the content of the research. However, this survey uses the individual (rather than the household) as the primary unit of analysis, and only includes travellers to the charging zone.

This allows basic comparisons to be made across the different groups. However, the sampling methods used for the different surveys do not allow rigorous quantitative comparison between results from each of the two surveys.

As part of the household and individual surveys discussed in this chapter, respondents were asked two different types of questions. One type focussed upon general issues about the impacts respondents anticipated the scheme would have upon them and members of their household. The second focused in detail upon collecting information about each stage of a recent 'tour' made from leaving home until returning home during the course of one day. Respondents were then asked to consider how they anticipated this 'selected tour' would be affected by congestion charging. This tour was selected using criteria which gave priority to activities completed most often inside the charging zone during future charging hours or those which the respondent felt would be most affected by congestion charging. As a consequence of this selection criteria, the majority of these tours included destinations inside the zone, although a small proportion of respondents in inner London (16 percent) focussed on tours outside of the charging zone. Respondents who drove by car on their selected tour are referred to as 'drivers' throughout this chapter. Those who used any other method of travel for the selected tour are referred to as 'non-drivers'.

In the household survey, of those living inside the zone, 612 respondents drove on their selected tour and 824 were non-drivers. Of those living in inner London, these proportions were 604 drivers and 1,035 non-drivers. In the individual survey, of those respondents living in outer London, 368 drove on their selected tour and 1,176 were non-drivers for those living beyond the M25, these proportions were 136 drivers and 452 non-drivers. The data from the individual survey has been weighted to reflect the profile of travellers to London.

Special inquiries

Special inquiries provide scope for addressing specific issues that can not be effectively or efficiently addressed through the 'general' surveys above. For example, although the household and individual surveys will capture a number of people with particular travel needs, the available sample will not provide adequate resolution of either specific sub-groups or the particular issues relevant to them. As the scheme is implemented the special inquiries provide an efficient, flexible and responsive mechanism to rapidly deploy a research capability to investigate specific 'people-related' issues as they emerge.

Special inquiries can take a variety of forms. An example is a series of 'key informant' panels, which aim to take advantage of the fact that those who travel frequently within the charging zone are best-placed to provide information and insights about the effects of the scheme. Other examples include looking at the scheme from the perspective of disabled people and tracking changes to travel to work behaviour by specific groups of workers.

Appendix 7 looks at the expectations of people who took part in some of the Special Inquiries conducted before the scheme began. The following six sections draw from the results of the household and individual surveys outlined above:

1. **Expectations of the impacts of congestion charging on selected tours** in terms of factors such as congestion and journey experience;
2. **Anticipated impact upon accessibility to central London** including analysis of the expectations of those from special interest groups;
3. **Expected advantages and disadvantages of the congestion charging scheme** for respondents and other household members;
4. **Anticipated neighbourhood impacts** of the scheme in terms of factors such as the economy, parking and public transport;
5. **How drivers expected to adapt to congestion charging** in terms of their journeys to the zone and use of other methods of transport;
6. **Types of changes anticipated by drivers and public transport users** in terms of factors such as journey duration and the day to day implications these changes may have.

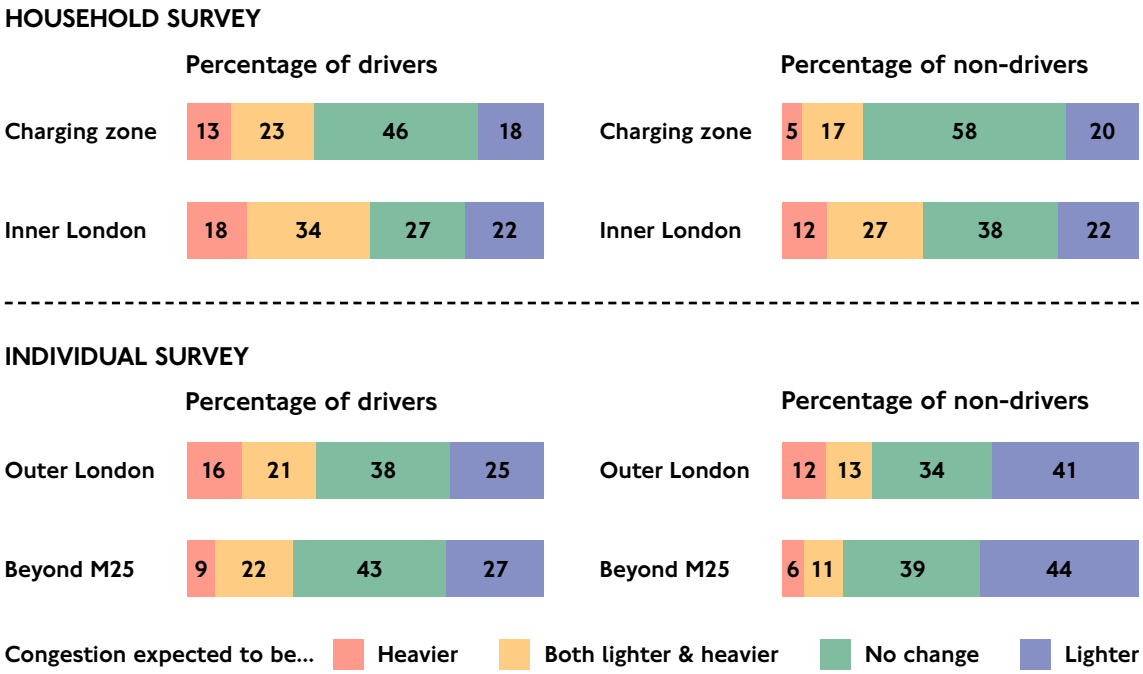
8.3. Expectations of the impacts of congestion charging on selected tours

This section looks at how people interviewed in the household and individual surveys expected the scheme to affect a range of factors related to travelling to, from and inside the charging zone such as traffic congestion, public transport and journey experience. In the figures that follow, the responses of 'drivers' and 'non-drivers' (as defined above) have been separated, along with the responses of people living in the four surveys areas which are: inside the charging zone, inner London, outer London and beyond the M25. All responses in this section are based on answers given in relation to the respondent's selected tour, as explained above.

Expected impact on traffic congestion

Respondents were asked how they thought congestion charging might affect traffic levels on a tour like the one they had made recently inside the charging zone. Figure 8.1 shows the responses of drivers and non-drivers from each of the four survey areas who had made such a tour inside the charging zone. This shows that most respondents expected traffic on such a journey to be lighter or no different to that experienced at the time of the survey.

Figure 8.1. Anticipated impact of congestion charging on traffic congestion.

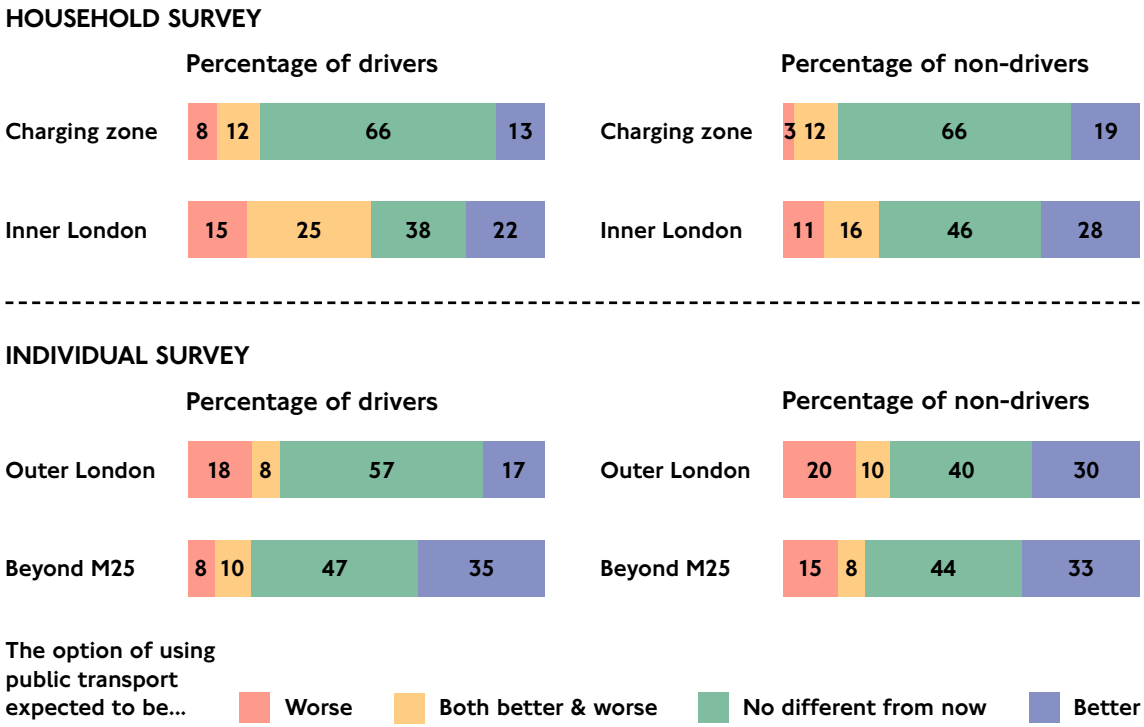


Expected impact on using public transport

Respondents were asked whether they thought the scheme's effects on congestion together with the planned public transport improvements would make the option of using public transport better or worse when thinking about the selected tour they had made recently inside the congestion charging zone.

Figure 8.2 shows that non-drivers were more likely than drivers to think that public transport would be a better option as a result of the scheme. However, the most common response was that the option of using public transport would be no different from now; more expected the option to be better than worse.

Figure 8.2. Expected impact on the option of using public transport.



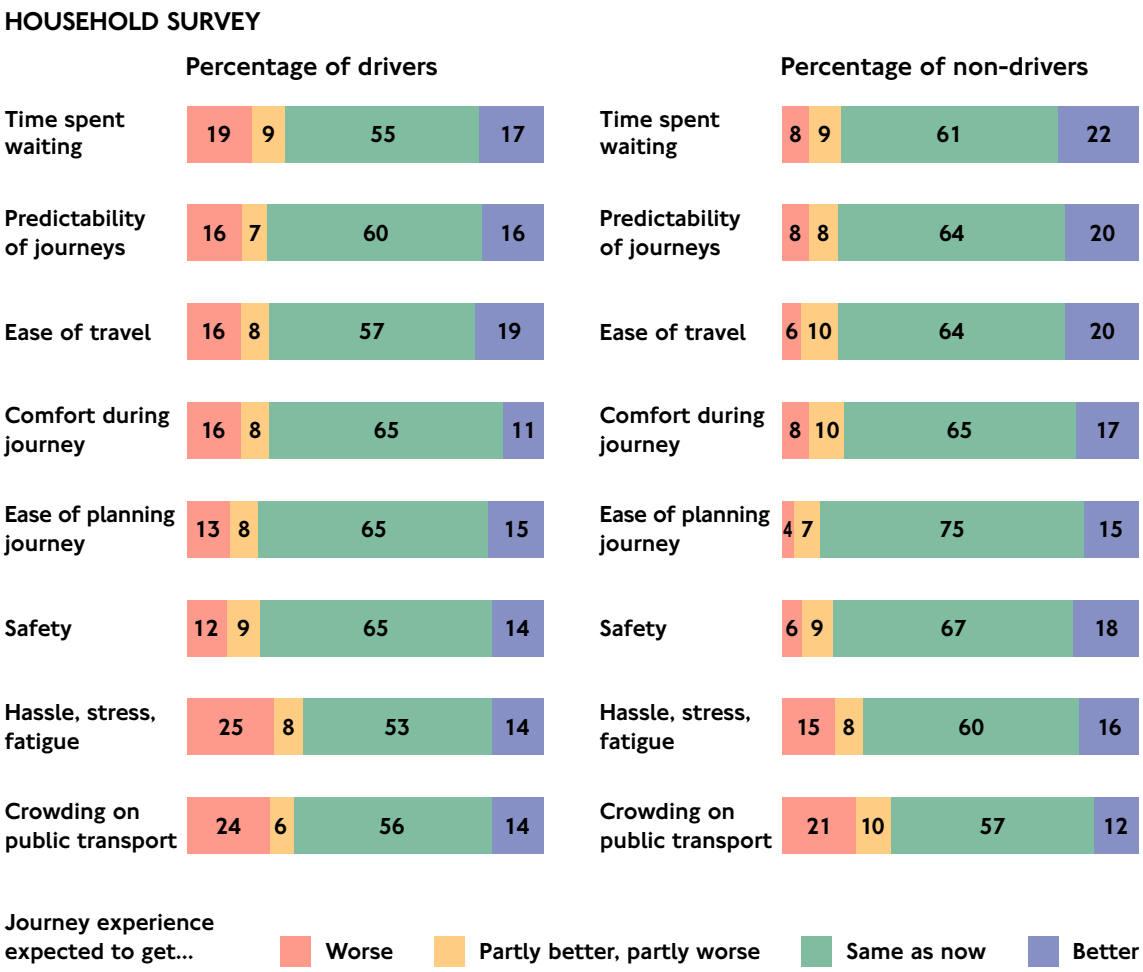
Expected changes to the journey experience

Using their selected tour in the charging zone as an example, respondents were asked whether they expected their journey experience to become better, worse or stay the same after congestion charging was in place. Expectations were considered under a series of headings as shown in Figures 8.3 to 8.6. For this analysis, results are grouped by the respondents residential location[3].

Those living inside the charging zone

Figure 8.3 shows that the majority of respondents living inside the charging zone said they expected their journey experience in the zone to stay the same as now. Non-drivers were more likely to expect aspects of their journey experience to improve than deteriorate, except with regard to crowding on public transport. Hassle, stress, fatigue and crowding were the main concerns for drivers living inside the charging zone.

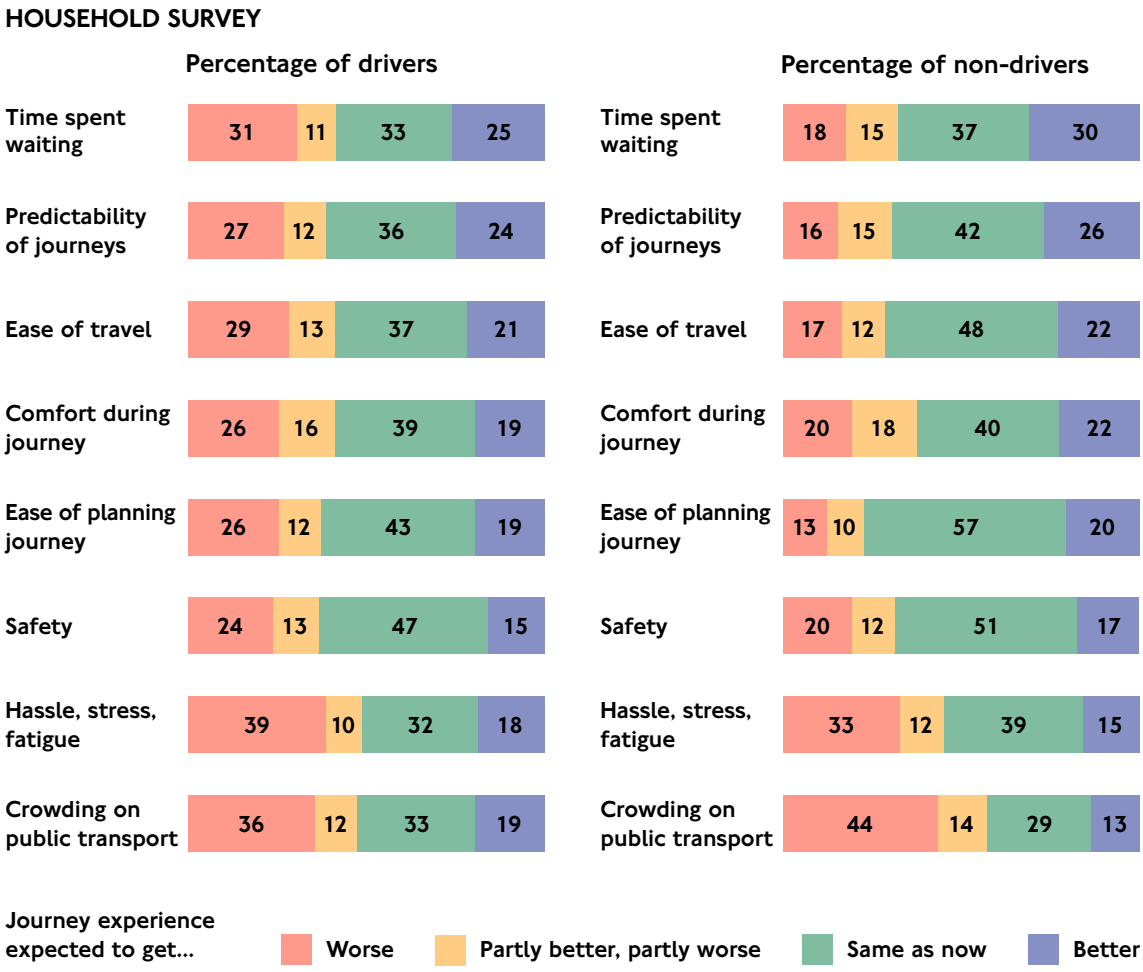
Figure 8.3. Expected changes to the journey experience: respondents living inside the charging zone.



Those living in inner London

Compared to respondents living inside the charging zone, more inner London respondents expected the scheme to have an impact on their journey experience in the zone. However, in most cases the largest category of respondents were those who expected their journey experience would remain the same as now. Both drivers and non-drivers were particularly concerned about crowding on public transport and expected the hassle, stress and fatigue of their journey to increase.

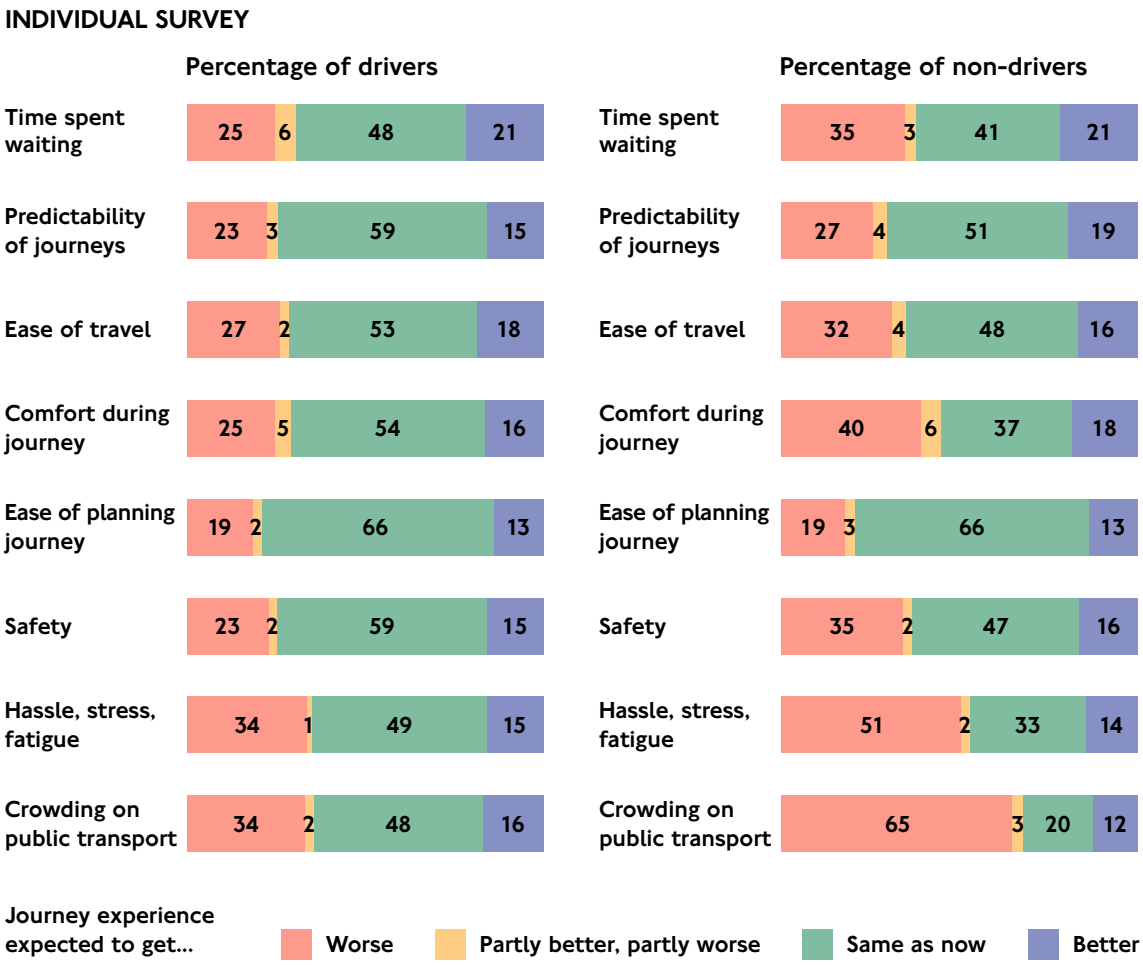
Figure 8.4. Expected changes to the journey experience: respondents living in inner London.



Those living in outer London

Respondents living in outer London who travelled into the charging zone were more likely to expect their journey experience in the zone to get worse than improve, although the most common response among drivers was an expectation that their journey would stay the 'same as now'. Their views reflect concerns over increased congestion on their routes into the centre and the effects of increased demand for public transport, which most of them use. Crowding on public transport was the main concern, particularly for non-drivers.

Figure 8.5. Expected changes to the journey experience: respondents living in outer London.



Those living beyond the M25

When thinking about their selected tour, drivers living beyond the M25 were more likely to expect an improvement than a deterioration in their journey experience to central London when congestion charging was introduced. Their main hopes were improvements in the predictability of their journeys and a reduction in time spent waiting. The majority of non-drivers expected no change to most aspects of their journey experience, although over half were concerned about increased crowding.

Figure 8.6. Respondents living beyond the M25.

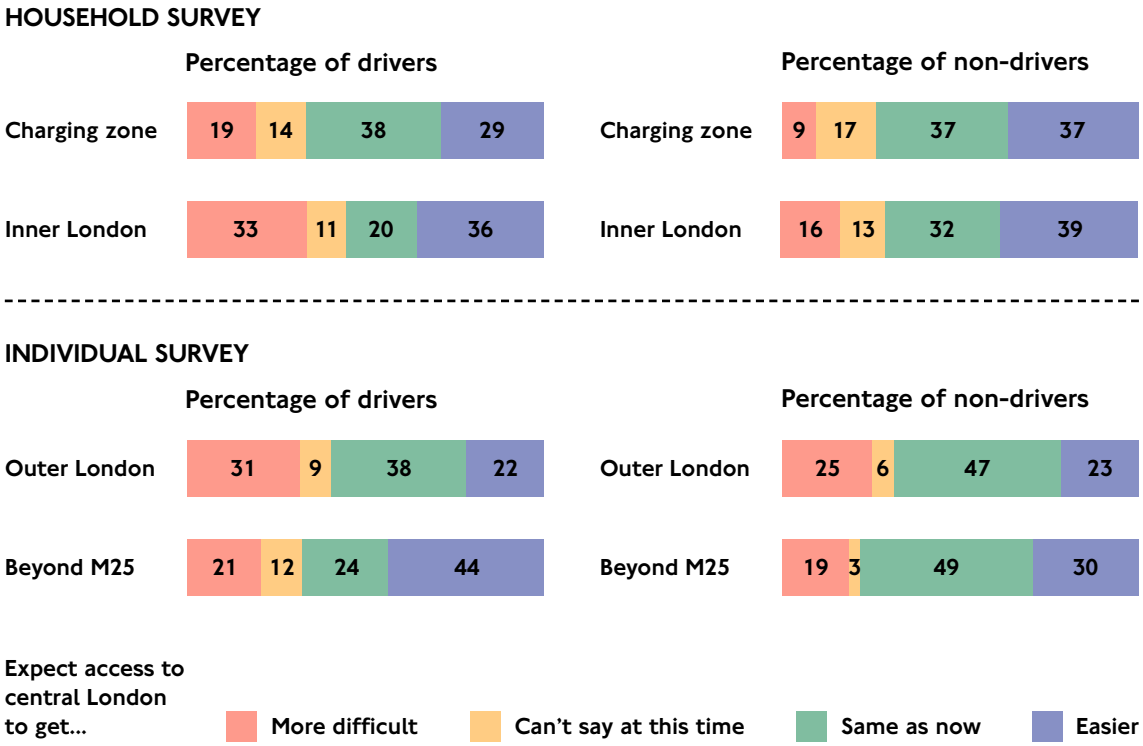
8.4 Anticipated impact upon accessibility to central London

General accessibility

Respondents were asked, in general, what effects they expected congestion charging to have upon their accessibility to central London[4].

With the exception of those living in outer London, more respondents expected their access to central London to get easier than expected it to get worse. Greatest improvements in accessibility were anticipated by non-drivers living in the charging zone and inner London, and drivers from beyond the M25. Drivers and non-drivers from outer London were more likely to expect access to become more difficult.

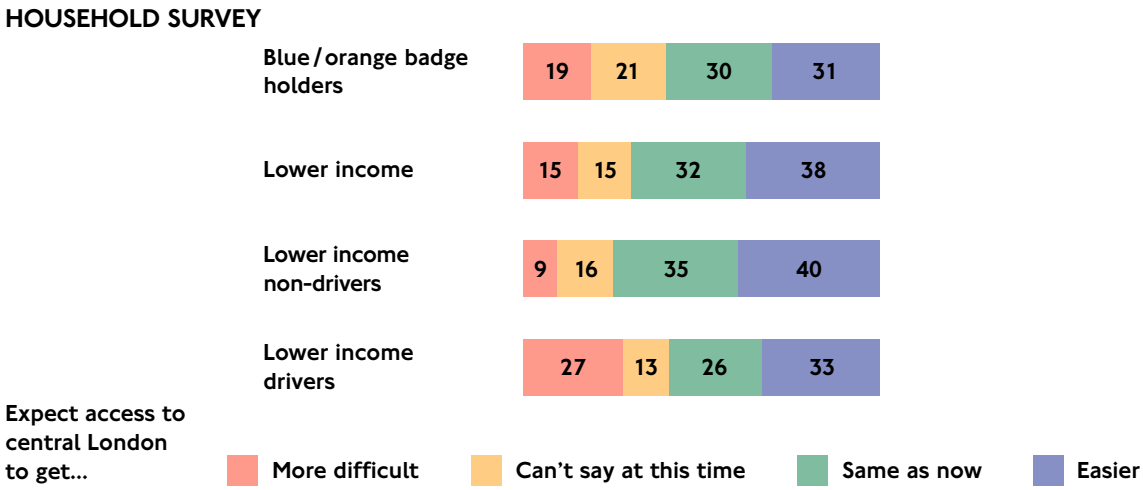
Figure 8.7. Perceived impact on general accessibility to central London for drivers and non-drivers from all survey areas.



Specific groups

It has been suggested that some groups of people may experience disproportionate adverse impacts from the scheme. Figure 8.8 shows how blue or orange badge holders and lower income groups living in the charging zone and inner London expected the scheme to affect their access to central London. It can be compared to Figure 8.7, which shows the results for the total sample. All of these key groups have similar expectations about the impact that the scheme will have upon their access to central London as the comparable driver/non-driver population as a whole.

Figure 8.8. Perceived Impact on accessibility to central London for key interest groups from the charging zone and inner London.



8.5. Expected advantages and disadvantages of congestion charging

This section looks in general at the anticipated advantages and disadvantages of congestion charging, and how respondents expected the scheme would impact upon their household overall. The anticipated impacts upon different income groups are explored, along with an analysis of those groups and individuals most likely to expect to experience positive, negative or neutral impacts of the scheme[5].

Anticipated advantages of the congestion charging scheme

After respondents had been interviewed in-depth about the changes they might make to their travel patterns and household routines in response to the scheme, they were asked to say what they expected the scheme's main positive and negative effects would be for them personally. The three most frequently anticipated benefits of congestion charging and its complementary measures were reduced traffic congestion, better and less crowded public transport services and improved air quality. The proportions of respondents anticipating these benefits varied depending upon where they lived. Those living beyond the M25 were most likely to anticipate benefits.

Anticipated disadvantages of the congestion charging scheme

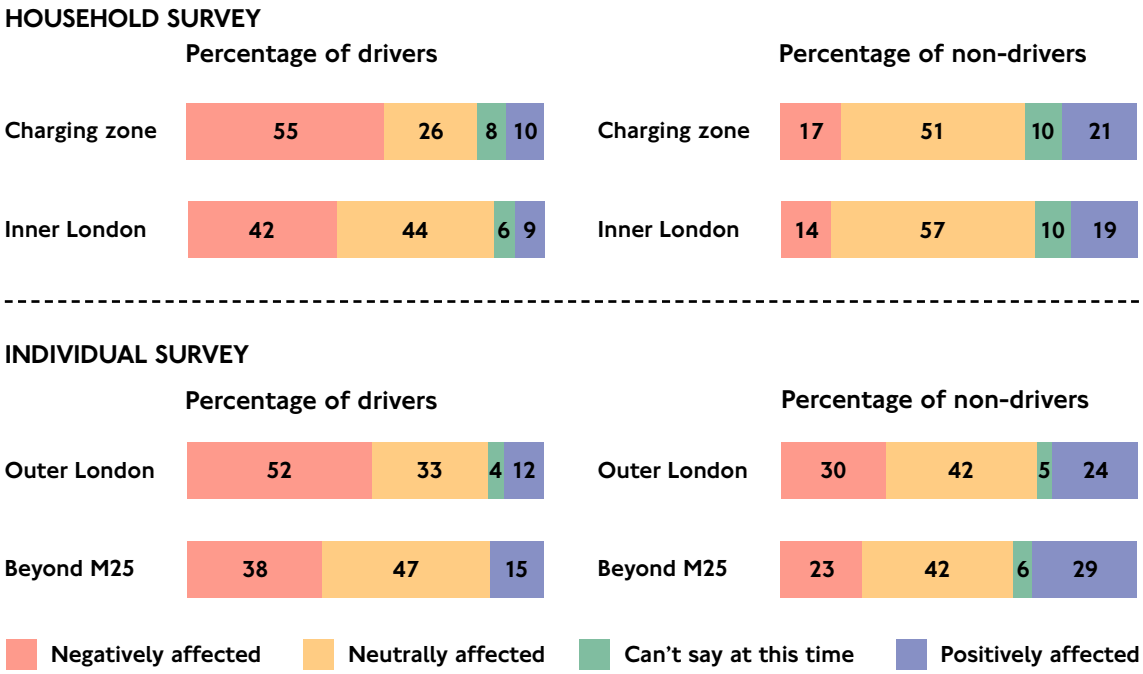
The most frequently mentioned disadvantages of the scheme included increased travel costs (including the cost of the charge itself), increased traffic outside the charging zone and on the boundary, and more crowding and discomfort on public transport.

Respondents living inside the charging zone were concerned that the charge might deter friends and family from visiting them. In inner London, increased traffic outside the congestion charging zone and on the boundary was the major concern. The main concern of respondents living in outer London was the effect of overcrowding on public transport. Those from beyond the M25 were most concerned about increased travel costs.

Anticipated overall impact of congestion charging

After considering both the positive and negative impacts of the scheme and its complementary measures, respondents were asked how they thought they would be affected overall. Figure 8.9 shows responses for drivers and non-drivers in the four survey areas. This shows that non-drivers are more likely than drivers to expect the scheme's impact to be neutral or positive. A large proportion of drivers from all survey areas expected the impact of the scheme to be negative. This proportion is greatest amongst drivers resident in the charging zone. Looking across the four survey areas, an overall positive impact was most likely to be expected non-drivers living beyond the M25.

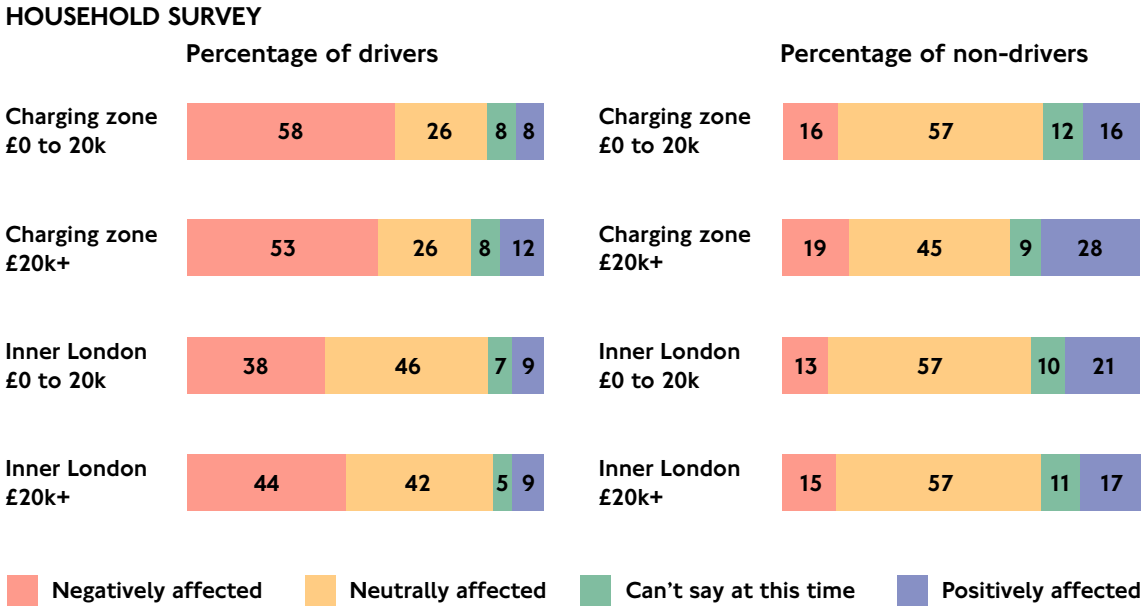
Figure 8.9. How drivers and non-drivers expected to be affected by congestion charging overall.



Anticipated impacts upon different household income groups

Figure 8.10 shows the expected impact of the scheme on drivers and non-drivers from households with different incomes. Drivers were always much more likely to expect to be negatively affected than non-drivers, with financial impacts being their main concern. However, these proportions do not vary substantially according to household income.

Figure 8.10. How drivers and non-drivers with different household incomes expected to be affected by congestion charging over all.



Groups most likely to expect advantages and disadvantages

Table 8.1 identifies the top five types of individual or household from the charging zone and inner London more likely to say that they expect to be either positively, negatively or neutrally affected by congestion charging. Views are compared with the baseline for all respondents, and the percentages show the proportion of individuals or households in each category.

Table 8.1. Those who overall were most likely to expect positive, negative or neutral impacts from congestion charging.

HOUSEHOLD SURVEY

Those most likely to expect to be positively affected	Those most likely to expect to be neutrally affected	Those most likely to expect to be negatively affected
Average value across the household survey		
16%	47%	28%
1. Cyclists (40%) 2. Non-drivers who live near the boundary (27%) 3. Unemployed (seeking work) (24%) 4. Respondents from households without a car (24%) 5. Single person/couple up to age 30 (24%)	1. Motorcyclists (70%) 2. Pedestrians (61%) 3. 14 to 16 year-olds (58%) 4. Non-drivers who live in inner London (57%) 5. Respondents from households without a car (57%)	1. Drivers who live near the boundary (62%) 2. Charging zone resident car drivers (55%) 3. Drivers in general (48%) 4. Respondents from households with two or more cars (45%) 5. Inner London resident car drivers (42%)

8.6. Anticipated neighbourhood impacts

This section reports results from the seven neighbourhoods that were the focus of the household survey. Respondents were asked general questions about how they expected the scheme to impact upon their local neighbourhood in terms of factors such as the economy, parking, public transport and the local environment. The results from the neighbourhoods inside the zone and those in inner London are compared. For this analysis, respondents are split by those households with and without cars[6].

Survey neighbourhoods

Figure 8.11 below shows where the household surveys took place between September and mid-November 2002[7]. The survey was carried out on a neighbourhood basis to allow expression of local effects and differences between areas in factors such as the transport network, alternative methods of travel to the car, and access to local shops and services[8]. Table 8.2 represents the seven survey neighbourhoods in terms of these factors.

Figure 8.11. Map of the neighbourhood survey locations.

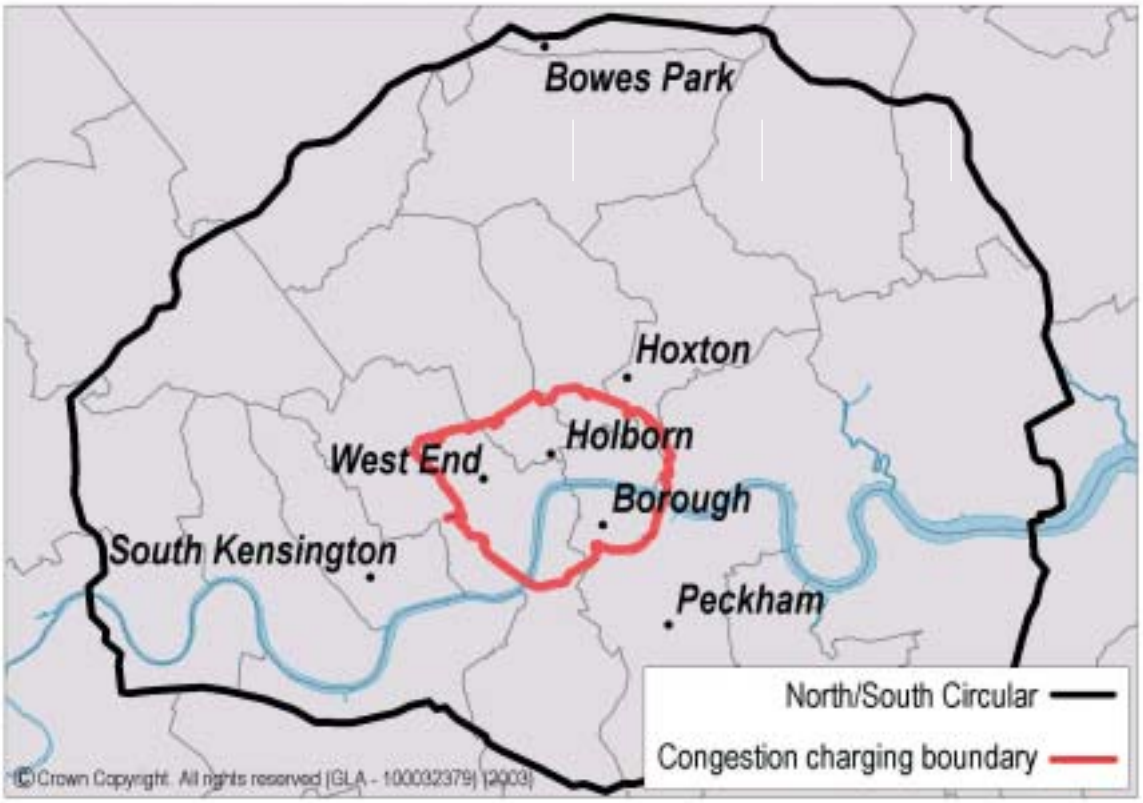


Table 8.2. Characteristics of the seven survey neighbourhoods.

Survey neighbourhoods		Level of access to …		
Neighbourhood	**London area**	**Local facilities**	**Charging zone by car**	**Charging zone by public transport**
Borough	Charging zone	Low	N/A to respondents resident inside zone	Low*
Holborn		High		Medium*
West End		Med/high		High*
South Kensington	Inner London	High	Low	High
Hoxton		High	High	Low
Peckham		Low	High	Low
Bowes Park		Low	Low	High

*Local access to public transport inside the zone.

Neighbourhoods inside the charging zone

Respondents living in the three neighbourhoods in the charging zone had generally consistent expectations about the scheme's future impact upon their local area, as shown in Table 8.3[9]. Respondents from households without a car were more likely to expect improvements than those with a car. Overall the most common expectations of residents living inside the charging zone were of improvements in their local environment in terms of congestion, air quality and noise levels and in the availability and reliability of public transport. A number also expected health benefits.

The majority did not think that the scheme would make any difference to the availability of parking or the sense of safety and community but of those who did, the expectation was generally of an improvement.

Most respondents expecting congestion charging to have an impact on the local economy tended to anticipate that it would have a negative impact. The feeling amongst these respondents was that the congestion charge would increase business costs or reduce customer numbers.

Table 8.3. Anticipated impacts on the local neighbourhood for households with and without a car, for neighbourhoods inside the charging zone.

With car						Without car				
Environment	Parking	Public transport	Economy	Sense of community and safety		Environment	Parking	Public transport	Economy	Sense of community and safety
Borough										
23%	23%	17%	33%	17%	**Worse**	46%	34%	50%	13%	23%
27%	38%	26%	32%	44%	**Same as now**	12%	11%	9%	28%	4%
19%	22%	25%	30%	26%	**Can't say at this time**	25%	33%	22%	31%	53%
31%*	17%	32%	5%	12%	**Better**	17%	22%	19%	27%	20%
Holborn										
8%	9%	9%	25%	7%	**Worse**	7%	7%	7%	19%	4%
37%	45%	30%	36%	59%	**Same as now**	36%	37%	28%	37%	58%
9%	18%	25%	32%	17%	**Can't say at this time**	8%	24%	19%	35%	16%
45%	29%	37%	7%	17%	**Better**	49%	32%	47%	9%	22%
West End										
10%	6%	6%	33%	5%	**Worse**	4%	6%	8%	25%	5%
35%	55%	42%	39%	68%	**Same as now**	28%	41%	34%	44%	61%
9%	11%	18%	23%	13%	**Can't say at this time**	7%	22%	17%	26%	16%
46%	27%	34%	5%	14%	**Better**	61%	31%	41%	6%	18%

* Shading denotes highest value category.

Inner London neighbourhoods

The views of respondents living in the neighbourhoods in inner London were more diverse. Table 8.4 shows how respondents expected the scheme to impact upon their local environment, split into car and non-car owning households[9]. Each neighbourhood presents different types of opportunities in terms of high, medium or low access to the charging zone by car, and public transport, and in the availability of local facilities.

Shared expectations

Across all four of the inner London neighbourhoods, the majority of respondents were concerned that increased local traffic would create problems for the environment and that parking problems would be exacerbated. Respondents from households with a car were more likely to expect these detrimental affects than respondents from households without one.

Other views

It is of interest to examine differences between the inner London neighbourhoods. Respondents in Hoxton, Peckham and Bowes Park said they expected the frequency and reliability of local public transport to improve:

'I will be able to use public transport if it's more regular, as I cannot stand for long'.

A majority in South Kensington expected the opposite, one individual commenting:

'I don't trust public transport improvements'.

The feeling amongst some respondents in this neighbourhood was that additional bus services could increase congestion making existing services more unreliable.

Compared to those living inside the charging zone, a greater proportion of inner London respondents expected benefits to their local economy in terms of local trade and employment as a result of the scheme. These proportions were largest in Bowes Park. One respondent was of the view that congestion charging:

'may attract people to the area which would be a good thing, bringing more money and life into the area'.

Almost half of the respondents who expected change in Bowes Park anticipated an improvement to the sense of community and safety. One respondent believed that congestion charging would mean that their local neighbourhood would have *'clearer roads and a feeling of space'.*

Table 8.4. Anticipated impact on local neighbourhoods for households with and without a car: neighbourhoods in inner London.

With car						Without car				
Environment	Parking	Public transport	Economy	Sense of community and safety		Environment	Parking	Public transport	Economy	Sense of community and safety
South Kensington										
56%*	55%	35%	21%	27%	**Worse**	43%	44%	32%	14%	19%
19%	28%	29%	38%	46%	**Same as now**	21%	25%	22%	40%	47%
9%	7%	16%	30%	20%	**Can't say at this time**	8%	10%	15%	29%	22%
16%	10%	21%	11%	7%	**Better**	28%	20%	31%	17%	12%
Hoxton										
57%	60%	19%	19%	24%	**Worse**	32%	38%	14%	15%	17%
20%	25%	24%	45%	54%	**Same as now**	21%	29%	25%	42%	48%
7%	8%	12%	24%	16%	**Can't say at this time**	18%	18%	13%	31%	23%
16%	6%	44%	12%	6%	**Better**	29%	15%	48%	12%	11%
Peckham										
53%	53%	29%	22%	29%	**Worse**	41%	43%	21%	21%	19%
32%	35%	31%	37%	46%	**Same as now**	37%	42%	28%	35%	49%
6%	6%	17%	29%	19%	**Can't say at this time**	8%	12%	18%	29%	19%
9%	6%	24%	11%	6%	**Better**	15%	3%	32%	14%	12%
Bowes Park										
45%	50%	19%	7%	18%	**Worse**	30%	39%	16%	7%	11%
28%	36%	31%	48%	50%	**Same as now**	31%	40%	21%	45%	55%
8%	8%	13%	27%	20%	**Can't say at this time**	6%	5%	9%	27%	17%
18%	5%	36%	19%	11%	**Better**	33%	16%	54%	20%	17%

* Shading denotes highest value category.

8.7. How drivers expected to adapt to congestion charging

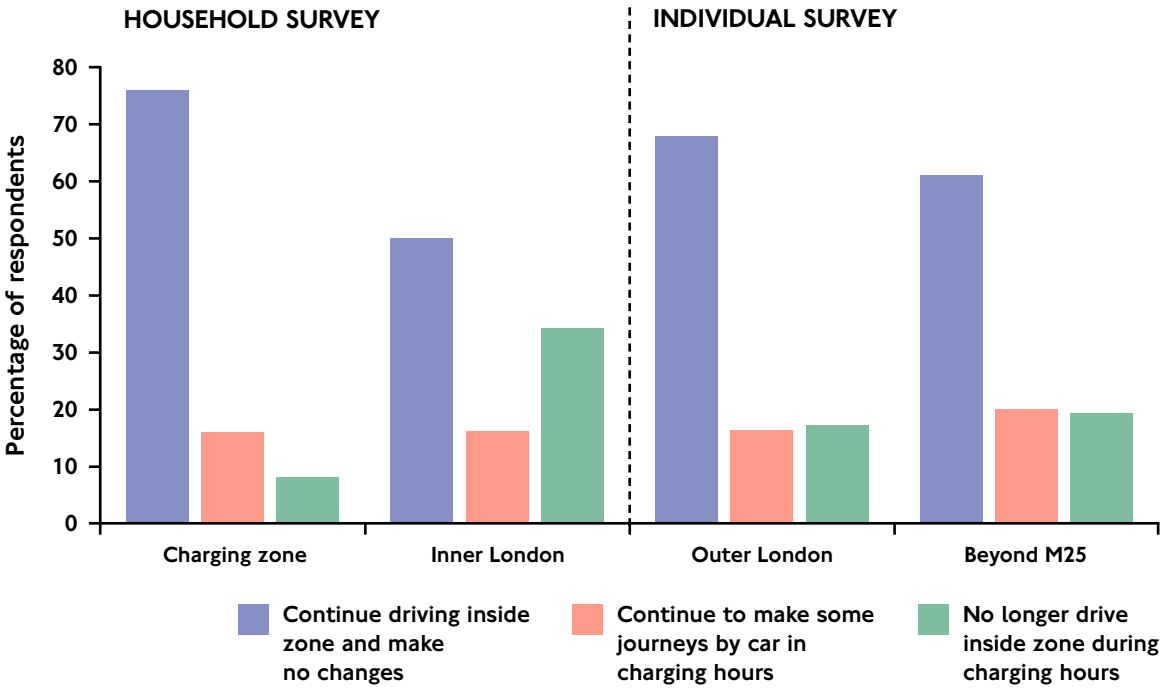
This section looks in general at how those who drive in the charging zone, at least occasionally, expected to adapt to congestion charging. The adaptations are examined in terms of:

- whether these drivers expected to make any changes to their travel arrangements when the scheme was in place;
- how drivers who live inside the zone and inner London anticipated making changes to the frequency with which they use different methods of travel;
- how much they expected to spend on the charge each year.

Car journeys to the charging zone

All those who drove in the future charging zone during charging hours were asked a general question relating to whether they would make any adjustments to their car journeys to, from and within the zone as a result of the scheme. Figure 8.12. shows that in each survey area, at least half of all these respondents expected to continue driving in the zone as they do now[10]. The greatest proportion of this group who expected to continue driving in the zone were those who live there and are therefore eligible for a 90 percent discount. Those most likely to anticipate making most changes were drivers from inner London who would have to pay the full charge.

Figure 8.12. Expected changes to car journeys to the charging zone.

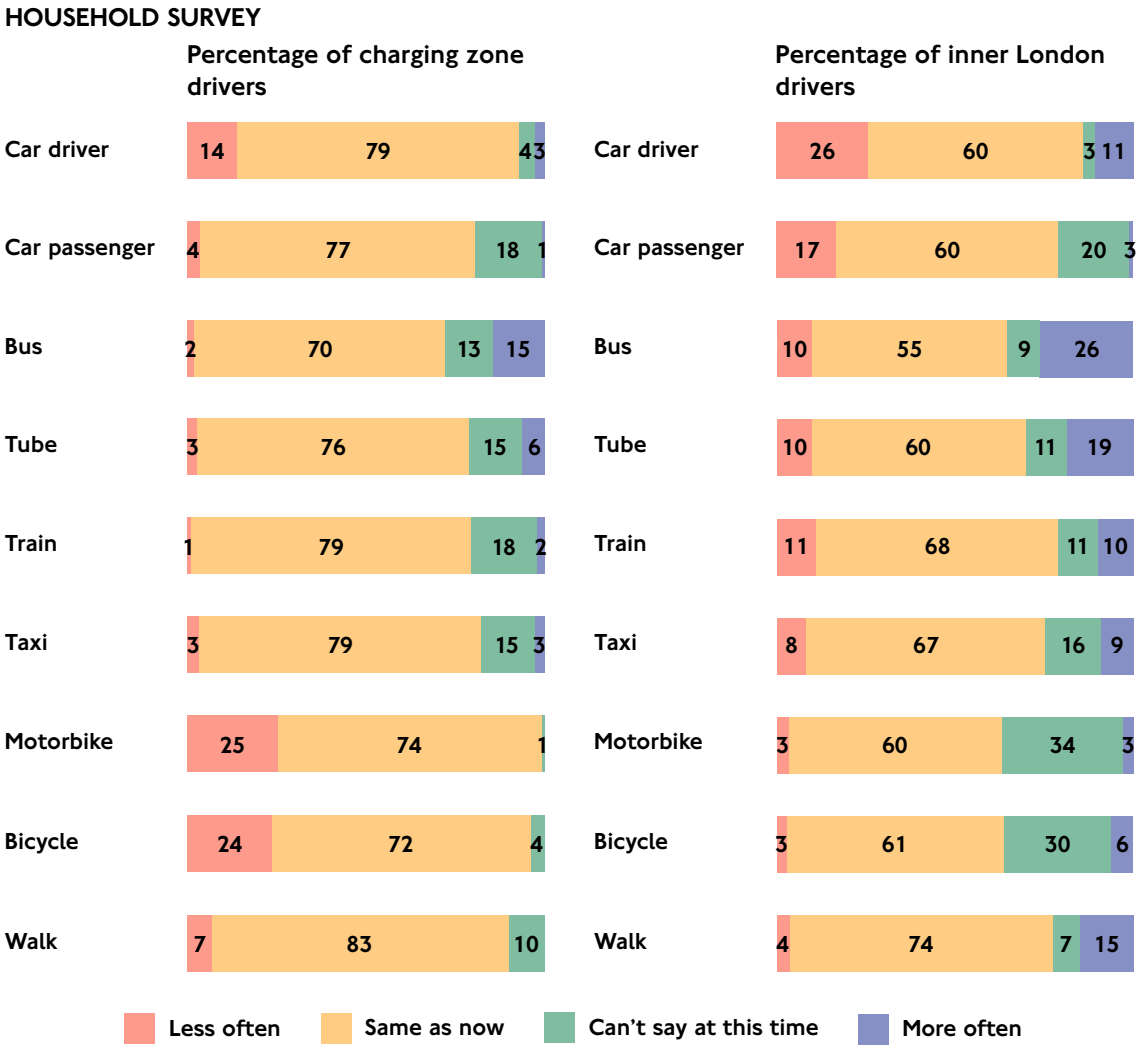


Anticipated changes in method of travel

Respondents living in neighbourhoods inside the charging zone and inner London were given information about the expected reduction in traffic congestion as a result of the scheme and planned improvements to public transport in their local area. They were then asked a general question about whether they expected their use of different transport methods to change when congestion charging was introduced.

Figure 8.13 shows the extent to which current drivers living inside the charging zone expected to change the use they make of different methods of travel after congestion charging was introduced[10]. The majority expected congestion charging to make no difference to their transport usage. Of those who expected to change, drivers anticipated reducing car use and travelling more by bus.

Figure 8.13. How drivers living inside the charging zone and in inner London expected to change their methods of travel.



Compared to charging zone respondents, proportionally more drivers in inner London expected to change their method of travel after congestion charging is introduced. Again, they expected to use the car less and the bus more, but also expected to use the Underground more and to make more journeys on foot.

Anticipated annual expenditure on the congestion charge

This section looks at responses to a general question asked about how often people said they intended to make journeys that would incur the charge[10]. Respondents living inside the charging zone are eligible for a 90 percent discount. Eighty-two percent of this group expected to pay for 41 to 52 weeks of the year, meaning their annual expenditure would be £102.50 to £126.

Table 8.5. Anticipated annual expenditure on the congestion charge for drivers resident inside the charging zone[11].

Respondents from:	41-52 Weeks £102.50-£126	21-40 weeks £52.50-£100	1-20 weeks £2.50-£50
Charging zone	82%	9%	9%

Anticipated expenditure on congestion charges was very different for respondents from inner London. Only 45 percent of respondents planned to pay the charge more than twice a week at a cost of £520 to £1260 per year. Anticipated expenditure on congestion charges varies yet again amongst drivers from outer London and beyond the M25. The majority (66 percent) of drivers from outer London anticipated paying two or more days a week at a cost of £520 to £1260 a year. In contrast, a majority (61 percent) of drivers from beyond the M25 expected to pay the charge one to ten times a year at an annual cost of just £5 to £50. Results for each survey area are shown in Table 8.6[10].

Table 8.6. Anticipated expenditure on the congestion charge for all drivers from inner and outer London and beyond the M25.

Respondents from:	2+ days a week £520-£1260	Once a week to once a month £60-£260	1-10 days a year £5-£50
Inner London	45%	42%	13%
Outer London	66%	23%	12%
Beyond M25	31%	8%	61%

8.8 Types of changes anticipated by drivers and public transport users

When considering their selected tour, respondents were asked whether they anticipated reorganising this journey in any way, for example, by using a different method of travel or changing their destination when the scheme was introduced. They were also asked if these changes would affect the duration of their journey and if so, what the day to day implications of these changes would be.

Anticipated changes to journeys

Respondents were invited to consider a selected tour made recently from home and back. They were then asked whether and how this trip might have been organised if the scheme had already been introduced. Responses are analysed below split into the four survey areas and distinguishing between the responses of drivers and non-drivers[12].

Table 8.7 shows that most respondents did not expect congestion charging to make any difference to the way they organised the selected tour. Around 67 percent of drivers in the charging zone and inner London expected to make no changes to their tour. This compares to nearly 90 percent of non-drivers in the charging zone and inner London and slightly less for those in outer London and beyond the M25. Of those who expect to change their tour in some way, most drivers and non-drivers anticipated changing their method of travel, followed by changes to journey or departure time.

Table 8.7. Anticipated changes to selected journey.

Type of journey change to selected journeys*	Charging zone and inner London		Outer London and beyond the M25	
	Drivers	Non-drivers	Drivers	Non-drivers
Make no change	67%	89%	68%	85%
Change to journey time or departure time	10%	7%	9%	7%
Change method of travel	15%	4%	11%	5%
Change destination	2%	1%	1%	2%
Change time of day or day of travel	6%	2%	4%	3%
No longer make the journey	2%	0%	2%	0%

*Respondents sometimes made more than one of these adjustments.

Journey duration

Respondents were asked to consider whether time spent travelling on their selected tour from home and back might change after the scheme began. The majority of non-drivers from all survey areas expected the scheme to have no impact on their journey duration. The few who did expect changes tended to expect faster journeys, with the majority expecting to save between 10 and 30 minutes.

Drivers were more likely to anticipate journey times to change, especially those who drive from beyond the M25. More drivers from all survey areas expected their journeys to take longer, with the majority expecting to spend up to an extra 15 to 30 minutes on their journey.

Table 8.8 shows what difference respondents expected these changes would make to their lives, using a selection of verbatim comments.

Table 8.8. Impact of spending more or less time travelling.

	Impact of spending less time travelling	Impact of spending more time travelling
Improve my day	*'I'll relax more'* *'My day will be less stressed'*	*'More rushed'* *'More stress / tiredness'*
Me and my family	*'I don't know what I'll do with the time, but it will be better than sitting in traffic'* *'More time to sleep'* *'Watch TV'* *'Have more leisure time'* *'Spend more time with friends and family'* *'More time for outdoor leisure'* *'Nothing in particular'* *'More time to prepare a meal / eat'* *'More time to get the housework done'*	*'Less leisure time'* *'Less time to do other things'* *'Less time to do domestic chores'* *'Less time to cook / eat'* *'Get up earlier – less sleep'* *'Less time with the family'* *'Less time socialising'* *'Late for picking the children up from school'*
Work / study	*'More time for homework'* *'Spend more time at work / college'*	*'Lose income / customers'* *'Late for appointments / work'*

Technical notes

1 Results from the charging zone and inner London Household Survey presented here are based on responses from 2,286 households, interviewed between September and mid-November 2002. Broadly matched samples of households were interviewed in seven sample neighbourhoods. Households were selected according to quotas based on household income, car ownership and life stage. The inner London sample consists primarily of people who visit the charging zone. Samples therefore are not fully representative of the population in these areas, nor of the charging zone/inner London as a whole.

2 Results from the survey of people from outer London and beyond the M25 are based on responses from 2,132 people interviewed between October and mid-November 2002. Sample sizes shown are actual sizes, however, in the analysis of this survey, the data have been post-weighted (using independent data on trip purpose, mode of travel, gender, age and area of residency) so that the results reflect the profile of people who travel into central London on weekdays, from outer London and beyond the M25.

3 People who expected their selected journey would no longer involve travel in the charging zone once the scheme is in effect were excluded from the analysis of journey experience. Those who were unable to give an opinion about how their journey experience may be affected by the scheme were also excluded from this analysis.

4 In the analysis of accessibility, all drivers and non-drivers from the survey were included, whether or not their selected journey involved travel inside or outside the charging zone.

5 In the analysis of advantages and disadvantages of congestion charging, all drivers and non-drivers from the survey were included, whether or not their selected journey involved travel inside or outside the charging zone.

6 All respondents who took part in the household survey are included in this analysis of neighbourhood impacts.

7 Broadly matched samples were interviewed in each neighbourhood. Households were selected according to quotas based on household income, car ownership and life stage. The inner London sample consists primarily of people who visit the charging zone. Samples therefore are not fully representative of the population in these four neighbourhoods.

8 Assessments of access to central London by car and public transport and access to local shops and services were based upon data from the Capital Public Transport Accessibility Model, London Transportation Studies Model and The Index of Multiple Deprivation 2000.

9 The five key neighbourhood impacts shown here are derived from a number of more detailed factors. For example, the environment factor combines opinions about the impact of the scheme on congestion, pollution and noise.

10 Responses are shown for all respondents who said that they drive a car or van inside the charging zone during charging hours at least occasionally for one or more of their current activities.

11 Anticipated annual expenditure for residents excludes the £10 registration fee. Annual charges are calculated on 252 charging days in the year.

12 In the analysis of anticipated changes to tours after congestion charging has become operational, all drivers and non-drivers were included, whether their selected tour included travel inside or outside the charging zone.

9. Environment

9.1. Introduction

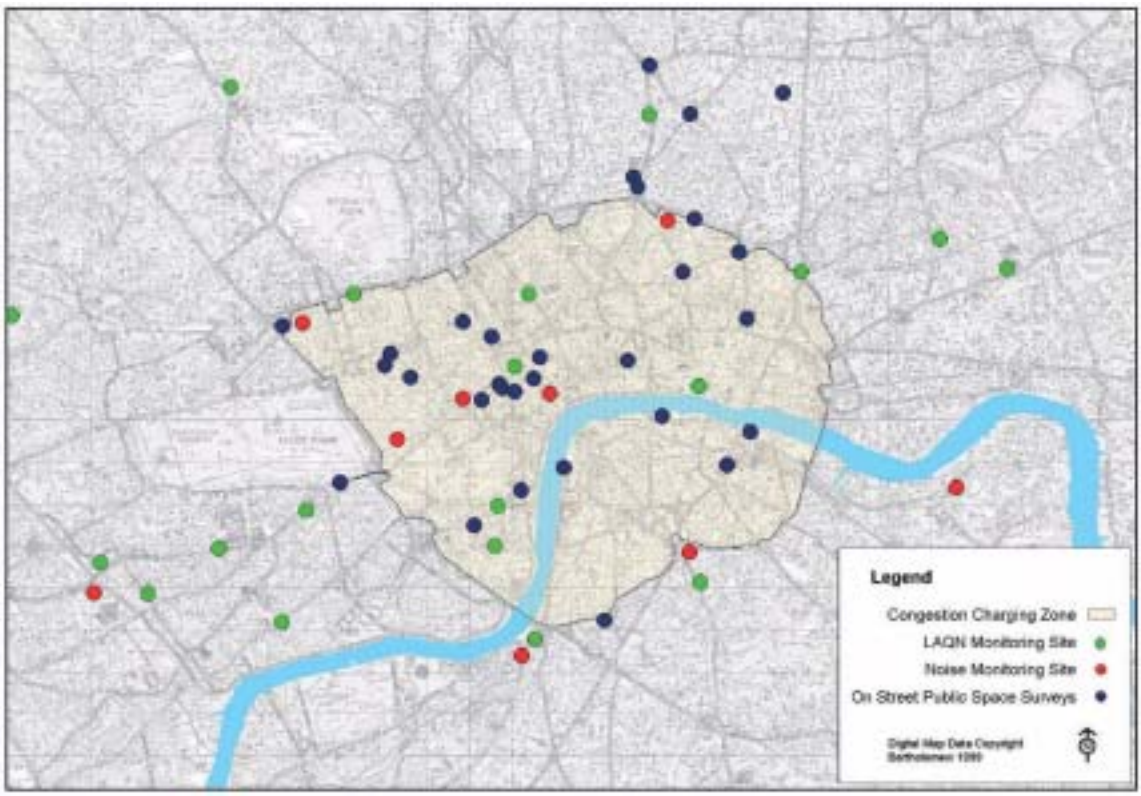
This section is concerned with the impacts of congestion charging on the environment. It briefly summarises the expected environmental effects of the scheme, further describes the assessment frameworks being employed, and sets out key data describing environmental conditions before charging starts.

Separate sections then consider the following four areas:

- air quality impacts: measurement of ambient concentrations;
- air quality impacts: emissions and air quality modelling;
- traffic noise impact;
- perceived quality of the central London environment.

Figure 9.1 shows the location of environmental impact surveys referred to in this section.

Figure 9.1. Location of key environmental impacts surveys.



9.2. Expected environmental impacts

Congestion charging is expected to change the volumes and patterns of traffic in and around the charging zone. This will result in changes to road vehicle emissions, which will in turn affect concentrations of pollutants in the atmosphere. This relationship is not a direct one, however, and the changes in local pollutant concentrations resulting directly from the scheme are likely to be small (typically less than plus/minus 1 or 2 percent), and hence difficult to detect using conventional assessment methods in the short- or medium-term.

The processes determining the relationship between traffic and air quality change are complex. The following are some reasons why only relatively modest air quality changes are expected from a scheme that is expected to affect traffic volumes in places by up to 15 or 20 percent:

- congestion is only one of many influences on air quality in London. Others include the weather, pollution from other sources and locations, and on-going technological improvements to vehicles;
- congestion charging only operates for approximately one-third of the hours in a year, whereas the air quality objectives that are of greatest concern are framed in terms of annual and daily averages;
- congestion charging will mainly affect cars, which produce less pollution per vehicle-kilometre in comparison with, for example, buses and lorries;
- changes in emissions from traffic do not lead to equivalent changes in local concentrations of air pollution, owing to factors such as chemical reactions, dispersion and mixing in the atmosphere.

Comparable considerations also apply to the effect of congestion charging on levels of traffic noise. Traffic changes in response to charging are not expected to result in changes to the local noise environment (ambient noise levels) that are within the perceptual range of most individuals. Nevertheless, concerns have been expressed about the possible local-scale impact of displaced traffic, particularly around the Inner Ring Road.

Congestion charging could facilitate a range of improvements to the street environment in the charging zone, both directly through reducing traffic and congestion, and also indirectly, through streetscape improvement initiatives. In due course, the overall effect of these could be a noticeable improvement to the quality of central London as a place to live, work and visit. Although largely unquantifiable this may be recognised in terms of how Londoners and visitors to London perceive aspects of the local environment.

9.3. Defining pre-charging conditions

The effects that are being measured here do not lend themselves to straightforward quantitative indicators describing pre-charging conditions. This is for two main reasons:

- quantities such as air pollution concentrations and noise vary continuously across time and space, and simple 'zonal averages' are not meaningful;
- air quality, noise and indeed people's perceptions of the environment are affected by a diverse range of external influences, the majority of which will have little or nothing to do with congestion charging.

With regard to air quality and noise, the approach adopted has been to overlay specific additional monitoring work on existing assessment work being done in pursuit of the Mayor's air quality and noise strategies. In each case, the approach that will be used to determine and quantify changes from the various causes are described. Individual perceptions of environmental quality will form an interesting complement to these quantitative measurements, but may not provide scientific evidence of change.

For air quality, the focus of the monitoring is on oxides of nitrogen (NO_2 and its precursor NO_x), and fine particulate matter (PM_{10}). These are the two pollutants that are of greatest interest to air quality assessment in London, in terms of the ability to meet national objectives. Other local pollutants (e.g. carbon monoxide – CO) can also be assessed using the framework described, although prevailing levels of these are not such as to give rise to concern regarding London's ability to meet national objectives.

9.4. Air quality impacts: measurement of ambient concentrations of key pollutants

Role of air quality measurement

Direct measurement is the most accurate way of determining pollutant concentrations at specific locations, and is likely to be the first point of reference for those seeking to assess the air quality impacts of the scheme. However, it is not possible to measure everywhere, so monitoring locations are chosen to be representative of comparable locations across an area.

Also, air pollutant concentrations at any point are determined by a complex relationship between local and distant emissions; meteorological and topographic factors; and atmospheric chemistry. Measurements typically have a precision of plus or minus 10 percent, and the variability of climate between seasons and years means that several years' data is usually required before apparent short-term trends can be verified.

The relatively small changes to concentrations of atmospheric pollutants that are expected to arise from traffic changes brought about by congestion charging are therefore not expected to be apparent from these measurements in the short term. In addition, it will not be possible from these measurements alone to distinguish the relative contribution of congestion charging from all the other influences operating at the same time; for example, the natural renewal of vehicles. Nevertheless, these measurements form the benchmark for monitoring changes in the concentration of air pollutants.

Air quality monitoring

Data from the majority of air quality monitoring sites in London are available through the London Air Quality Network (LAQN). Of the more than 80 sites potentially available, sub-sets have been selected to be representative of scheme geography and exposure of the public. These are set out in Table 9.1. Sites in the 'core' category have been selected so as to have an uninterrupted historical dataset of at least 5 years. A number of secondary indicator sites, complementary to the core sites but with uninterrupted datasets of less than 5 years, have also been identified.

Table 9.1. Selected LAQN indicator sites.

Core indicator sites	Secondary indicator sites
Within charging zone - urban background Russell Square, London Borough of Camden.	**Within charging zone - urban background** Queen Victoria Street, Corporation of London, Horseferry Road, City of Westminster
Within charging zone - roadside None available.	**Within charging zone - roadside** Shaftesbury Avenue, London Borough of Camden; Victoria Street, City of Westminster.
Inner Ring Road - roadside Marylebone Road (kerbside), City of Westminster.	**Inner Ring Road - roadside sites** Old Street, London Borough of Hackney; Vauxhall Cross, London Borough of Lambeth.
Inner London roadside Swiss Cottage, London Borough of Camden; Cromwell Road, Royal Borough of Kensington & Chelsea; Mile End Road, London Borough of Tower Hamlets.	**Inner London roadside** Old Kent Road, London Borough of Southwark; New Cross, London Borough of Lewisham; High Street, London Borough of Wandsworth; Kings Road, Royal Borough of Kensington & Chelsea; Harrods, Royal Borough of Kensington & Chelsea.
Inner London urban background North Kensington, Royal Borough of Kensington & Chelsea; Elephant and Castle, London Borough of Southwark; Poplar, London Borough of Tower Hamlets; Pembroke Road, Royal Borough of Kensington & Chelsea.	**Inner London urban background** Bethnal Green, London Borough of Tower Hamlets; Upper Street, London Borough of Islington; Loughborough Junction, London Borough of Lambeth.
Suburban outer London Slade Green, London Borough of Bexley; Kingsbury, London Borough of Brent; Eltham, London Borough of Greenwich; Teddington, Richmond Upon Thames.	**Suburban outer London** Several additional sites available.

Recent trends in air quality for NO_2 and PM_{10}

In the figures that follow, results are presented as an average across all of the core indicator sites in each category, expressed as running annual mean concentrations for oxides of nitrogen (NO_x) and nitrogen dioxide (NO_2) and as the number of exceedence days (days per year when levels exceed the air quality objective) for fine particulate matter (PM_{10}). Fine particulate matter consists of particles smaller than 10µm aerodynamic diameter. These forms of presentation can help smooth out temporary discontinuities in the data resulting, for example, from analyser malfunction or nearby temporary construction work. Results for the Marylebone Road site are presented individually in Figure 9.5, as an example of how site-specific features, not immediately related to wider traffic change, can significantly affect measurements from this source.

Whilst there are no national objectives for NO_x, it is important as it consists of NO_2 and its precursor NO, and it is more directly sensitive to changes in traffic levels. Figure 9.2 shows a general trend of slowly-decreasing NO_x concentrations. The exception to this trend is the Marylebone Road site, a kerbside location on the boundary of the charging zone, where levels of NO_x appear to have risen before falling rapidly since Autumn 2001.

Figure 9.2 . Recent trends in oxides of nitrogen (NO_x) concentrations at indicator sites.

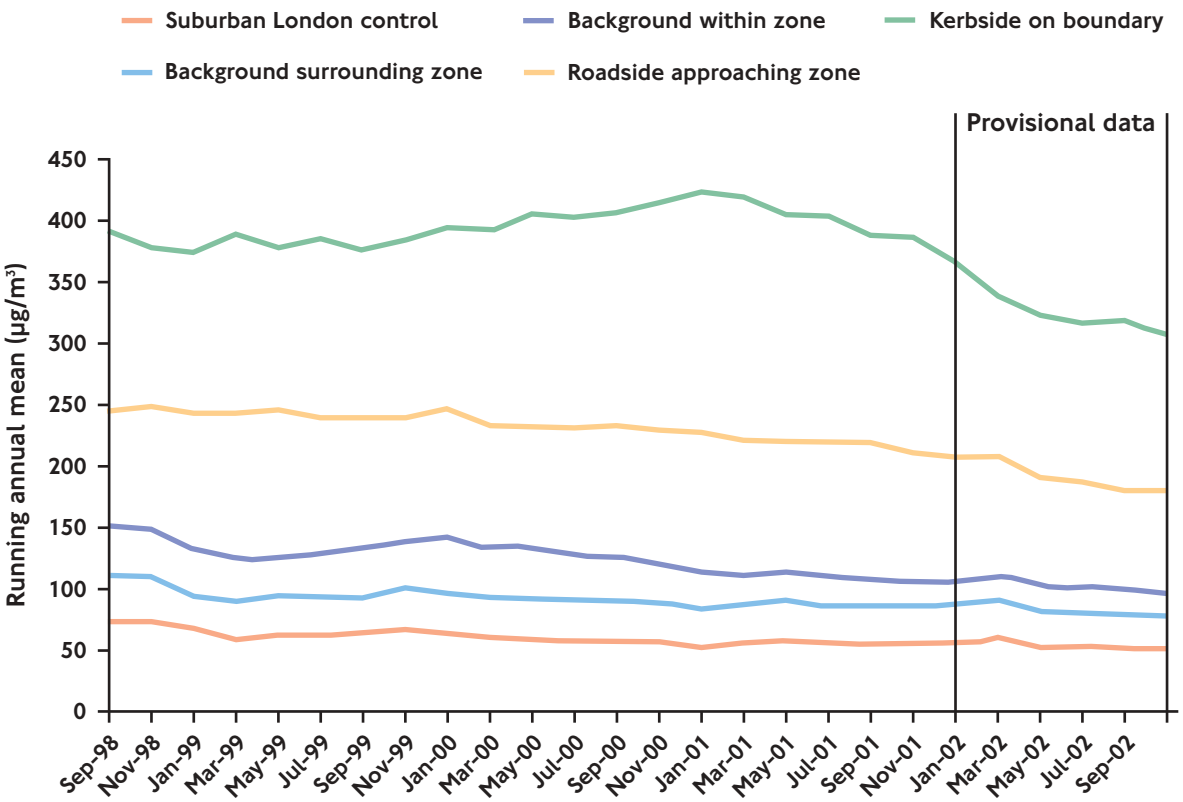
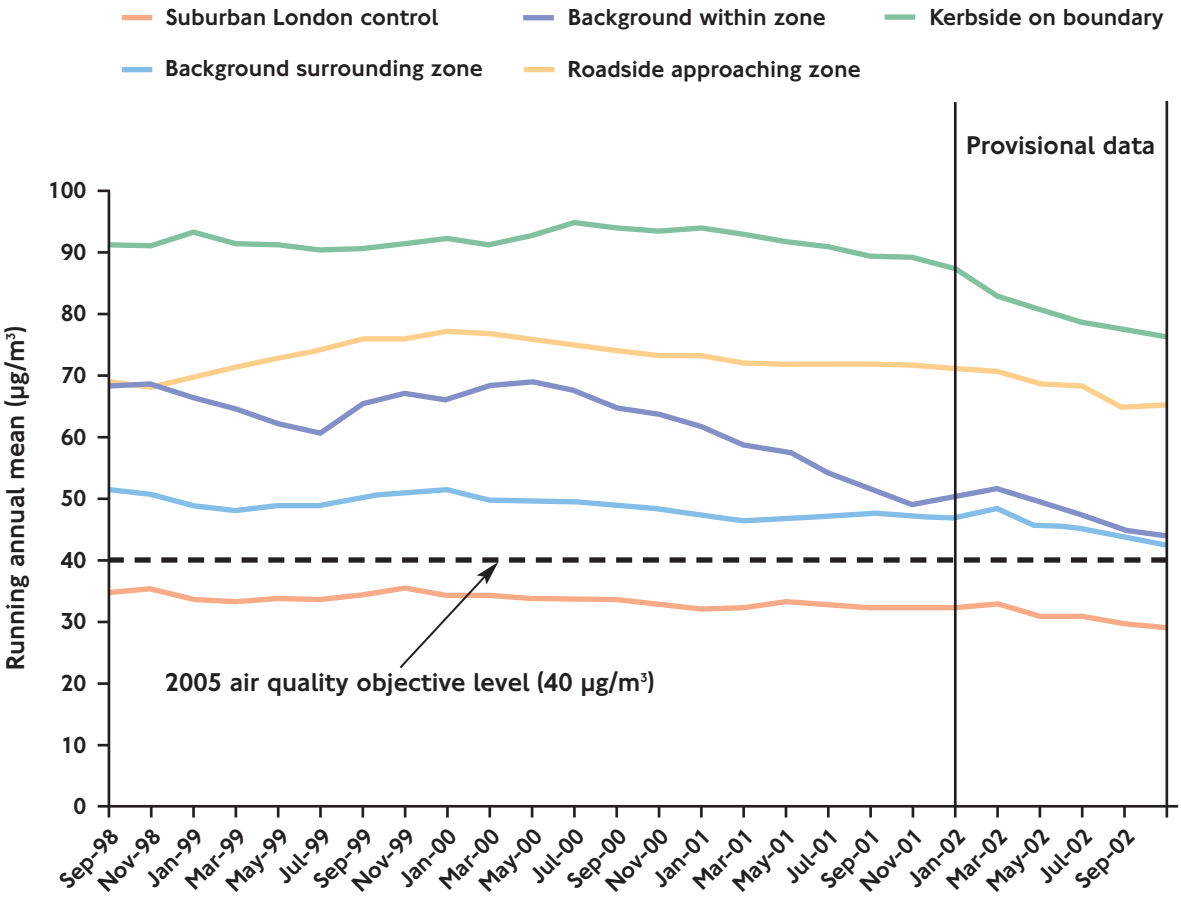


Figure 9.3. Recent trends in nitrogen dioxide (NO_2) concentrations at indicator sites.



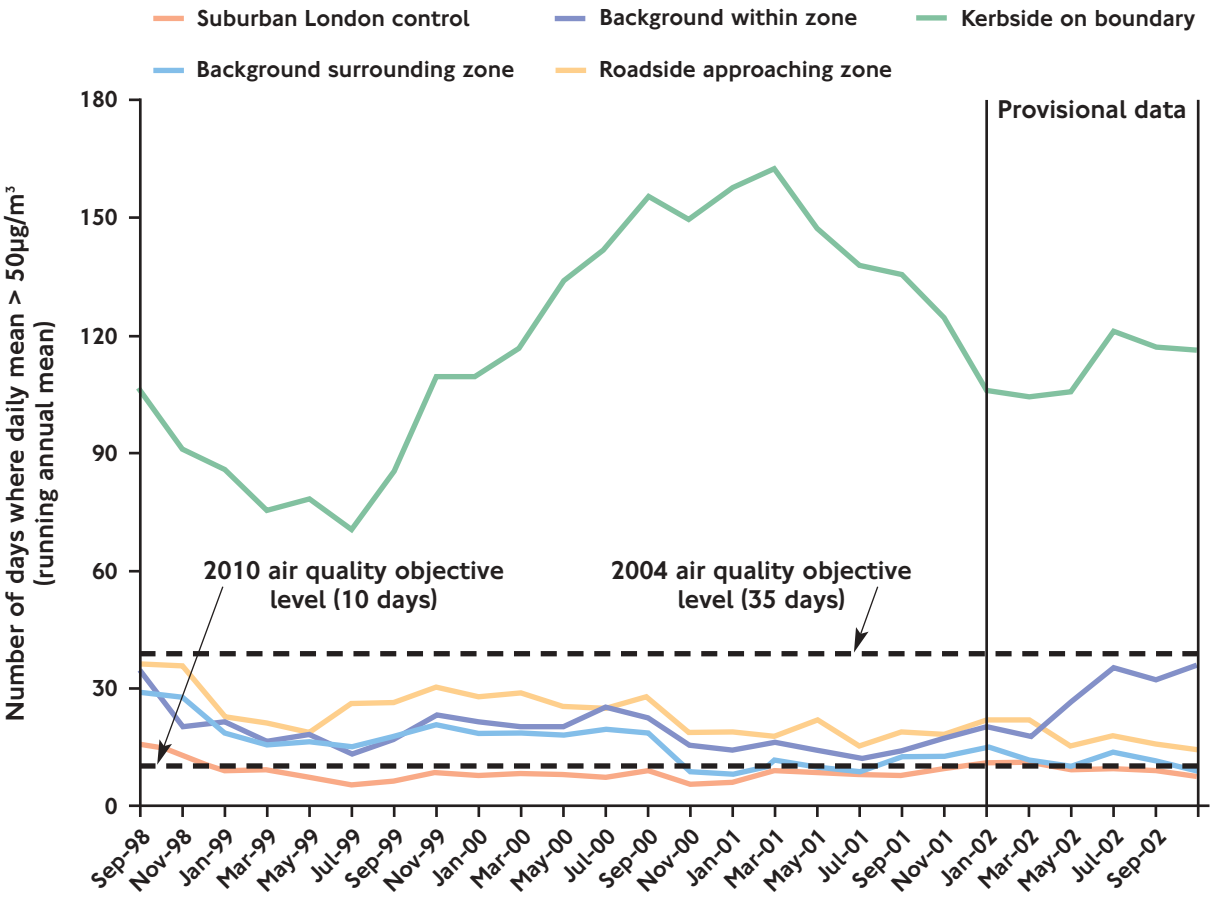
In Figure 9.3, the recent trends in nitrogen dioxide[1] are less clear due to the complex atmospheric chemistry involved in the conversion of NO into NO_2. The decreases in NO_X shown in Figure 9.2 have therefore not translated directly into an equivalent decrease in levels of NO_2 (Figure 9.3), although all sites do show a fall since early 2000. These recent falls in NO_2 may be reflective of several other influences (e.g. the prevailing 'climate' over the last 18 months), as well as local traffic change.

Recent trends in PM_{10}[2] are shown in Figure 9.4. A large proportion of particulate matter in London arises from distant sources independent of local traffic emissions. There is no clear recent trend in these background levels and they vary significantly with weather and wind direction.

The roadside indicator sites give higher readings, showing that local emissions do significantly increase the number of exceedence days where traffic levels are high and the monitoring site is close to the roadside.

Particulate levels at the Marylebone Road site stand out above the others. Local concentrations of PM_{10} were significantly affected by local construction work during 2000, and the establishment of a bus lane in 2001, which tended to move traffic away from the kerbside.

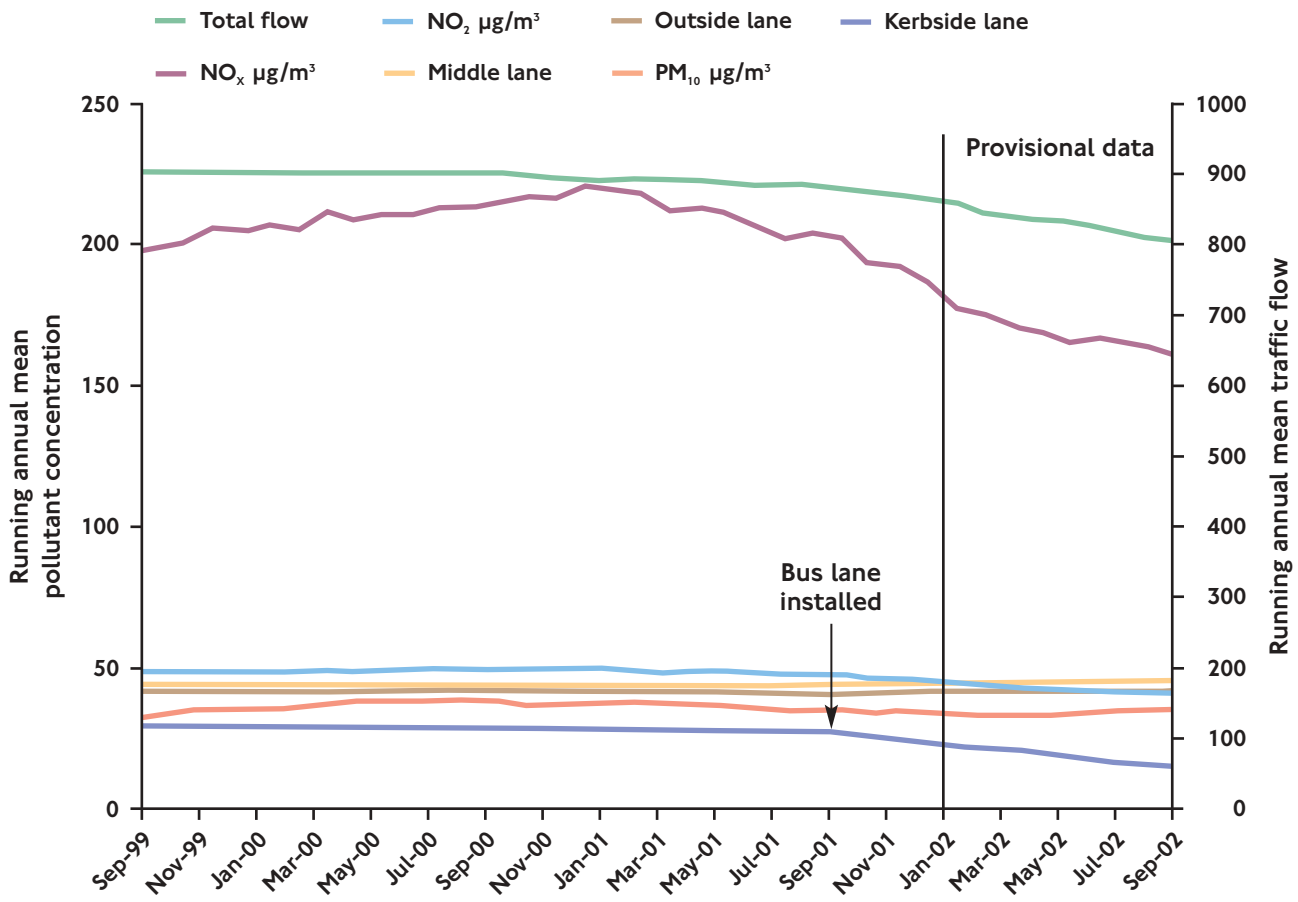
Figure 9.4. Recent trends in fine particulate matter (PM_{10}) concentrations at indicator sites.



The Marylebone Road kerbside monitoring site benefits from the availability of parallel traffic flow data, which has been collected continuously since 1998[3]. This allows an examination - in the context of this specific site - of the relationships between traffic flow and air quality at a point immediately adjacent to the carriageway (Figure 9.5).

A pair of bus lanes were introduced into this six-lane carriageway during 2001. This had an immediate effect on traffic flows on the kerbside lanes. There is no corresponding rise in traffic volumes in the other two pairs of lanes, and therefore overall traffic volumes dropped. A clear fall in concentrations of NO_x follows, but this is not directly reflected in a corresponding fall in levels of NO_2. PM_{10} levels remain essentially static, reflecting little overall change in the volumes of larger, diesel-powered vehicles, and the significant influence of remote sources.

Figure 9.5. Relationship between traffic and air quality at Marylebone Road kerbside site.



9.5. Air quality impacts: emissions and air quality modelling

Area-wide changes to vehicle emissions (and hence area-wide concentrations of air pollutants) can be assessed by a detailed inventory of the changes in traffic flows and composition, comprehensive data for which will arise from elsewhere within the monitoring programme.

This assessment can make use of the London Atmospheric Emissions Inventory (LAEI) framework, which is maintained by the Greater London Authority (GLA)[4].

To develop an emissions and air quality scenario for a given year, it is necessary to include data describing all sources of emissions. The congestion charging monitoring programme will provide fairly immediate traffic flow data, but other data relating for example to emissions from industrial processes and domestic sources, will typically take around 2 years to become available. This problem can be overcome through a process of incremental updates, changing one component of the inventory whilst holding others constant. Therefore, changes to road traffic emissions can be calculated a few months after the end of the year to which they relate, but the relative proportions of total emissions accounted for by road traffic can only be estimated when a full dataset for the year of interest is available. A forward programme for these updates has been agreed, in conjunction with the assessment programme for the Mayor's Air Quality Strategy, as set out in Table 9.2.

Estimating the effects of congestion charging on the concentration of air pollutants can be performed using air quality modelling that is compatible with that used for the Mayor's Air Quality Strategy. This can allow both retrospective assessments of air quality, using data describing the effect of the scheme on traffic, and forecasts to future years for which objectives apply, taking into account the effects of congestion charging. In this way, assessment of the air quality impacts of congestion charging can be integrated into the wider air quality assessment process for London, and the effects of congestion charging can be separated from other influences on air quality.

Air quality assessment framework

A series of emissions and corresponding air quality scenarios will be generated as part of the monitoring of congestion charging, corresponding to the availability of traffic and other necessary input data. The timetable for these is set out in Table 9.2.

Table 9.2. Schedule of air quality assessments for congestion charging.

Assessment horizon	Expected availability	Main change assessed
2001 before charging	See below	Base conditions corresponding to Mayor's Air Quality Strategy
2002 before charging	Spring 2003	Pre-scheme traffic conditions (2002)
2003 first post-charging	Late Autumn 2003	Early post-scheme traffic conditions (Spring 2003) vs. 2001/2002
2003 second post-charging	Spring 2004	Post-scheme traffic conditions (2003) vs. 2001/2002, plus other pollutant sources vs. 1999/2001/2002
2004 post-charging	Spring 2005	Post-scheme traffic conditions (2004) vs. 2001/2002/2003
2005 post-charging	Spring 2006	Post-scheme traffic conditions (2004) vs. 2001/2002/2003/2004

As the first in this series, a 2001 pre-charging emissions inventory and air quality scenario has been developed by projecting forward from the existing 1999 base case for road transport from the LAEI. This does not, of course, make use of the detailed traffic data collected in 2002 or update any non-traffic sources from the existing GLA (Air Quality Strategy) base of 1999. This will be the primary purpose of the Spring 2003 update, which is currently under development. However, it does provide a recognised starting point that corresponds to the assessments and projections made in the Mayor's Air Quality Strategy. This 'incremental' approach is important so that changes to air quality for reasons other than congestion charging can be separately identified.

Detailed emission estimates are available (based on the 1999 LAEI traffic estimates (updated to 2001) for each main road link in London, for each hour of the day, including weekends. These estimates have been aggregated for the different areas of interest, covering the charging zone, the Inner Ring Road, the remainder of inner London, and outer London to the GLA boundary.

As data from the wider monitoring programme becomes available (e.g. detailed speeds and traffic flow change data), this will be incorporated into the assessment framework and used to generate further air quality assessments.

Emissions estimates for 2001

Tables 9.3 and 9.4 below summarise the emissions from road traffic for oxides of nitrogen (NO_x) and fine particles (PM_{10}). These are the two pollutants of greatest interest in terms of meeting the national air quality objectives in London.

The charging zone contributes about 4 percent of the total road traffic NO_x emitted in Greater London and about 6 percent of the total road traffic PM_{10}[5]. In terms of emissions from all identifiable sources within the charging zone, 63 percent of NO_x arises from road transport, and 95 percent of PM_{10}. These emissions are relatively high considering the area of the charging zone covers only 1.4 percent of the land area of Greater London. There are two reasons for this. First, the density of roads and traffic in the charging zone is higher than other areas of London. Second, the emissions from almost all vehicle types are higher in the charging zone because average vehicle speeds are lower than in the rest of London.

Table 9.3. Emissions of oxides of nitrogen (NO_x), Tonnes per annum, all road traffic sources, 2001.

Area	Motor cycles	Taxis	Cars	Buses & coaches	Light goods	HGV rigid	HGV artic	TOTAL %
Charging zone	4	180	350	290	130	270	50	4
Inner Ring Road	1	50	110	90	50	110	30	1
Inner London	16	450	3160	1210	930	1920	810	27
Outer London	23	1070	8760	1820	2180	3530	4000	68
TOTAL %	<1	6	39	11	10	18	15	100

Table 9.4. Emissions of fine particulate matter (PM_{10}), Tonnes per annum, all road traffic sources, 2001.

Area	Motor cycles	Taxis	Cars	Buses & coaches	Light goods	HGV rigid	HGV artic	TOTAL %
Charging zone	2	20	20	6	20	10	2	6
Inner Ring Road	0	10	5	2	6	5	1	2
Inner London	6	40	120	20	110	80	30	29
Outer London	8	60	280	30	240	140	140	64
TOTAL %	1	9	30	5	26	17	12	100

Assessments of local pollution concentrations for 2001

These road traffic emissions estimates have been combined with comparable estimates in respect of all other identifiable sources of emissions across Greater London, and used to derive maps of forecast pollutant concentrations for a 2001 base year.

The methodology used for this is consistent with that used for the Mayor's Air Quality Strategy. In particular, to provide compatibility with other air quality assessment work in London, air pollution forecasts have been made using '1997 meteorology' for NO_2 and a '1996 meteorology' for PM_{10}[6]. However, given the exceptionally large contribution made by secondary particulates (particles imported from elsewhere or formed by chemical reactions in the atmosphere) during 1996, PM_{10} predictions have also been made assuming 1999 meteorology, which is more typical of an average year.

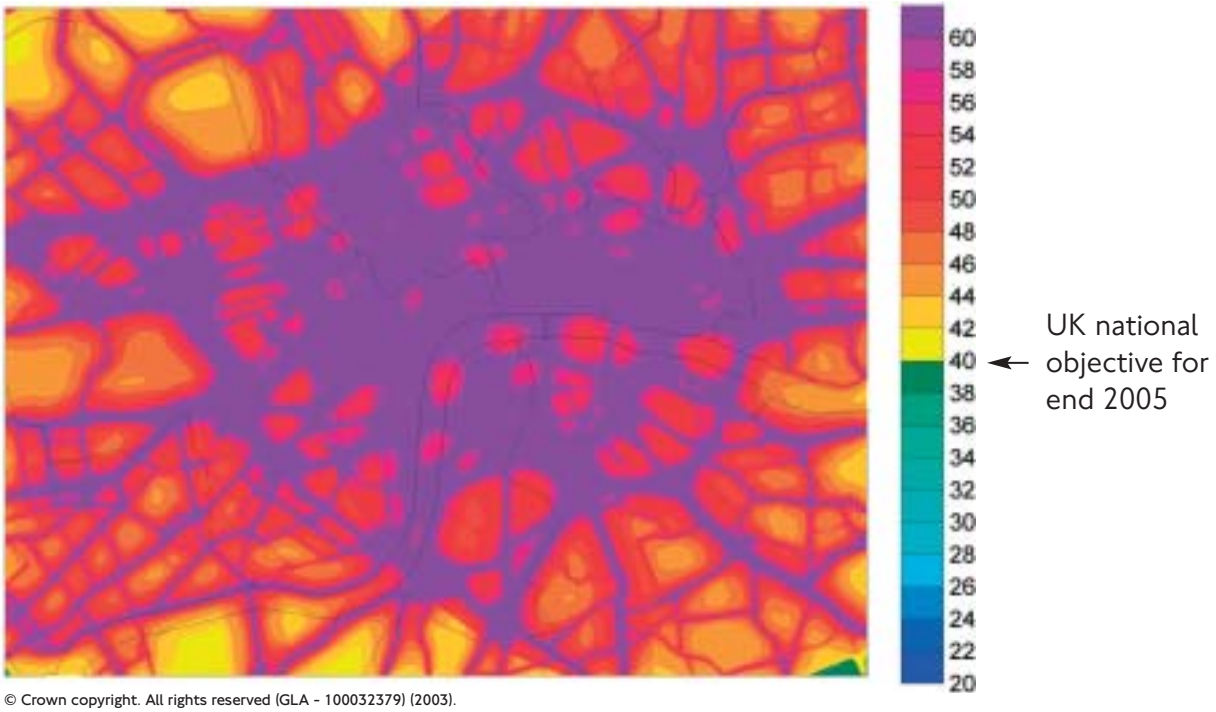
Figures 9.6, 9.7 and 9.8 show outputs from the air quality assessment, presented as maps of pollutant concentration across the charging zone and surrounding area. Using these high-resolution maps, it is possible to make a visual and various computational assessments of air quality, in terms of the specific objectives applying to each pollutant, against national objectives. Future progress towards these objectives will be monitored through the wider GLA programme, and any contribution from congestion charging to air quality change will become evident through the traffic emissions calculations described above, as a specific exercise fully integrated into the wider assessment framework.

2001 assessment for Nitrogen Dioxide (NO_2)

Figure 9.6 shows annual mean NO_2 concentrations for 2001. The concentrations shown by this map can be compared against the relevant objectives, which is the UK national objective and EU limit value of 40 µg/m^3, as an annual average value, to be achieved by the end of 2005 and the start of 2010 respectively.

In interpreting these maps, it should be noted that the concentrations shown relate to 2001, whereas the objectives are required to be achieved by 2005 and 2010. Forecasts of progress towards these objectives will be made under the work programme associated with the Mayor's Air Quality Strategy.

Figure 9.6. Modelled concentrations of NO_2 for 2001, annual average values in µg/m^3. Poor weather year.



2001 assessment for Particulate Matter (PM_{10})

The most relevant air quality objective for PM_{10} is expressed in terms of the number of days in any one year where the daily mean concentration exceeds 50 µg/m^3. Figure 9.7 shows a contour plot of the daily exceedence objective for PM_{10} assuming a ('typical') 1999 meteorology. Figure 9.8 shows the equivalent plot assuming a ('worst-case') 1996 meteorology. There are various objectives, in terms of number of daily exceedences, that apply. These are:

- a national objective and EU limit value of no more than 35 days exceedence of 50µg/m^3 per year, to be achieved by the end of 2004.
- a London-specific national objective of no more than 10 days exceedence 50 µg/m^3 per year, and an annual average of 23 µg/m^3 to be achieved by 2010.

- a provisional national objective of no more than 7 days exceedence of 50 µg/m^3 per year, and an annual average of 23 µg/m^3, also to be achieved by 2010 for the rest of the UK.

Figure 9.7. Number of days (2001 forecast) where daily PM_{10} concentration is greater than 50µg/m^3. Typical weather year.

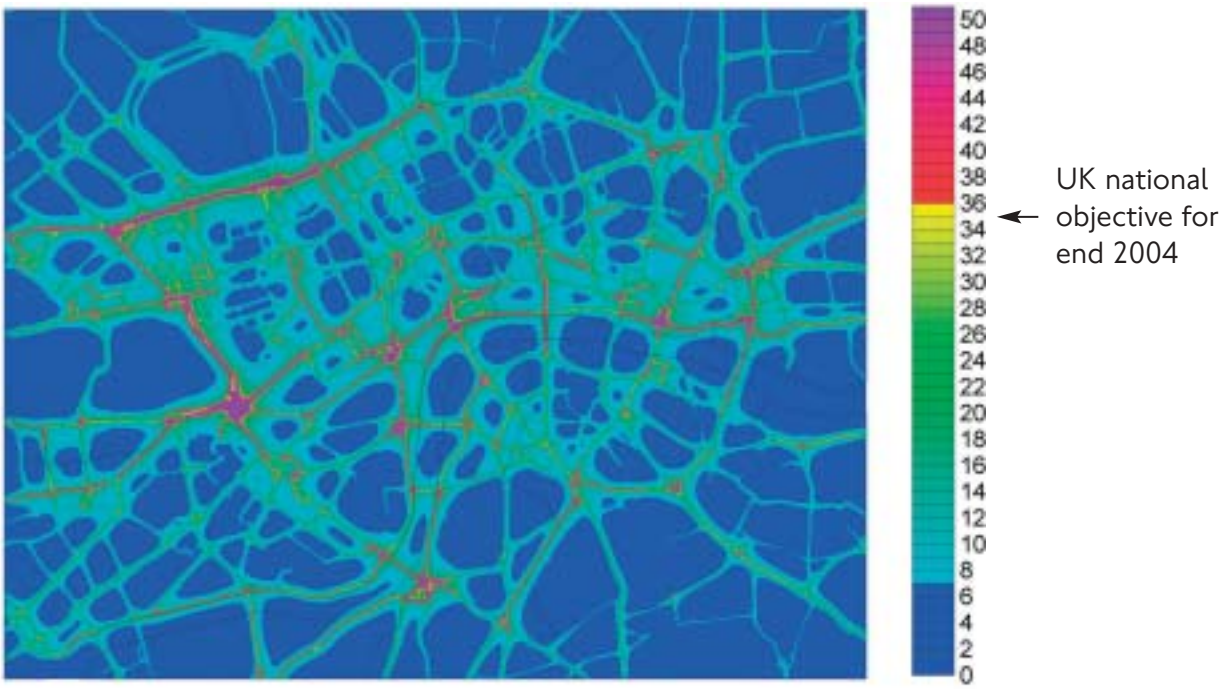
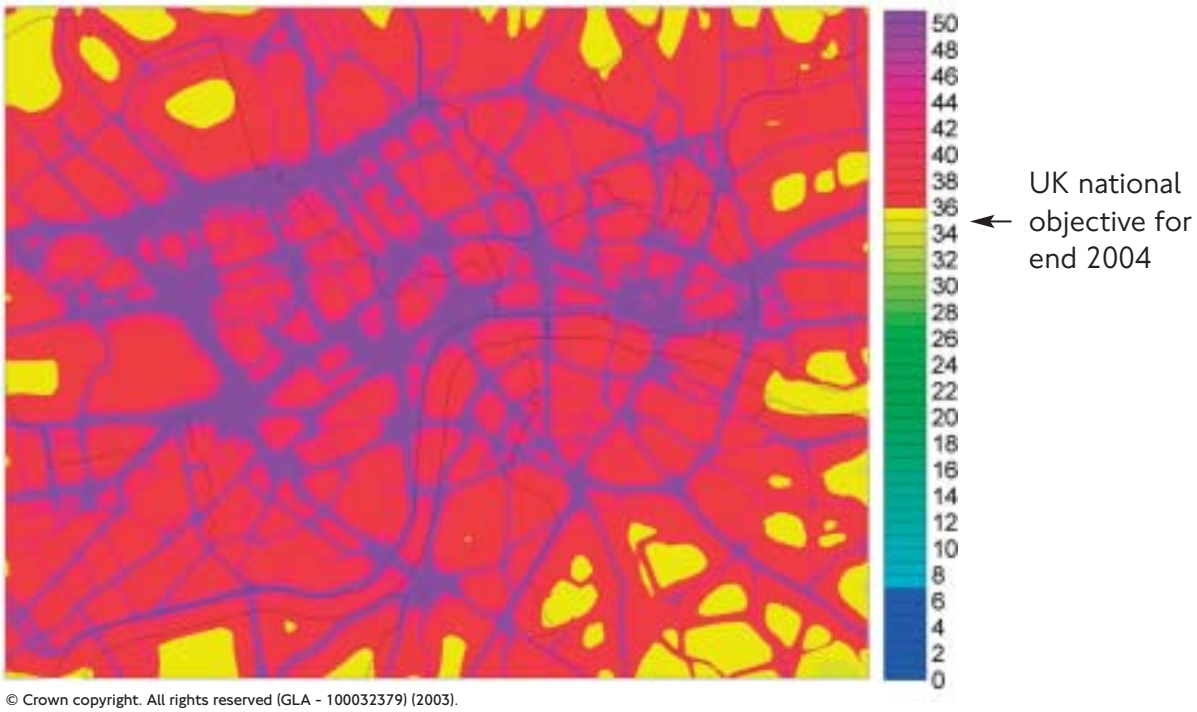


Figure 9.7 shows that, for 2001 and assuming a typical meterology, the no-more-than 35 days objective is exceeded close to some major roads and junctions. The 2010 London-specific objective of no-more-than 10 days is exceeded close to most major roads and junctions. The plot shows that, even in 2001, most of the charging zone meets the national objective of seven days that will apply for 2010.

From Figure 9.8, which uses a worst-case (1996) meteorology, it is clear that the number of days during which all of the objectives are exceeded is considerably higher, and it is against this 'precautionary' scenario that progress towards meeting air quality objectives is most properly assessed.

Figure 9.8. Number of days (2001 forecast) where daily mean PM_{10}, concentration is greater than 50 µg/m³ (1996 meteorology). Poor weather year.



9.6. New information for environmental assessment

The comprehensive traffic monitoring programme for congestion charging will allow much greater precision in air quality assessments for central London than has hitherto been possible. Traffic volumes and congestion will be comprehensively measured, as described in Chapters 3 and 4. Additionally, during 2003, new information will become available from the ANPR cameras that enforce the scheme (see Chapter 3). This should allow the following further improvements to air quality assessments:

- direct measurement of the age, fuel and technology profiles of the central London vehicle fleet;
- a more comprehensive picture of vehicle speeds and, crucially, how speeds vary, both by time period and across different parts of the network;
- information on the take-up of alternative fuels and environmentally-friendly vehicle technologies.

9.7. Other pollutants, greenhouse gases and energy use

A comparable process will also apply to tracking changes in emissions of other local air pollutants for which there are national objectives, for Carbon Dioxide (CO_2) - an important 'greenhouse' gas, and for fossil fuel use by road transport, an important indicator for the Mayor's forthcoming Energy Strategy[7].

Based on the 2001 air quality scenario described above, traffic within the charging zone uses approximately 114 million litres of fuel per year, and generates 284 kilotonnes of Carbon Dioxide.

9.8. Traffic noise

Measuring noise

As part of work to support the Mayor's London Ambient Noise Strategy[8], TfL have undertaken sample measurement surveys of noise at a range of locations alongside the Transport for London Road Network (TLRN) throughout London. This programme has been supplemented with a small number of sites in and around the charging zone. Sites most relevant to congestion charging are shown on Figure 9.1.

Noise measurements can be expressed using a variety of indicators. dB(A) refers to decibels measured on a sound meter incorporating a frequency weighting (A) which differentiates between sounds of differing frequencies in a manner comparable to the human ear. For most traffic situations, measurements in dB(A) broadly agree with people's assessment of loudness. L_{Aeq} (T) is a measurement over a given time period (T), expressed as an equivalent continuous sound level. This can be thought of as an average of the fluctuating sound level over the measurement period. In terms of the significance of changes, a change of 1dB(A) is only perceptible under exceptional conditions, and changes of less than 3dB(A) are usually considered to be imperceptible in typical urban conditions. Table 9.5 below defines some key noise measurements.

Table 9.5. Noise measurements

A-weighting:	A system of adjustments applied to sound of different frequencies to take account of the way the sensitivity of the human ear varies with sound frequency.
Decibel dB:	A unit of sound pressure level on a logarithmic scale – logarithmic ratio of a sound pressure relative to a reference level.
dB(A):	'A' weighted decibel – see 'A-weighting'.
L_{eq}:	Equivalent continuous sound level: a measure of long term average noise exposure. Is the level of steady sound which, if heard continuously over a period of time, would contain the same total sound energy as the actually varying sound events occurring during that time period.
L_{A10}:	The A-weighted level of noise exceeded for 10 percent of a specified measurement period, in this case 10 percent of the time.
L_{Aeq}:	The equivalent continuous sound level is the notional steady sound level which, over a measurement period, delivers the same amount of sound energy as the actual fluctuating level.
L_{A90}:	The A-weighted level of noise exceeded for 90 percent of a specified measurement period.

Pre-charging measurements

Surveys at all relevant sites were undertaken for a continuous 48-hour period during the winter of both 2001/2002 and 2002/2003 (before the introduction of congestion charging). Summary results for sites relevant to congestion charging are shown in Table 9.6. Of particular interest is the variability within each site between surveys. The causes of these cannot generally be separately identified; however, the existence of such variability is indicative of the likely difficulties that will be encountered in interpreting noise measurements taken after charging has started against these measurements.

The information from these surveys is sufficient to allow more detailed examination of the noise climate at each of the sample sites, using various indices. Figures 9.9. and 9.10 illustrate the type of analyses that are possible. Both figures show sound profiles across a 24-hour day for the sites at Marylebone Road (Figure 9.9) and Central Street (Figure 9.10)[9]. Marylebone Road forms part of the Inner Ring Road, and Central Street is a secondary road within the charging zone, perhaps typical of 'background' conditions. The measurements were taken during the winter of 2002/3.

Table 9.6. Sample noise measurements dB(A). Congestion charging monitoring sites, winter 2001/2 and 2002/3 compared, dB(A).

Site number	Index	2001/2002	2002/2003	Difference dB(A)
Site 5	L_{Aeq}, 16 hour Day	73.0	74.4	+1.4
	L_{Aeq}, 8 hour Night	71.1	72.9	+1.8
Site 6	L_{Aeq}, 16 hour Day	70.2	69.6	-0.6
	L_{Aeq}, 8 hour Night	66.9	65.2	-1.7
Site 7	L_{Aeq}, 16 hour Day	57.4	61.0	+3.6
	L_{Aeq}, 8 hour Night	50.9	52.2	+1.3
Site 16	L_{Aeq}, 16 hour Day	71.7	72.5	+0.8
	L_{Aeq}, 8 hour Night	72.3	71.5	-0.8
Site 19	L_{Aeq}, 16 hour Day	62.6	63.4	+0.8
	L_{Aeq}, 8 hour Night	57.6	59.1	+1.5

Site 5: Marylebone Road (Inner Ring Road)
Site 6: Farringdon Street (within charging zone)
Site 7: Central Street (within charging zone - 'background' site)
Site 16: New Kent Road (radial road approaching Inner Ring Road)
Site 19: Berkley Square (within charging zone)

Figure 9.9. 24-hour noise profile, Marylebone Road (Inner Ring Road).

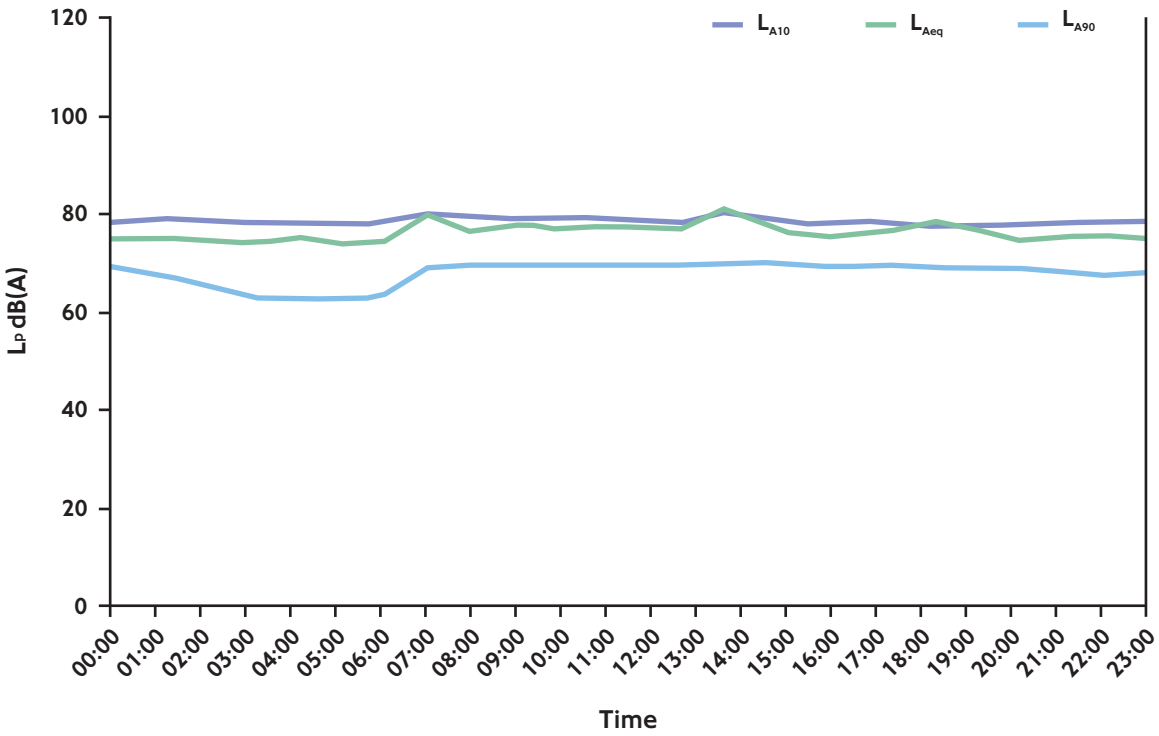
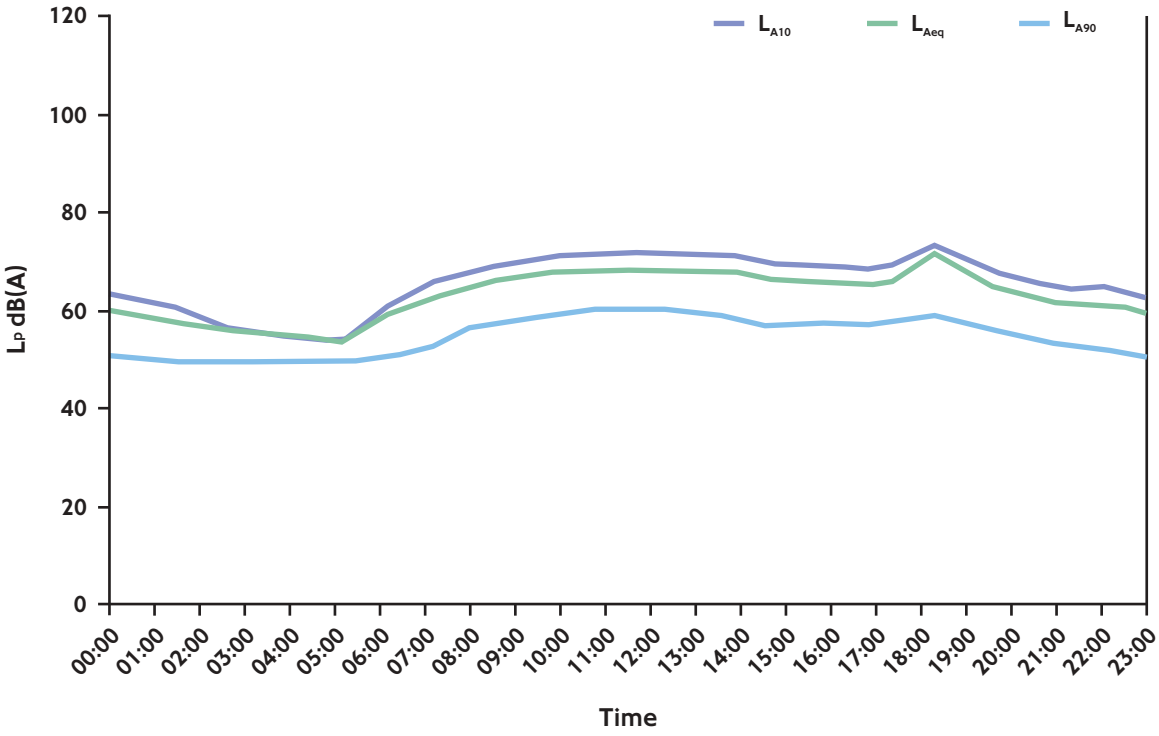


Figure 9.10. 24-hour noise profile, Central Street ('background' site within charging zone), 2002/2003.



Noise mapping

Measurements at a limited number of sites are unlikely to provide completely clear evidence of any changes associated with congestion charging, nor can measurements be made at all locations. However, TfL is working with DEFRA on its noise modelling and mapping project as part of the wider UK initiative for a National Ambient Noise Strategy and this will provide a broader picture of noise levels.

Noise modelling uses data on traffic flow, composition, speed and other variables to generate noise levels, typically presented in the form of 'sound immission contours'. By contrast with measurement, noise modelling only relates to the noise sources of interest, which by definition excludes other sounds. Modelling has the advantage of being able to generate noise predictions across a whole area, compared to measurements which can only be undertaken at a limited number of locations. However, existing noise calculation methodologies do not include all the factors affecting road traffic noise generation, although the main variables are modelled. Transport for London will therefore be working with DEFRA-appointed contractors to help produce noise maps over the coming year. Data relating to traffic flows from elsewhere in the monitoring programme will be made available for this purpose.

Noise models can, of course, be used retrospectively or prospectively to assess changes in conjunction with observed or predicted changes in traffic flow.

9.9. Quality of the central London environment

By reducing the amount of traffic in and around the charging zone, congestion charging is expected to improve the general environment in central London. These changes will be overlaid on a very wide range of other factors that determine how people 'on the street' perceive the quality of their environment.

Assessment method

This section looks at results from a programme of On-Street Public Space Surveys conducted during the Autumn of 2002. These surveys combined indicative measures of pedestrian activity (reported in Chapter 6) with short on-the-spot interviews, to gauge the attitudes of people in typical central London locations to their immediate environment. Survey locations were chosen so as to capture people engaged in different types of activity, such as shopping or visiting tourist attractions. The opportunity was also taken to explore the attitudes of people at these locations to congestion charging, and the anticipated effects of this charging on environmental quality.

A total of 24 locations were surveyed in and on the boundary of the charging zone, together with further sites in the boundary case study area (see Appendix 6). Together these involved a total of around 10,000 individuals. Survey locations were categorised into the following broad functional categories:

- areas at the edge and just outside charging zone;
- business areas;
- locations with a high concentration of restaurants;
- theatre/cinema areas;
- major tourist attractions;
- retailing locations.

Some results from the Autumn 2002 series of surveys, illustrating the information that has been gathered, are given below. In interpreting the following figures, readers should be aware that:

- the primary purpose of these surveys is to measure changes in attitudes before and after congestion charging starts, rather than to compare scores across the different functional categories of site within the same survey wave;
- environmental quality encompasses a wide range of tangible and intangible factors, the relative 'importance' of which will vary between respondents.

Perceptions of overall environmental quality

Figure 9.11 shows responses to a question that sought a general score (on a scale of 1 to 5) for overall 'pleasantness' of the location. In addition, respondents were asked to nominate the 'best' and 'worst' aspects of the location in which they were interviewed from a list of a dozen nominated attributes in each case. Results are shown in Tables 9.7 and 9.8. Traffic noise was the most commonly mentioned 'worst' aspect at three of the six categories of site.

Figure 9.11. On-street public space surveys Autumn 2002. Mean scores for overall 'pleasantness of area', by type of area.

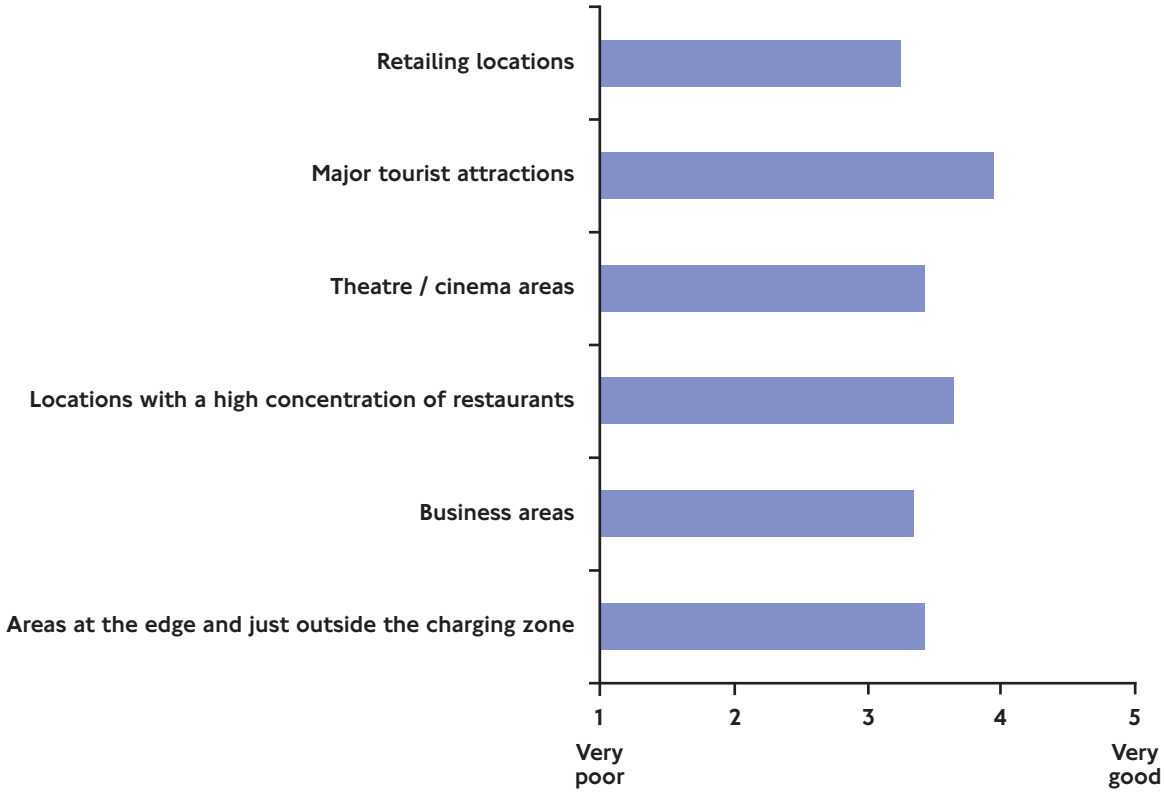


Table 9.7. On-street public space surveys Autumn 2002. 'Best' aspect about each area, by type of area.

	Retailing locations	Major tourist attractions	Theatre/Cinema areas	Locations with a high concentration of restaurants	Business areas	Areas at the edge and just outside of the charging zone
	%	%	%	%	%	%
Range of shops	52	9	28	28	14	34
Attractiveness/feel of area	6	30	15	17	11	10
It is central	10	4	13	13	20	16
Amenities in area	7	7	13	17	11	9
Art/cultural facilities	3	19	13	4	9	2
River	1	13	1	0	7	0
Specific shop	4	0	2	5	3	5
River walks	1	8	1	0	4	0
Transport facilities	3	1	2	0	4	3
People are friendly	2	1	2	2	1	3
Nothing	7	2	4	4	10	6
Don't know	2	1	2	3	4	3
Other	2	6	3	6	3	7
Base (number of interviews)	**1,471**	**1,383**	**1,535**	**1,451**	**1,445**	**1,478**

Table 9.8. On-street public space surveys Autumn 2002. 'Worst' aspect about each area, by type of area.

	Retailing locations	Major tourist attractions	Theatre/Cinema areas	Locations with a high concentration of restaurants	Business areas	Areas at the edge and just outside of the charging zone
	%	%	%	%	%	%
Traffic noise/amount of traffic/noise	16	11	11	11	21	25
Dirty/litter	12	12	15	20	9	11
Crowded	17	14	15	10	11	7
Pollution	14	4	11	10	11	9
Congestion	8	5	7	5	10	6
Expensive	5	5	5	7	4	7
Undesirable elements	3	7	10	4	4	4
Ugly concrete/architecture/look of area	4	5	3	2	7	2
Unsafe/high crime rate	2	1	4	2	1	5
Amenities	2	2	0	1	2	2
Nothing	11	22	11	17	13	12
Don't know	3	4	3	4	3	4
Other	3	8	5	5	5	7
Base (number of interviews)	**1,471**	**1,383**	**1,535**	**1,451**	**1,445**	**1,478**

Perceptions of air quality and noise

Respondents were asked to rate a number of specific environmental attributes in relation to the location at which they were surveyed. Alongside attributes such as public transport provision and amount of traffic, specific scores on a scale of 1 (lowest) through 5 (highest) were sought for air quality and noise. These are summarised in Figures 9.12 and 9.13. Changes in these attitudinal indicators after congestion charging is implemented will complement the objective, quantitative measurements of air quality and noise described above.

Figure 9.12. On-street public space surveys Autumn 2002. Overall rating of air quality by type of site.

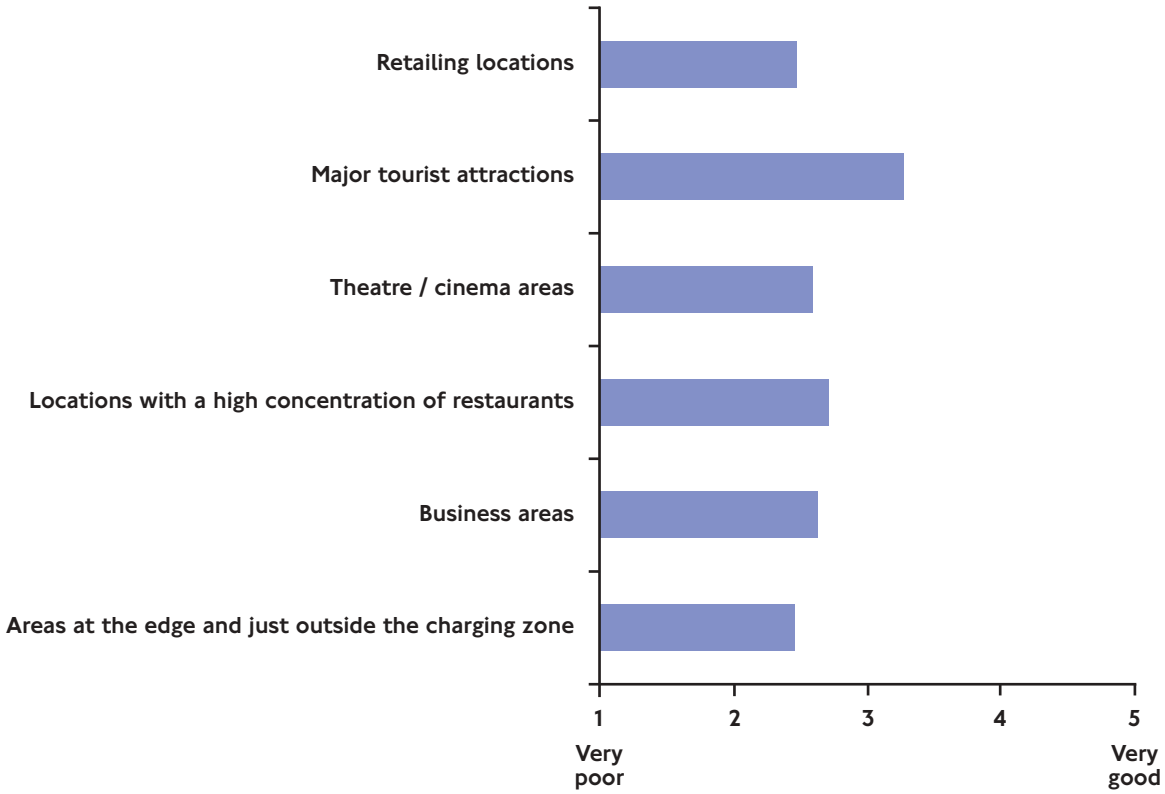
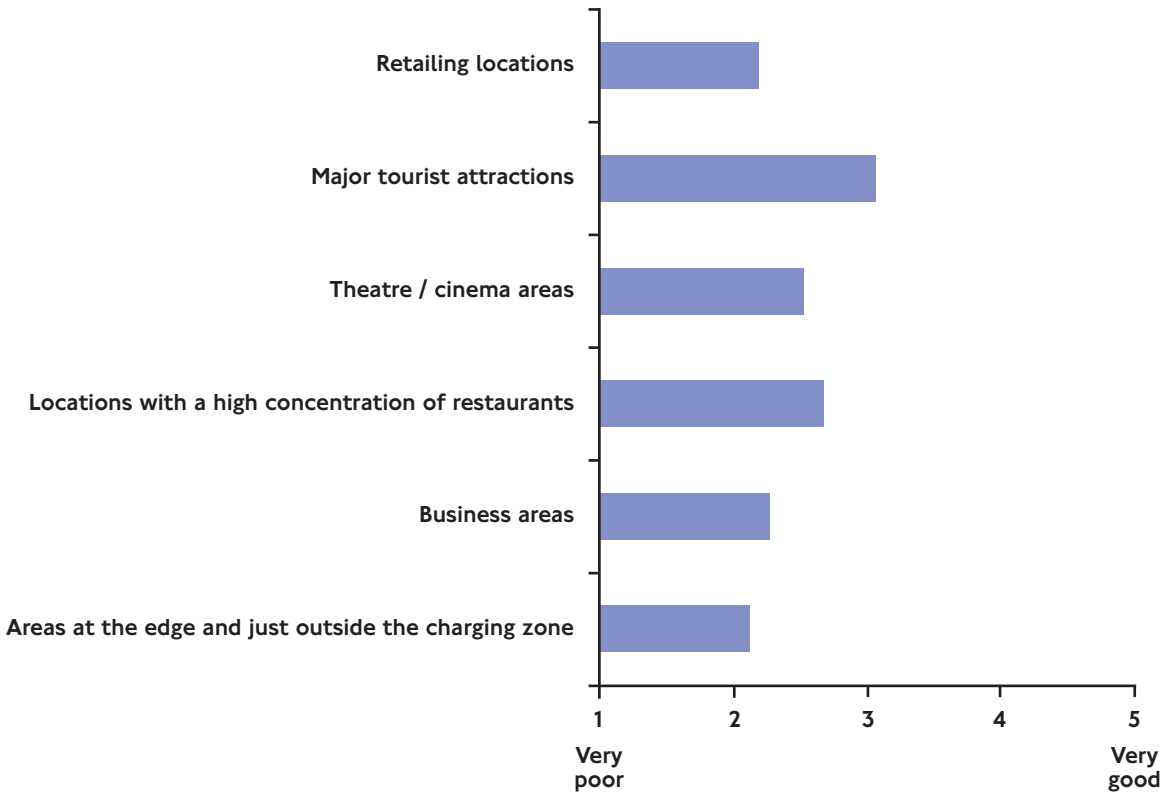


Figure 9.13. On-street public space surveys Autumn 2002. Overall rating of noise by type of site.



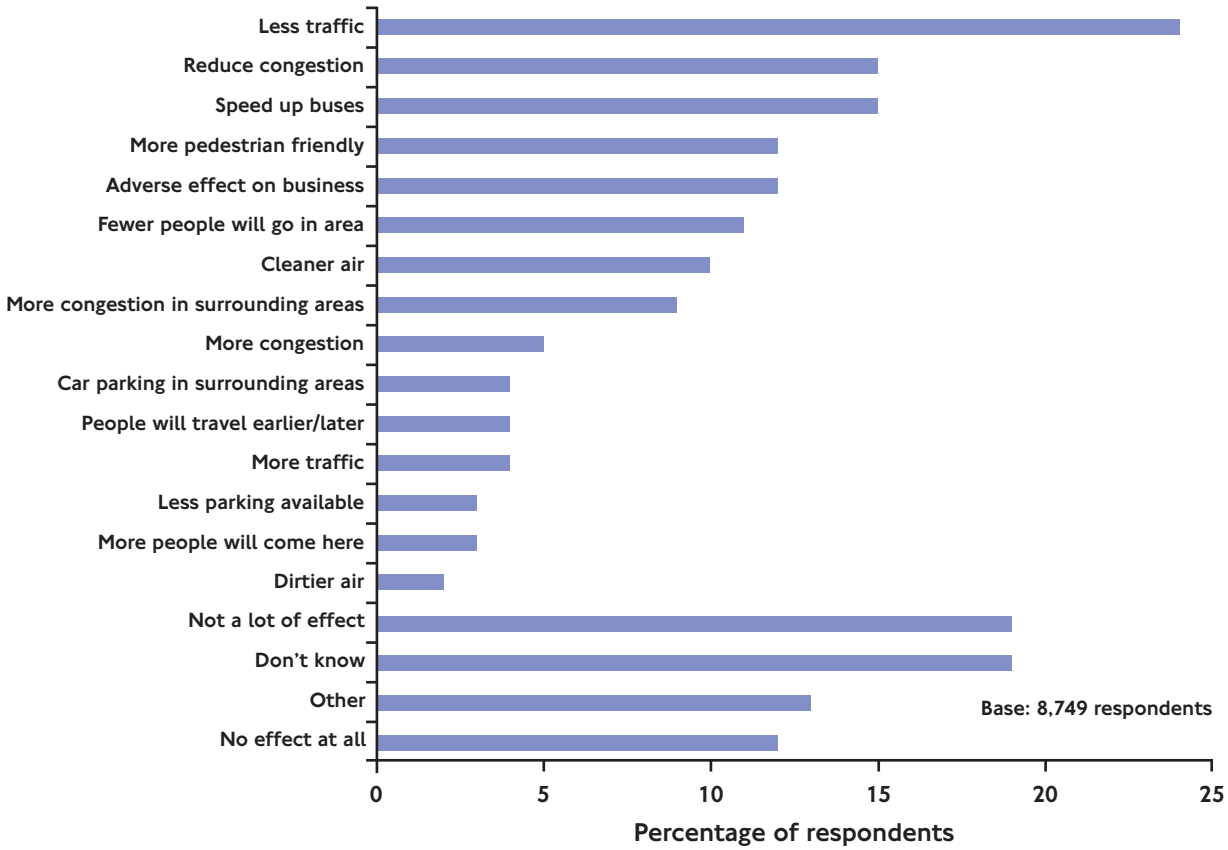
Anticipated impact of congestion charging on the locality

Respondents across the survey sites were invited to comment without prompting on the ways in which they expected congestion charging to affect the area. Responses (an average of two items per respondent) were coded against a range of possible effects. Results across all survey areas are summarised in Figure 9.14.

At sites inside of the zone, the most frequently anticipated impact of congestion charging was a reduction in traffic, cited by 24 percent of respondents. Nineteen percent didn't expect congestion charging to have any noticeable effect on the survey location, while others expected buses to speed up and congestion to reduce.

At locations around the boundary of the charging zone, respondents anticipated increases in traffic and congestion when the scheme is introduced. However, it is apparent from these surveys that many are unsure what impacts the scheme will have, or anticipate very little change as result of the scheme.

Figure 9.14. On-street public space surveys Autumn 2002. Expected impacts of congestion charging on the local environment.



Technical notes

1 Trends in nitrogen dioxide (NO_2) in Figure 9.3 are presented as micrograms per cubic metre as a running annual mean, in relation to the national objective of 40 µg/m^3 to be achieved by end 2005. It should be noted that this objective is not applicable to 'kerbside' sites (such as Marylebone Road) where public exposure is expected to be short-term.

2 Trends in PM_{10} in Figure 9.4 are presented in terms of 'exceedence days' when levels exceed the air quality objective (in this case, 50µg/m^3 as a 24-hour mean). The current national objective to be met by the end of 2004 would be achieved if particulate levels exceed this concentration on 35 days per year or less. A new objective for London, reducing this to 10 days per year, will apply from end 2010. Again, it should be noted that these objectives are not applicable to 'kerbside' sites (such as Marylebone Road) where public exposure would typically be short-term.

3 All indicators in Figure 9.5 (including traffic flows) are presented as running annual means. For PM_{10}, it should be particularly noted that measurements are expressed in terms of running annual mean concentrations, rather than in terms of 'exceedence days' in Figure 9.4.

4 More information on air quality modelling can be found in the Mayor's Air Quality Strategy (see www.london.gov.uk/mayor/strategies/air_quality/index.jsp).

5 Estimated traffic emissions for the areas of interest for congestion charging monitoring are based on a 1999 traffic scenario for the London Atmospheric Emissions Inventory, factored to 2001. They do not, therefore, reflect a definitive set of measured traffic conditions for 2001. Future scenarios, as described in Table 9.2, will use traffic data gathered under the congestion charging monitoring programme, as described in Chapter 4.

6 Air quality models assume a set of meteorological conditions that determine how emissions are dispersed across the study area, how they mix and interact in the atmosphere, and how concentrations are affected by the import of pollution from outside the study area. These are expressed in terms of 'meteorological years', which reflect actual measured meteorology for recent years. Because meteorological conditions differ significantly between years, some years will produce relatively low annual-average concentrations of pollution, whilst others will produce higher concentrations. Air quality assessment will usually take a 'precautionary approach' to estimating compliance with air quality objectives, and this usually implies using a recent 'meteorological year' that displays 'worst case' characteristics. For NO_2, 1997 is the current reference meteorological year. For PM_{10}, it is 1996. Projections made using these meteorological years will therefore display concentrations that would only be expected to occur with correspondingly-extreme meteorological conditions. In selecting these years, the projections here are compatible with those made by the Greater London Authority. For PM_{10}, 1999 could be considered to be a more typical year, and concentrations are also shown using this meteorology for comparison. By adopting fixed meteorology years for model assessments, the effects of congestion charging can be examined in isolation from annual variability caused by changing annual weather.

7 The Mayor's Energy Strategy is expected to be published in September 2003.

8 As at April 2003, the Mayor's Ambient Noise Strategy is available as a public consultation draft (see www.london.gov.uk/mayor/strategies/noise/downloads.jsp).

9 The L_{Aeq} values quoted in Table 9.6 are free-field values normalised to a distance of 10 metres from the kerb.

Appendix 1
Scheme summary

A1.1. Legal framework

The core legal framework for central London congestion charging is contained in the confirmed Greater London (Central Zone) Congestion Charging Order 2001 as varied by three main Variation Orders[1] and one minor technical Variation Order. These Orders set out how and where the scheme will operate, who qualifies for a discount or exemption, and how the revenues from congestion charging will be spent.

For ease of reference, TfL has prepared a consolidated version of the above Orders. This Consolidated Scheme Order[2] reflects the provisions that have been in force since 14 February 2003, before the start of congestion charging.

A1.2. Transport Strategy proposal

Congestion charging is a response to a specific proposal in the Mayor's Transport Strategy:

Proposal 4G.13: Transport for London will make an order to introduce a congestion charging scheme in central London broadly as outlined in annex 5…

The Transport Strategy stated that such a scheme, combined with improvements to public transport, would provide a powerful means of securing one of the Mayor's key priorities – tackling traffic congestion.

The strategy referred to the potential advantages of a congestion charging scheme in central London:

- it would reduce congestion, not only within, but also beyond the charging zone; road users would have quicker and more reliable journey times, and traffic queues would reduce;
- it would be more effective in reducing through traffic than other measures; for example, parking controls can reduce terminating traffic, but can increase through traffic – a particular problem for central London;
- it would take advantage of the extensive public transport serving central London. Already over 75 percent of people coming to central London in the morning peak are travelling by Underground, rail or bus;
- it would improve bus operations; 40 percent of all bus journeys within London are on routes which serve central London – their journey times and reliability are severely impeded by traffic congestion;
- it would produce substantial net revenues; which by law must be spent on improving transport within Greater London for a minimum of 10 years from the introduction of the scheme;

- it would benefit business efficiency; as growing congestion is a serious threat to business and employment in London;
- it would integrate well with other initiatives to reduce congestion and improve public transport and would support a wide range of objectives;
- it would make central London a more pleasant location; with less congestion it would be easier to move around; and be more attractive to businesses and visitors;
- it would be relatively quick to introduce. A scheme could be operational in central London by early 2003.

There was extensive consultation on the scheme and various features were modified from the original TfL proposals. Subsequently there were a number of variations to the scheme, again the subject of consultation. The key elements of the scheme introduced in February 2003 are described below:

A1.3. Where do the charges apply?

The charging zone is shown in Figure A1.1. It is bounded by the Inner Ring Road: ie Marylebone Road, Euston Road, Pentonville Road, Tower Bridge, Elephant & Castle, Vauxhall Bridge, Victoria, Hyde Park Corner and Marble Arch. This provides a diversion route for displaced through traffic. The charge applies to vehicles using or parking on roads within the charging zone, but not for using or parking on the Inner Ring Road itself.

A1.4. When do charges apply?

The charging hours apply from 07:00 to 18:30, Monday to Friday, excluding Public Holidays.

A1.5. What charges apply?

The standard daily charge is £5 per vehicle. Charges can also be paid weekly, 4-weekly or annually.

A1.6. When do charges have to be paid?

To drive or park on a street within the charging zone during the hours of operation the registration number of each vehicle (unless exempt or registered for a 100 percent discount) has to be notified to TfL, as the charging authority, and the charge paid. Payment can be made in advance of the day of travel. However, vehicle registration numbers can also be notified up to midnight on the day of travel. For payment after 22:00 but before midnight on the day of travel, the charge is £10 to encourage pre-payment and to assist enforcement.

Figure A1.1. Map of the charging zone.

A1.7. Which vehicles are charged?

The congestion charge applies to all motor vehicles except exempt vehicles and those registered for a 100 percent discount or reimbursement, which are outlined below. Special provisions apply to certain vehicles registered in Northern Ireland, the European Community or European Economic Area member states.

A1.8. Which vehicles are exempt or eligible for a discount?

The Mayor and TfL recognise that some people could face difficulty in switching to public transport from the car, particularly those with mobility problems. In addition, others perform critical public services or help to contribute towards the delivery of other transport improvement objectives. The vehicles listed below are either exempt, receive a 90 or 100 percent discount or 100 percent reimbursement from the £5 daily charge.

Exemption

Drivers of the following exempt vehicles will not have to pay the charge, nor register with TfL:

- Motorbikes, mopeds and bicycles.
- London licensed taxis.
- London licensed minicabs.
- Emergency services' vehicles exempt from Vehicle Excise Duty (VED).
- NHS vehicles that are exempt from VED.
- Vehicles used by disabled persons that are exempt from VED.
- Disabled passenger-carrying vehicles (e.g. Dial-A-Ride) exempt from VED.
- Public Service Vehicles with nine or more seats licensed as buses. (taxation class 34 or class 38).

90 percent discount

Residents in the charging zone are eligible to register one private vehicle each for a 90 percent discount. An annual payment of £10 is required to register for this discount.

Provided residents register with TfL, the minimum charge payable is for a period of one week (5 consecutive charging days) at £2.50. It will also be possible to make payments monthly (20 consecutive charging days) at £10 and annually (252 consecutive charging days) at £126.

If you park in a resident's parking bay in your own local parking zone, or off-street inside the charging zone, and don't move your car during the hours of operation, you don't need to pay the charge.

100 percent discount

- Vehicles used by disabled persons or organisations in receipt of a Blue or Orange Badge will not have to pay the charge, provided that they register with TfL and make an initial one-off payment of £10.

Drivers of the vehicles listed below will not have to pay the charge provided that they register with TfL and make an annual registration payment of £10 per vehicle.

- Electrically propelled vehicles.
- Certain alternative fuel vehicles meeting strict emission standards, e.g. gas, electric and fuel cell vehicles (including bi/dual fuel). For more details see www.powershift.org.uk
- Specially adapted recovery vehicles.
- Breakdown vehicles in use to provide roadside assistance or recovery services operated by accredited organisations e.g. AA, RAC, Green Flag.

Drivers of the vehicles listed below will not have to pay the charge and do not have to make a registration payment provided that they register with TfL.

- Vehicles with nine or more seats, not licensed as buses.
- Certain operational vehicles used by the emergency services (fire, police and ambulance).
- Certain operational vehicles used by the eight local authorities within or partly within the charging zone and the Royal Parks Agency.
- Vehicles used for lifeboat haulage and HM Coastguard purposes.
- Certain Port of London Authority vehicles in use to attend emergencies on the River Thames.
- Certain operational military vehicles.

100 percent reimbursement

- Vehicles used by certain NHS staff on journeys carrying bulky, heavy or fragile equipment, confidential patient notes, controlled drugs etc, or responding to emergencies when on call.
- Vehicles used by certain NHS patients attending hospital appointments – patients who have compromised immune systems, require regular therapy or assessment or require recurrent surgical intervention and where the patient is clinically assessed as too ill, weak or disabled to travel to an appointment on public transport.
- Vehicles used by firefighters for operational journeys between fire stations.

Congestion charges will have to be paid for those vehicles by the individuals concerned who will then claim them back from their employer or the relevant NHS Body. Transport for London will then refund the charges incurred to those organisations.

A1.9. How does the scheme work?

Drivers or operators of vehicles in the charging zone pay the charge, either in advance or on the day, to have the registration number of their vehicle entered into a database. Transport for London maintain a database of vehicle registration numbers for vehicles for which the change has been paid, or where the vehicle is exempt or subject to a discount. Inclusion of a vehicle registration number on the database could be for a day, a week, 4-weeks, or on an annual basis.

Drivers or vehicle operators can pay the charge and notify their vehicle registration numbers at retail outlets, by post or phone, over the Internet or through text messaging.

Accounts are available for operators of fleets registering more than 25 vehicles. There are two types of arrangement, both involving payments in advance. For both arrangements there is a registration procedure involving the fleet operator stating in advance which vehicles are in the fleet, and payment of an annual £10 registration charge for each such vehicle. No penalty charges are applied to vehicles pre-registered under an agreed 'fleet account'.

The automated fleet arrangement for goods vehicles excludes cars. Operators pay a higher daily charge and charges are paid for pre-registered vehicles detected automatically in the charging zone through their registration number.

The fleet arrangement aimed at cars is available to all vehicle types. The fleet operator confirms at the end of the account period which vehicles have been present in the charging zone.

A1.10. How is the scheme enforced?

The number plates of vehicles entering or moving within the charging zone are photographed by a network of fixed and mobile cameras. Parked vehicles are inspected by foot patrols. The registered keeper of any vehicle, which has been identified within the charging zone without an appropriate congestion charge having been paid, is liable to a penalty charge of £80. This is discounted to £40 for payment within 14 days. If a penalty charge has not been paid and there are no representations or appeals, a charge certificate is issued after 28 days and the registered keeper would be liable for a penalty charge of £120.

There is also a system of vehicle clamping and/or removals to deal with persistent evaders – that is when three or more penalty charges are outstanding with respect to the vehicle. The system of clamping and/or removals applies within Greater London and not just within the charging zone. Bailiffs are used to recover the debts from outstanding penalty charges.

The charging scheme has a system of appeals and independent adjudication comparable to the arrangements for adjudication within Greater London of disputed parking penalty charges.

A1.11. Supporting measures

In addition to defining the key parameters of the scheme, the Mayor's Transport Strategy proposed that:

Proposal 4G.14: Supporting measures to the proposed congestion charging scheme, as outlined in annex 5… will be introduced by Transport for London and the boroughs.

In particular, these measures are intended to ensure that:

- public transport can cope adequately with the transfer of car users who decide not to pay the charge and transfer to Underground, rail or bus services for their journeys to and from the charging zone;
- the road system around the charging zone can cope adequately with those drivers who previously drove through the charging zone and who decide to avoid the charge by travelling around the zone.

Congestion charging has been complemented by a range of new measures designed to make public transport and other alternatives to car travel easier, cheaper, faster and more reliable. Much of this effort has gone into improving bus services into and within the charging zone. The improvements to buses are expected to attract some shorter distance underground and rail travellers to bus. Combined with the reductions in congestion from the scheme itself, the overall effect is intended to offer suitable public transport for those car users who wish to switch mode.

Over 11,000 extra spaces on buses entering the changing zone in the morning peak hour were introduced before charging started, and extra capacity provided through new routes, frequency increases on existing routes and introduction of larger buses.

See Appendix 8 for information on the traffic management measures that support congestion charging.

For further information on the congestion charging scheme visit www.cclondon.com

Technical notes

1

- Interim arrangements for minicabs prior to full licensing and a facility for zone residents to obtain a discount for hire vehicles.
- A minor boundary change at Shoreditch.
- Incentives for Blue Badge Holders, Alternative Fuel Vehicles, Residents and Fleet Operators to register early.

2 Full text available at www.tfl.gov.uk/tfl/cc_consolidated_scheme_order.shtml

Appendix 2
Dissemination of results and data

Key principles

- Openness: TfL wishes to provide full access to all results and data collected.
- Objectivity: TfL wishes results and data to be accurate and fit for its intended purpose.

Practical considerations

- Resources: there are limited staff and other resources that can be applied to special requests for results or data.
- Timescales: it can take weeks or even months before data received by TfL are deemed fit for purpose.

Principal formats for presenting results and data

- Annual Report: comprehensive overview of the programme with summaries of all available results.
- Technical Reports: detailed analyses and interpretations of specific survey data.
- Bulletins: periodic summaries of selected data, particularly longitudinal volumetric data.
- Data sets: extracts from surveys to meet specific needs or requests from *bona fide* researchers.

Releasing results and data

- Annual Report: a priced publication with free copies to key stakeholders; also to be placed on the internet.
- Technical Reports: free issue to meet reasonable requests; charges may apply to special requests; index to be placed on the internet.
- Bulletins: free issue to meet reasonable requests; charges may apply to special requests; also to be placed on the internet.
- Data sets: *bona fide* researchers includes local authorities and representative bodies of affected groups; charges may apply to special requests.
- Traffic data to boroughs from TfL automatic counters on borough roads: special protocol applies.

Timetable for releasing results and data

- Congestion Charging Annual Report: publication in the Spring covering results from the previous year.
- Preview of First Annual Report covering key conditions before charging: was published February 2003.
- Preliminary Review: selected indications of key impacts after six months operation; to be published Autumn 2003.
- Bulletins: publication as relevant results are assembled and fit for purpose.
- Data sets: availability as results from individual surveys are assembled and fit for purpose.

Appendix 3
Survey programme and data availability

A3.1. Introduction

The following section sets out the main components of the surveys and research being undertaken as part of the impacts monitoring programme for congestion charging. For each component, it provides:

- a brief description of the survey or research item;
- an indicative timetable for each survey going forward from the start of congestion charging on 17 February 2003;
- an indication of when outputs should be received by TfL from contractors or other survey sponsors.

The programme is divided into seven parts, each covering research designed to address one of the following issues:

- Congestion;
- Traffic patterns;
- Public transport;
- Travel behaviour and secondary transport effects;
- Economic impacts;
- Social impacts;
- The environment.

Data availability

Transport for London expects to receive data and material from contractors and third parties according to the timetable specified in this appendix. Transport for London will review this material to ensure that it is accurate and is fit for its intended purpose. Following formal TfL acceptance from contractors, data or other materials will be available to *bona-fide* researchers on request. It is not possible to be precise about the duration of the TfL acceptance process. However, the following are guidelines:

- for volumetric-type data (e.g. regular traffic counts and congestion/speed surveys), TfL would normally expect to be in a position to formally accept data from contractors – and hence be able to release on request to *bona fide* researchers – within 4 weeks of the date of receipt. For example, for traffic volume counts such as for vehicles entering the charging zone, TfL would normally expect to receive data from contractors within 4 weeks of the end of the survey programme. Transport for London would then normally take 4 weeks to formally accept data from contractors as being fit for purpose. Therefore, *bona-fide* researchers would normally be granted access to the data from 8 weeks after the end of the survey programme;
- for other materials, such as research reports, TfL would normally expect to be in a position to formally accept the material from contractors – and hence be able to release on request to *bona fide* researchers – within 8 weeks of the date of initial receipt;

- information provided to the monitoring programme by third-parties will be available on-request from the originators according to their own policies and timescales for data dissemination.

Interpreting the data

In considering the progressive availability of data from the monitoring programme, it is necessary to bear in mind the rate with which different impacts will occur and reach a stable post-charging situation. In interpreting results from the programme, the following guidelines should be applied:

- for data relating to traffic speeds, congestion, traffic volumes and public transport patronage, TfL would expect stable post-charging conditions to be reflected in the monitoring data from Autumn 2003 onwards;
- for data relating to social, economic and business impacts, TfL expect a process of progressive adaptation lasting for several years. This will be reflected in the outputs from the monitoring programme, which will consider both short- and long-term effects. Earliest indications of these impacts would be reported after the first year of surveys.

Description

Key surveys and other work are listed under each section in the following tables. Each piece of work is described as follows:

Programme:	Title of element of monitoring programme.
Monitoring objective:	The main quantity/issue being measured.
Description:	Brief description of survey.
Planned survey frequency:	Summary of planned future work.
Core/3rd party:	Indication of whether survey work is sponsored directly by the congestion charging monitoring programme ('core') or available from third-party surveys ('3rd party').
Data type:	Basic description of survey output, primarily whether quantitative or 'volumetric' data, qualitative/research or secondary analysis.
Indicative TfL receipt of data:	Indicative delay between completion of fieldwork/research and receipt of contractor deliverables by TfL. Note: 'deliverable' may be a dataset, a report, other materials or a combination of all three. Note that data availability to *bona-fide* researchers will be in accordance with the timescales described above under 'data availability'.

A3.2 Congestion

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Central London Speed Survey	C1	Network speeds in central London/ charging zone.	Moving-Car-Observer (MCO) survey covering a pre-defined network of central London roads. Charging zone and Inner Ring Road can be disaggregated from the wider (DfT) definition of central London.	Established historical time series. Jan/Feb 2003 July/Aug 2003 March/April 2003 Sep/Oct 2003 May/June 2003 Nov/Dec 2003 June/July 2003 (note overlap) Programme from 2004 subject to review.	Core	Volumetric	6 weeks following end of survey period.
Inner London Speed Survey	C2	Network speeds in inner London.	MCO survey covering a pre-defined network of inner London roads. Directly complementary to central London survey.	Jan to June 2003 Jan to June 2004 Jan to June 2005	Core	Volumetric	10 weeks following end of survey period.
Outer London Speed Survey	C3	Network speeds in outer London.	MCO survey covering a pre-defined network of outer London roads. Directly complementary to central and inner London speed surveys.	3-yearly-basis over 12-month period, next survey 2003.	3rd party	Volumetric	3 months following end of survey period.
Approach Radials and Inner Ring Road Speed Survey	C4	Network speeds on Inner Ring Road and main radial routes approaching the charging zone.	MCO survey covering Inner Ring Road and main approach radials, out to points corresponding with location of ANPR monitoring cameras (see C5). Provides intensification of speed survey effort for Inner Ring Road and base of main radial approaches.	Jan/Feb 2003 July/Aug 2003 March/April 2003 Sep/Oct 2003 May/June 2003 Nov/Dec 2003 June/July 2003 (note overlap) Programme from 2004 subject to review.	Core	Volumetric	6 weeks following end of survey period.

A3.2 Congestion (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
ANPR cameras	C5	Network speeds within the charging zone, on the Inner Ring Road, and on the main radial routes approaching the charging zone.	ANPR-equipped cameras record vehicle registration numbers of passing vehicles. These can be matched between arbitrary pairs of cameras to monitor the passage of individual vehicles to/from and within the charging zone, on a continuous basis. Matches can be classified into broad vehicle type by reference to DVLA data. Enforcement cameras (on the boundary of, and within, the charging zone) have been supplemented by 70 cameras along the Inner Ring Road and within inner London on the main radial approach routes to the charging zone, giving approximately 500 cameras in total.	Cameras will operate continuously during charging hours, and periodically (for monitoring purposes only) during non-charging hours. Programme will continue for lifetime of current enforcement technology.	Core	Volumetric	Weekly updates, 4-weekly contractor reports.
Characteristic journeys	C6	Journey time reliability for sample of 'real-life' regular car travellers to/from the charging zone.	Panel-based survey of drivers making regular journeys in and around charging zone. 100 participants record timings for regular nominated journeys for a 4-month window bracketing inauguration of scheme.	November 2002 to April 2003. Possible repeat Nov 2003 to April 2004 (subject to review).	Core	Panel research	Contractor report 4 weeks after end of survey.
Other speed/ congestion-related data available to monitoring programme	C7	Various, supporting and corroborative data on speeds and congestion.	(a) An estimate of baseline uncongested/free-flow speeds is available from the DfT overnight MCO survey conducted during 2001. (b) MCO speed surveys are also undertaken for the TLRN and LBI networks. (c) Point-based estimates of speeds are potentially available from Automatic Traffic Counter installations throughout London. (d) Various proxy indicators of congestion are available from the SCOOT traffic signal control system.	Various, to be utilised as required / appropriate.	3rd party	Various	Various

A3.3 Traffic volumes

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Charging zone cordon counts (JIRR)	R1	Traffic entering/leaving charging zone.	14-hour manual counts (volumes by vehicle type) with continuous ATCs at busiest sites. All charging zone boundary sites are counted in both inbound and outbound directions.	Jan/Feb 2003 May/June 2003 Sep/Oct 2003 May/June 2004 Sep/Oct 2004 May/June 2005 Sep/Oct 2005.	Core	Volumetric	4 weeks following end of survey.
Charging zone counts (internal)	R2	Traffic circulating in charging zone.	14-hour manual counts (volumes by vehicle type) with continuous ATCs at sub-set of sites. Stratified random sample (by road type) across five internal sub-zones.	Jan/Feb 2003 May/June 2003 Sep/Oct 2003 May/June 2004 Sep/Oct 2004 May/June 2005 Sep/Oct 2005.	Core	Volumetric	4 weeks following end of survey.
IRR counts	R3	Traffic volumes on Inner Ring Road.	14-hour manual counts (volumes by vehicle type) with continuous ATCs at sub-set of sites. Random sample of sites corresponding to sub-sections of Inner Ring Road defined by five internal (charging zone) sub-zones.	Jan/Feb 2003 May/June 2003 Sep/Oct 2003 May/June 2004 Sep/Oct 2004 May/June 2005 Sep/Oct 2005.	Core	Volumetric	4 weeks following end of survey.
Radial screenlines	R4	Traffic making orbital movements outside Inner Ring Road.	Four radial screenlines extending outwards from Inner Ring Road. Complete coverage, combining continuous ATCs, 14-hour and peak-period-only manual counts.	Jan/Feb 2003 May/June 2003 Sep/Oct 2003 May/June 2004 Sep/Oct 2004 May/June 2005 Sep/Oct 2005.	Core	Volumetric	6 weeks following end of survey.
Borough local roads	R5	Traffic change on local borough roads (specific, borough-nominated sites).	Spot traffic counts at approximately 50 sites in central and inner boroughs, using automatic (continuous) or manual methods. Counts undertaken before, during and after congestion charging begins. Designed to detect possible traffic volume changes on local roads within, and around the charging zone.	Combination of permanent ATCs, recording continuously, temporary ATCs, installed for specific monitoring periods, and manual counts, taken during windows to be agreed with the borough concerned.	Core	Volumetric	4 weeks following end of survey.

A3.3 Traffic volumes (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Specific local traffic issues (stand-by counting resource)	R6	Traffic change in relation to specific local issues or traffic schemes.	Manual traffic counts at specific sites to be taken as required in relation to emerging local traffic issues.	Forward programme cannot be determined in advance.	Core	Specific issues	Immediate turn-around expected.
DfT London traffic monitoring programme	R7	Traffic volumes and long-term trends in central, inner and outer London.	Manual and automatic (continuous) counts undertaken throughout Greater London. All major links counted on a rolling basis over a 7-year period, each year's counts representing a sub-set of a sample stratified by road type.	Counts are undertaken on a continuous basis according to the sample stratification. Annual estimates of traffic volumes can be derived for central, inner and outer London.	3rd party	Volumetric	Specific sites c. 6 weeks. Annualised estimates c. 9 months.
TfL TLRN monitoring programme	R8	Traffic volumes on the Transport for London Road Network (TLRN) road network.	Continuous ATCs located at sites on the TLRN only. Non-random sample, giving indicative traffic volume trends on TLRN.	Count programme on-going throughout 2003/4/5.	3rd party	Volumetric	4 weekly batches 4 weeks after end of survey period.
TfL London traffic monitoring programme	R9	Traffic volumes in central, inner and outer London.	Extension of existing TLRN monitoring programme to give 'high-level performance indicators' for traffic trends in central/inner/outer London. New sites being progressively established late 2002 and early 2003.	Count programme on-going throughout 2003/4/5.	3rd party	Volumetric	4 weekly batches 4 weeks after end of survey period.
LBI (Bus Plus) traffic monitoring programme	R10	Traffic volumes on LBI routes.	Series of spot-counts for general traffic volumes on LBI routes. Permanent ATC and 14-hour manual.	Undertaken on before/after basis for both LBI 1 and LBI 2. Forward programme to be determined.	3rd party	Volumetric	Various.

A3.3 Traffic volumes (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
TfL Central London cordon (STC cordon)	R11	Traffic volumes entering/leaving central London (DfT definition).	Traffic counts along a watertight cordon enclosing central London (DfT definition – larger than the charging zone). All traffic entering and leaving this definition of central London is counted to give an annual estimate of traffic volumes for a typical day.	Sep/Oct 2003 Sep/Oct 2004 Sep/Oct 2005.	3rd party	Volumetric	6 weeks following end of survey period.
TfL Thames screenline	R12	Traffic volumes crossing river Thames.	Traffic counts along a watertight screenline following the Thames within Greater London. All traffic crossing Thames is counted to give an annual estimate of traffic volumes for a typical day. Six bridges within charging zone and two on Inner Ring Road.	Historically counted bi-annually during Autumn neutral period. This will continue. However, congestion-charging-related sites will be counted to following forward programme: Jan/Feb 2003; March/April 2003; Sep/Oct 2003; Sep/Oct 2004; Sep/Oct 2005.	3rd party	Volumetric	6 weeks following end of survey period.
TfL inner London cordon	R13	Traffic volumes entering/leaving inner London (DfT definition).	Traffic counts along a watertight cordon enclosing inner London (DfT definition). All traffic entering and leaving this definition of inner London is counted to give an annual estimate of traffic volumes for a typical day.	Historically counted tri-annually during Autumn neutral period. Forward programme will continue on an annual basis.	3rd party	Volumetric	10 weeks following end of survey period.
TfL London boundary cordon	R14	Traffic entering/leaving outer London (DfT definition).	Traffic counts along a watertight cordon enclosing Greater London (DfT definition). All traffic entering and leaving this definition of London is counted to give an annual estimate of traffic volumes for a typical day.	Historically counted tri-annually during Autumn neutral period. This frequency will continue.	3rd party	Volumetric	10 weeks following end of survey period.
SCOOT Automatic Traffic Control System	R15	Indicative traffic volumes at SCOOT equipped traffic signal installations.	Spot-estimates of traffic volumes on continuous basis are potentially available from traffic signal installations equipped with loop-per-lane detectors. These detect the presence of vehicles in a similar way to automatic traffic counters.	Data potentially available on continuous basis, via the ASTRID system, dependent on loop configuration at available sites and site-specific calibration counts.	3rd party	Volumetric	Specific enquiries only.

A3.3 Traffic volumes (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Junction counts	R16	Traffic volumes and turning movements at selected key junctions in and around the charging zone.	Traffic volume and turning-movement counts undertaken at a selection of 18 key junctions in and around charging zone. Approximately 50 percent of sites are 'straight counts'. Remaining 50 percent require numberplate-matching surveys.	Counts to be repeated on an as required basis following the start of charging.	Core	Volumetric	6 weeks following end of survey period.
Vehicle occupancies	R17	Vehicle occupancies within charging zone.	Vehicle-occupancy counts at selected traffic count sites within and on boundary of the charging zone. Taken in conjunction with traffic counts to estimate person-trips using private transport to enter/within charging zone.	Counts undertaken on an annual basis in Autumn of each year.	Core	Volumetric	6 weeks following end of survey period.

A3.4 Public transport

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Bus Keypoints counts	P1	Bus passenger loadings and number of buses at strategic points.	A roadside count of the number of passengers boarding, alighting and departing, typically undertaken at the busiest points on the network. Each count covers one day.	Counts throughout London are undertaken. The survey was boosted so that all Keypoints that were also on the congestion charging boundary were covered in Autumn 2002. There will be comparable counts each Autumn.	Core and 3rd party	Volumetric	8 weeks following end of survey period.
Bus occupancy counts	P2	Average bus occupancies.	On-bus and roadside counts completed at a stratified random sample of sites on the gateway and inside the charging zone.	Each site is programmed to be surveyed in the Spring and Autumn neutral counting periods. Some gateway sites are replaced in the Autumn periods by the Keypoints surveys (see item P1 above).	Core and 3rd party	Volumetric	8 weeks following end of survey period.
MARQUIS	P3	Bus journey times and speeds on selected links.	The system has been developed for a range of purposes including monitoring of bus journey times/speeds.	Data is generated continuously, summarised to TfL in monthly batches.	3rd party	Volumetric	4 weeks following end of survey period.
Quality of Service Indicators (QSIs)	P4	Bus reliability.	Roadside surveys of bus departures/passing time at survey stops, compared with schedule.	Data is generated continuously, summarised to TfL in monthly batches.	3rd party	Volumetric	4 weeks following end of survey period.
Bus electronic ticket machine data	P5	Bus operated mileage and mileage lost due to traffic delays.	Scheduled mileage and operated mileage is collected from operators and held by London Buses.	Data is generated continuously.	3rd party	Volumetric	4 weeks following end of survey period.
Bus customer satisfaction survey	P6	Bus customer satisfaction.	A bus passenger interview survey, completed at the destination stop. Consists of attitudinal questions relating to various aspects of bus services.	Survey is undertaken on a continuous basis.	3rd party	Customer research	Reported quarterly.

A3.4 Public transport (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
London Bus Initiative (Bus Plus)	P7	Journey times.	A range of surveys are completed relating to a specific Bus Plus route including on-bus delay surveys, bus stop surveys, passenger surveys and other vehicles surveys. All of these are reported on by LBI, although some are completed by other parties and drawn on by LBI.	The intensity of surveys completed depends on the category of the route, with Quality Whole Route Plus routes receiving the most intense coverage to enable the results to be statistically robust.	3rd party	Various research	Various.
London Underground ticket gate data	P8	Underground passenger volumes.	Data (passenger entries and exits) from the automatic ticket barriers at each station where they are present.	Data is generated continuously, and presented according to congestion charging geography, on a 4-weekly basis.	3rd party	Volumetric	2 weeks following end of survey period.
London Underground revenue data	P9	Underground ticket sales.	Data supplied by London Underground from ticket sales offices. This data is considered supportive of the gate counts data, but not representing absolute passenger volumes.	Data is generated continuously.	3rd party	Volumetric	2 weeks following end of survey period.
Underground users survey	P10	Underground customer satisfaction.	An Underground passenger interview survey, completed on-station. Consists of attitudinal questions relating to various aspects of Underground services.	Surveyed in six times 4-monthly waves over a 2- year cycle.	3rd party	Customer research	8 weeks following end of survey period.
DLR period statistics report	P11	Service, performance and patronage on DLR.	Data supplied by DLR in a general report that details various aspects of its operation, including customer satisfaction.	Data is generated continuously.	3rd party	Published report	4 weeks following end of survey period.
National Rail station counts	P12	National Rail patronage.	On-platform all day outbound passenger counts and AM peak inbound passenger counts at all National Rail stations in or around the charging zone.	Surveyed annually in the Spring neutral counting periods.	Core	Volumetric	6 weeks following end of survey period
SRA terminal counts	P13	National Rail patronage.	On-platform AM peak inbound passengers and PM peak outbound passenger counts at terminal stations within London.	Surveyed annually in Autumn neutral counting periods.	3rd party	Volumetric	8 weeks following end of survey period.

A3.5 Travel behaviour and secondary transport effects

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Licensed taxis	T1	Taxis: supply, patronage, journey times and reliability.	Data describing licensed taxi supply will be available from the Public Carriage Office (TfL).	Continuous	3rd party	Volumetric	On request
			Volumetric counts of taxis will be available from the general traffic counting programmes.	Various (see R1-R17)	Core	Volumetric	See R1-R17
			It is intended to repeat the taxi surveys associated with the 2001 LATS surveys during Spring 2003.	Spring 2003	Core	Volumetric	12 weeks
			Taxi journey times and reliability will be specifically monitored through the ANPR journey time monitoring system.	Continuous	Core	Volumetric	See above
			Information on taxi occupancies will be available from the CAPC survey and from the core programme of vehicle occupancy counts.	Various (see T7)	Core and 3rd party	Volumetric	See T7
Unlicensed taxis	T2	Unlicensed taxis: supply, journey times and reliability.	Data describing the licensing of minicabs will be available from Public Carriage Office (TfL) records, although unlicensed minicabs are not amenable to conventional traffic counting methods.	Continuous	3rd party	Volumetric	On request
			A case study of selected minicab businesses will be undertaken as part of the business and economy programme (see B5).	Spring 2003	Core	Case study research	Contractor report available 8 weeks after survey period

A3.5 Travel behaviour and secondary transport effects (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Powered two-wheelers	T3	Powered two-wheelers: volumes, mode shares, accidents.	Trends in the volume of powered two-wheelers in and around the charging zone will be monitored through the general traffic counting programme.	Various (see R1-R17)	Core	Volumetric	See T1-T17
			Trends in the sales of powered two-wheelers will be understood through case-study work with a sample of retailers in London, to be undertaken under the business and economic programme (see B8).	January to June 2003	Core	Case study research	Contractor report available 8 weeks after survey.
			Trends in accidents involving powered two-wheelers will be monitored through the London Accident Analysis Unit monthly reports, coupled with specific research to detect emerging adverse trends at an early stage.	Ongoing, monthly reporting	3rd party	Volumetric	Monthly, with c. 6 month delay pending Police investigation.
Pedal cycles	T4	Pedal cycles: volumes, mode shares and accidents.	Trends in the volume of pedal cycles in and around the charging zone will be monitored through the general traffic counting programme.	Various (see R1-R17)	Core	Volumetric	See R1-R17
			Additional information will arise from other specific cycle surveys conducted by TfL.	Various	3rd party	Volumetric	Various
			Trends in accidents involving pedal cycles will be monitored through the London Accident Analysis Unit monthly reports, coupled with specific research to detect emerging adverse trends at an early stage.	Ongoing, monthly reporting	3rd party	Volumetric	Monthly, with c. 6 month delay pending Police investigation.

A3.5 Travel behaviour and secondary transport effects (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Railhead parking	T5	Railhead parking outside the charging zone.	Specific surveys of parking behaviour at selected stations in inner/outer London that may experience changes in railhead parking behaviour.	Autumn 2003 Spring 2003	Core	Volumetric	Contractor report available 6 weeks after end of survey period.
Commercial and local authority parking	T6	Changes to parking demand within the zone, the implications for commercial and local authority providers, and the business response.	Case study work and research with commercial and local authority parking providers	January to June 2003	Core	Case study research	Contractor report available 8 weeks after end of survey period.
Overall mode shares	T7	Mode shares and total travel to central London for passenger trips in the AM peak period.	The TfL central area peak count (CAPC) survey records mode shares for travel into central London (wider than charging zone) on a consistent basis, enabling trends in mode shares and total travel to be tracked.	Annually, in Autumn.	3rd party	Volumetric	Consolidated report available in Spring each year, reporting on autumn surveys.
Travel behaviour: trip rates, trip timing and journey purposes	T8	Travel behaviour changes affecting travel to the charging zone.	The 2001 London Area Transport Survey (2001 LATS) provides a pre-charging dataset describing broad patterns in travel behaviour affecting central London.	Updates to 2001 survey are currently under discussion.	3rd party	Not yet finalised	Future programme not yet confirmed.

A3.5 Travel behaviour and secondary transport effects (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Local Traffic Schemes (complemen -tary measures)	T9	Local impacts of local traffic schemes, interaction between local impacts and effects related to congestion charging.	TfL has funded monitoring of the local traffic impacts of three local traffic schemes in Islington (as part of the Boundary Case Study Area). Observed effects will be interpreted both in terms of the specific local schemes to which they relate, but also the traffic monitoring data from the wider monitoring programme.	Before surveys have been undertaken for the three schemes. Post-implementation monitoring will take place during Spring/Summer 2003, after which results will be assessed in conjunction with the London borough of Islington.	3rd party	Volumetric	Report expected mid-summer 2003.
Road traffic accidents	T10	Changes to road traffic accidents.	London Accident Analysis Unit will continue to process data for notified road traffic accidents. A monthly report will be prepared relating to the areas of interest for congestion charging.	Data is collated on a continuous basis, with a (typically) 4-6 month reporting lag owing to time needed for Police investigations.	3rd party	Volumetric	Monthly reports.
Pedestrian volumes	T11	Changes to pedestrian use of zone, pedestrian crossing behaviour in relation to Inner Ring Road.	It will not be possible to provide an estimate of changes in the volume of pedestrians circulating within the charging zone. Indicative volumetric data will, however, be available for a selection of 'high-profile' sites within and around the charging zone (see S3). Pedestrian crossing behaviour is being specifically monitored across a section of the Inner Ring Road located in the Boundary Case Study Area.	Autumn 2003 Autumn 2004 Winter 2003.	Core Core	Volumetric Volumetric	Contractor report available 6 weeks after survey programme. Contractor report available 6 weeks after survey programme.

A3.6 Economic impacts

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Businesses and organisations within charging zone: depth interview survey	B1	General impacts and behavioural and attitudinal responses of businesses and organisations within charging zone.	Depth interviews with a representative selection of 100 businesses and organisations located within charging zone. A variety of strategic and specific business functions are examined in terms of current awareness, attitudes and anticipated responses to the congestion charging, to be followed-up (ideally with same participants) over 4 years tracking evolving responses as they emerge in the context of other strategic influences.	Spring 2003 Autumn 2003 Autumn 2004 Autumn 2005	Core	In-depth research	Contractor report after 8 weeks.
Businesses and organisations within charging zone and boundary area: telephone-survey	B2	General impacts and behavioural and attitudinal responses of businesses and organisations within charging zone and boundary area.	Telephone interviews with a representative selection of 500 businesses and organisations located within the charging zone and boundary area. A sub-set of the issues covered in B1 (above) are examined using a telephone-based method, affording greater sample sizes but at reduced scope of coverage.	Spring 2003 Autumn 2003 Autumn 2004 Autumn 2005	Core	In-depth research	Contractor report after 8 weeks.
Businesses and organisations around the boundary of the charging zone: depth interview survey	B3	General impacts and behavioural and attitudinal responses of businesses and organisations located in the vicinity of the charging zone boundary.	Depth interviews with a representative selection of 50 businesses and organisations in the vicinity of the charging zone boundary. A variety of strategic and specific and boundary-related business functions are examined in terms of current awareness, attitudes and anticipated responses to the scheme, to be followed-up (ideally with same participants) over four years tracking evolving responses as they emerge in the context of other strategic influences. Boundary-related issues are specific focus of this research.	Spring 2003 Autumn 2003 Autumn 2004 Autumn 2005	Core	Research	Contractor report after 8 weeks.

A3.6 Economic impacts (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Dynamics of change fora	B4	Informed perspectives on congestion charging from knowledgeable representatives of key economic/activity sectors of the London economy.	Discussion fora, held with high-level representatives of key economic or activity sectors. Intended to receive informed feedback on general and specific impacts, to facilitate discussion and exploration of these, and to receive informed perspectives on the emerging monitoring results. Current fora include: City businesses Retail businesses Public services Central and inner London boroughs The voluntary sector Transport-related groups Road-transport-related organisations Groups representing those with a disability	Summer 2003 Summer 2004 Summer 2005 Further fora to be held as required.	Core	Qualitative research	Contractor report after 8 weeks.
Employee survey within the charging zone	B5	Work-related travel behaviour and congestion charging-related attitudes, perceptions and responses.	Basic quantification of work-related travel behaviour and employee attitudes towards the scheme from a sub-set of businesses and organisations participating in B1 (above). To be used as 'exemplars of change', rather than representing a statistically-robust sample.	Autumn 2003 Autumn 2004 Autumn 2005	Core	Research	Contractor report after 8 weeks.

A3.6 Economic impacts (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Macro-economic data and the mechanics of change	B6	A work package to draw together available third-party data describing the general operation, and specific aspects of, the London economy, and to identify and disaggregate the contribution of congestion charging to observed change.	A variety of data are regularly compiled by third-parties that describe both general and specific aspects of the London economy and their evolution over time. This work package assembles and interprets these data, in the context of identifying congestion charging-related impacts and distinguishing these from wider trends and influences. Examples of these datasets are: employment, business turnover, sector-specific surveys (e.g. tourism) and property price indices.	On-going research.	Core	Various, secondary data analysis	6 monthly reporting cycle.
Freight and distribution businesses: case studies	B7	To gather information describing the influence of congestion charging on all relevant aspects of company operation (e.g. identification and capitalisation of decongestion effects, operation of fleet payment schemes).	In-depth studies of 10 freight/distribution/ servicing businesses in and around the charging zone.	On-going research	Core	Case study-based research	6 monthly reporting cycle.

A3.6 Economic impacts (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Economic case studies	B8	Activity-specific in-depth case studies. Examining impacts of the scheme on activities of specific monitoring interest.	Certain activities will require in-depth, specific monitoring that would not be possible through a general business survey. This may reflect possible disproportionate impact arising from specific features of the activities considered, or areas of wider transport planning interest. These studies will take a variety of forms appropriate to the subject being monitored. Current studies include: New Covent Garden market Schools Commercial and local authority parking Trends in sales and usage of motorcycles The voluntary sector Hospitals	Generally, studies will adopt a 'before/after' timeframe, with all 'after' studies scheduled to be complete by December 2003. Work after 2003 will be determined on the basis of results of the 2002/3 work. The need for further studies may arise once congestion charging starts.	Core	Various, case-study based research	Reporting cycles appropriate to each case study.

A3.7 Social impacts

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Residents of charging zone and inner London: Household Interview Survey	S1	General impacts and behavioural and attitudinal responses of households within the charging zone and inner London.	A survey of all members of around 2,300 households located in seven neighbourhoods inside the charging zone and inner London, chosen according to social-economic makeup. Issues covered include current travel behaviour, views of and anticipated response to the scheme and perceptions of the local environment. Surveys after scheme inauguration will focus upon actual impacts in relation to expectations, and on specific issues that arise from the exploratory elements of the 2002 surveys.	Surveys for 2003/4 programmed for Autumn period.	Core	Qualitative research	Contractor report after 8-12 weeks.
Residents of outer London and beyond the M25: Telephone Interview Survey	S2	General impacts and behavioural and attitudinal responses of travellers to central London from outer London and beyond the M25.	A survey of around 2,100 people who live in outer London or beyond the M25. Participants are recruited in the charging zone and interviewed by telephone a few days later. Issues covered include current travel behaviour, views of and anticipated response to the scheme.	Surveys for 2003/4 programmed for Autumn period.	Core	Qualitative research	Contractor report after 8-12 weeks.
On-Street Public Space Surveys	S3	Social mix and usage of the charging zone. Also pedestrian volumes and attitudes towards the central London environment.	Some 10,000 on street interviews conducted in 28 public spaces in London (e.g. Oxford Street, Parliament Square and London Bridge). Issues covered include reasons for visiting the charging zone, perceptions of the environment and views of public transport.	Annual surveys undertaken in Autumn period (September/October). Further surveys planned for 2003/4.	Core	Qualitative research	Contractor report after 8 weeks.

A3.7 Social impacts (continued)

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
Special Inquiries	S4	Exploratory research to identify and characterise specific issues. Typically, focus-group-based exercises with representatives of groups who are either able to offer unique insights into the effects of congestion charging, or who have been brought to our attention as requiring specific monitoring.	Special Inquiries will be held into the following: Bus Drivers London Taxis Traffic wardens Parking attendants Drivers making regular deliveries Drivers making ad-hoc deliveries Disabled people. Fire Fighters Police Service Ambulance Service Minicabs Frequent drivers (4 groups)	Annual surveys undertaken in Autumn/Winter period (October to January). Further surveys planned for 2003 and 2004.	Core	Qualitative research	Contractor reports within 8 weeks of each group.

A3.8 Environment

Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
London Atmospheric Emissions Inventory	E1	Baseline and forecast emissions of National Air Quality Strategy pollutants, translated to corresponding ambient air quality scenarios on a rolling annual basis.	Bottom-up inventory of all identifiable sources of emissions of key pollutants to atmosphere across Greater London. Covers all pollutants subject to national objectives. Allows disaggregation by source and area, and identification of source-specific trends and influences in relation to emissions. The London Atmospheric Emissions Inventory will be operated in conjunction with the GLA, and will form the definitive statement of emissions for Greater London. Annual inventories will be available, with specific interim updates (incorporating key traffic effects) as the scheme is implemented. Emissions scenarios will be translated into air quality forecasts, in relation to national objectives. Estimates of emissions of greenhouse gases and energy use can also be produced. The inventory will specifically benefit from the wealth of traffic-related data being gathered under the wider congestion charging monitoring programme.	May 2003 November 2003 November 2004 November 2005 Interim updates reflecting congestion charging traffic changes due November 2003, May 2004.	Shared work prog. with GLA	Air quality scenario	Contractor report within 8 weeks.
London Air Quality Network	E2	Air quality at representative sites throughout/around the charging zone. General air quality trends throughout Greater London.	High-quality continuous measurement of air quality at established air quality monitoring sites throughout Greater London. Approximately 70 sites available, from which examples to represent the congestion charging geography can be chosen. Sites are quality-assured to government (AURN) standards. Various pollutants are measured, dependent upon the specific sites involved.	Pre-scheme baseline November 2002 First post-scheme scenario May 2003 Second post-scheme scenario November 2003 Third post-scheme scenario November 2004 Fourth post-scheme scenario November 2005	3rd party	Secondary analysis of LAQN data	Contractor report within 8 weeks.

A3.8 Environment (continued)

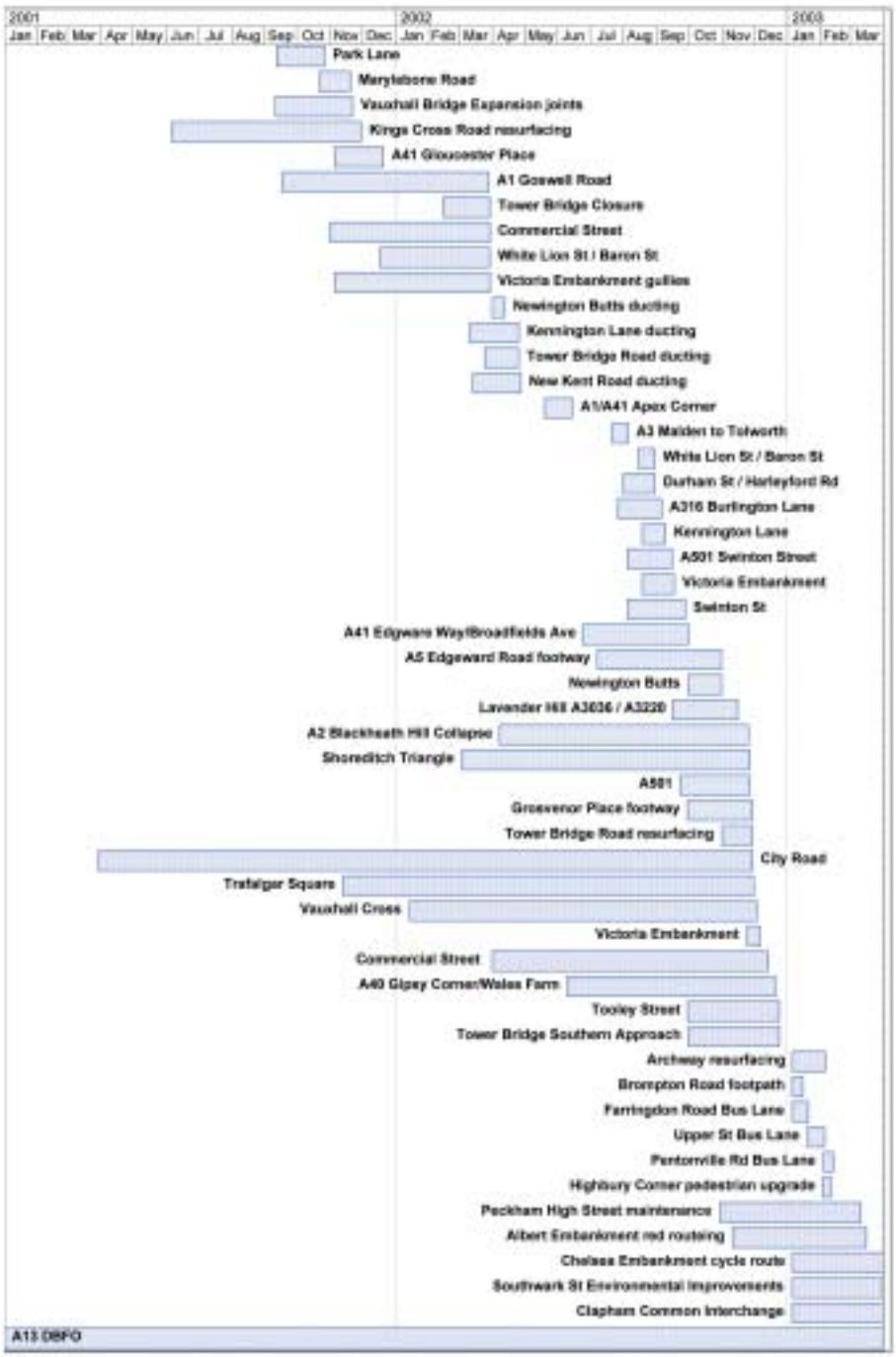
Programme	Ref	Monitoring objective	Description	Planned survey frequency	Core/ 3rd party	Data type	Indicative TfL receipt of data
TfL London Noise Survey	E3	Ambient noise levels at representative selection of sites throughout/around charging zone and more generally throughout Greater London.	Short-period measurements undertaken at a selection of 20 representative sites throughout greater London. Measurements taken during Autumn/Winter period each year. Sites are located within and around the charging zone to be representative of the different scales of traffic change expected.	Autumn/Winter 2003 Autumn/Winter 2004 Autumn/Winter 2005	3rd party	Noise data	Contractor report within 12 weeks.

Appendix 4
Temporary road network disruption during 2002

A greater than usual amount of disruption to the road network in and around central London has occurred during 2002. This has potential implications for the interpretation of the indicators discussed elsewhere in this report. Figure A4.1 demonstrates the scope of activity over this period and immediately preceding the introduction of congestion charging.

Disruption to the transport network is not unique to 2002, and will also be a feature of future years. Care must therefore be taken when comparing future measurements with historical data to ensure fair comparisons.

Figure A4.1. Major roadworks in central London, 2001 to early 2003.



Appendix 5
Measuring traffic patterns

A5.1. Introduction

Changes to traffic volumes, traffic patterns and traffic composition will be a fundamental effect of congestion charging. It is crucial that these changes are comprehensively and robustly measured. This section considers various practical issues related to the measurement and interpretation of traffic change in relation to the scheme.

A5.2. Available material

The 'geography' of the congestion charging scheme imposes a new set of monitoring requirements on to the existing traffic monitoring framework in London. These requirements are fully reflected in the design of the new traffic surveys that have been put in place specifically to monitor the scheme. However, it has only been possible to commence these surveys during 2002. They do not, therefore, provide a picture of long-term trends in traffic that would be required for an ideal appreciation of scheme effects. Long-term traffic surveys in and around the charging zone do provide rich time-series of data - in excess of 10 years - that allow background trends in central London traffic to be established.

In addition, as is discussed in Appendix 4, the year 2002 has been characterised by an unusual amount of short-term disruption to the road network in central London. This has included several major traffic management measures and a number of significant road maintenance schemes. This means that traffic measurements taken during 2002 are unlikely to be wholly representative of 'settled' pre-scheme conditions.

In developing an exposition of traffic conditions against which changes brought about by the scheme can be compared, it is necessary to bring together data from a variety of sources. The following sections describe the main data sources that are available for this purpose, and consider how they can be used in combination to establish the most effective picture of traffic flows and composition before congestion charging starts.

A5.3. Traffic survey practice

Traffic in and around central London has been measured on a consistent basis since the mid-1960s, with detailed results available from the mid-1980s. There are three basic types of surveys:

- **Area-based,** where traffic is counted at representative locations across an area or network, so as to produce estimates of traffic that are applicable to those areas or networks (e.g. total vehicle-kilometres travelled).
- **Line-based,** where counting is organised along geographical boundaries or other lines. These are referred to as 'screenlines' where the line involved runs between two points (e.g. the River Thames screenline) or 'cordons', where the line completely encloses the area of interest (e.g. the central London cordon).

- **Location-based,** where counts are directed towards specific sites that are revisited at intervals. These surveys are most appropriate for monitoring traffic change in relation to specific local issues, and are not designed to provide statistics across an area. It should, however, be noted that area- or line-based surveys will also produce data describing traffic conditions at all of the specific sites of which they are comprised.

Further sub-divisions are conventionally by time period, direction and vehicle classification. It should be noted that:

- traffic counts can typically be disaggregated to provide estimates for short time periods (e.g. hourly counts would be typical);
- counts taken during Spring and Autumn 'neutral periods' can be considered to be more representative of 'typical' conditions for the year, since they avoid the changes associated with the main school and summer or Christmas holiday periods;
- manual classified and continuous automatic counts can be used in combination to derive annualised estimates, the seasonal profile across the year being provided by the automatic counters;
- manual classified counts can typically distinguish up to 15 different vehicle types, based on visual identification. This is not possible with automated methods, and therefore both types of count need to be used in combination in deriving robust estimates of traffic change.

Using this framework, the following describes the datasets that are most pertinent to measuring the traffic impacts of congestion charging at the strategic scale.

A5.4. Long-term traffic surveys

- **The Thames Screenline.** This consists of counts taken at all Thames crossings within Greater London. It is 'watertight', in the sense that it is only possible to cross the Thames at counting locations, and runs directly through the charging zone (six bridges internal to the zone and two on the Inner Ring Road). It has been historically counted every 2 years. Counting of the whole screenline will continue on this basis, with supplementary counts taken at frequent intervals over the next few years on the eight bridges within and bounding the charging zone.
- **The Central London Cordon.** This consists of a cordon around the Central Statistical Area, which has traditionally been used as the definition of 'central' London for various survey purposes. This cordon is not co-incident with the charging zone, and encloses an area significantly larger than the charging zone. This cordon has historically been counted on a 2 to 3 yearly cycle, and will be counted on a more frequent basis over the next few years.
- **The Extended Central London Cordon.** For most of its circumference, the Central London Cordon lies at some distance beyond the Inner Ring Road. However, it runs inside the charging zone to the south of the river, and therefore does not give an unambiguous picture of traffic approaching the charging zone. This cordon (which was counted for the first time in Autumn 2002) simply extends the Central London Cordon to the south of the river to form a watertight cordon that is completely outside of the Inner Ring Road. This too will be counted on a frequent basis over the next few years.

- **The Inner London and London Boundary Cordons.** These are analogous to the Central London Cordon, defining inner London (roughly bounded by the North and South Circular Roads) and Greater London (a cordon roughly co-incident with the boundary of Greater London). These have historically been counted on a 3-yearly cycle, and it is expected that this frequency will remain unchanged in the medium-term.
- **The TfL Central Area Peak Count (CAPC) Cordon.** This involves a cordon around central London, broadly similar (but not identical to) the Central London Cordon described above. The Central Area Peak Count is primarily directed towards estimating the number of people travelling into central London on the morning weekday peak period. Although it does not include a full traffic count, it does include estimates of volumes of certain categories of vehicle, together with occupancy estimates, to give an estimate of private travel to central London. This cordon has traditionally been counted annually. This frequency will be maintained in the medium-term.

A5.5. Congestion charging surveys

- **Congestion Charging Boundary Cordon.** This consists of counts taken at all entry and exit points to/from the charging zone. It therefore describes a 'watertight' cordon completely enclosing the charging zone, giving an estimate of traffic entering and leaving the charging zone.
- **Counts within the charging zone.** This consists of a stratified-random sample of counting sites located throughout the charging zone, designed to give a statistically-robust estimate of traffic levels (in terms of vehicle-kilometres) within the charging zone.
- **Counts on the Inner Ring Road.** This consists of randomly-located counting sites along the entire length of the Inner Ring Road, designed to give an estimate of traffic flows at individual locations around the Inner Ring Road, together with an estimate of total vehicle-kilometres on this road.
- **Inner London Radial Screenlines.** These consist of four screenlines radiating outwards from the Inner Ring Road for a distance of approximately 5 kilometres, along which traffic at all intercepted roads is counted. The four screenlines extend in (approximately) north, south, east and west directions, and are located so as to help measure the scale of displaced traffic that uses routes other than the Inner Ring Road.
- **Counts on local roads.** In response to representations from boroughs within and surrounding the charging zone, TfL have sponsored a programme of counts on local (i.e. non-TLRN) roads throughout central and inner London. In all cases, the locations to be counted have been agreed with the host boroughs, and a range of permanent and short-period automatic and manual counting methods have been deployed. These counts will provide information about traffic change at the specific locations of interest, but do not in aggregate produce an indicator of traffic change that is useful at the strategic level.

- **Junction-turning-movement counts.** Detailed counts of junction turning movements at the main radial intersections with the Inner Ring Road and at a number of key junctions within the charging zone have been undertaken during 2002. These are designed to detect changes to the number of vehicle movements between the radial approaches to the charging zone and the Inner Ring Road itself, giving an indicator of changes to traffic avoiding the charging zone by using the Inner Ring Road. They will be repeated as required following the commencement of charging.

A5.6. Other relevant surveys

A number of other surveys are capable of providing background material describing traffic flows in and around the charging zone. These are:

- **Cordons and screenlines associated with the 2001 London Area Transport Surveys (LATS).** These use yet another definition of central London (the LATS central London cordon), together with two screenlines in inner London (extending both north and south of the charging zone). Counts at sites on these cordons and screenlines are supplemented by roadside interviews, designed to quantify origin-destination patterns of vehicle trips.
- **The DfT National Traffic Census.** As part of their National Traffic Census, which aims to produce estimates of traffic volumes (vehicle-kilometres) for the main UK regions, DfT organise a comprehensive series of counts covering the majority of main road links in Greater London. This survey occurs on a rolling seven-year cycle, and is limited to producing robust estimates only at the London-wide scale. However, the component counts provide valuable information on historical traffic conditions at specific locations within and around the charging zone.
- **The Transport for London (TLRN) Road Network monitoring programme.** This consists of automatic counters placed at representative locations around the Transport for London Road Network. Much of this work extends the monitoring originally developed for the 'Red Routes' in the 1990s.
- **Other counting programmes,** such as those sponsored by the London boroughs, will also provide useful background data.

A5.7. Measuring traffic change for congestion charging: a synthesis

Given these surveys and the data they generate, the following describes how each of the main traffic change quantities associated with congestion charging will be assessed:

Traffic circulating within the charging zone

For 2002, annualised estimates of weekday vehicle-kilometres driven will arise directly from counts taken under the congestion charging monitoring programme. These sites were counted on three occasions during 2002.

- During late February/March, so as to provide a 2002 dataset during the same season against which early effects of charging can be directly assessed.

- During April/May and again during September/October (the traditional Spring and Autumn neutral counting periods), which in combination provide the basis for an annualised estimate for 2002 (although in the absence of continuous data for 2002 this estimate can be only approximate).
- Continuous automatic traffic counters at a selection of sites have been progressively brought on-stream throughout the area during 2002, and produce continuous trend of total traffic volume from the date of their installation.

The counting programme following the start of charging will consist of the following components:

- counts taken at selected sites immediately following the start of charging, designed to obtain early indications of scheme effects;
- continuous trend monitoring (against available 2002 data) provided by automatic traffic counters located within the charging zone;
- Spring and Autumn neutral period counts, designed to be comparable to those taken during 2002, and to result in a definitive annualised estimate of vehicle-kilometres for the post-charging situation in 2003.

The congestion charging programme cannot produce directly comparable estimates of traffic flow for years prior to 2002, although efforts are being made to analyse the data that are available from various ad-hoc surveys in 2000 and 2001. The most consistent long-term dataset in this regard is provided by the Thames Screenline (the six bridges in the charging zone). Corroborative evidence will arise from the (small) number of automatic counters provided for the DfT National Traffic Census and the TLRN monitoring, that are located within the congestion charging zone, as well as from a comprehensive programme of long-term traffic monitoring undertaken by the Corporation of London.

Traffic entering and leaving central London

For 2002, annualised estimates of traffic entering and leaving the charging zone will arise directly from counts taken under the congestion charging monitoring programme. The charging zone boundary cordon was counted on three occasions during 2002:

- during late February/March, so as to provide a 2002 dataset during the same season against which early effects of charging can be directly assessed;
- during April/May and again during September/October (the traditional Spring and Autumn neutral periods), which in combination provide the basis for an annualised (approximate) estimate for 2002;
- continuous automatic traffic counters at selected sites have been progressively brought on-stream at entry and exit points during 2002, and produce a continuous trend of traffic data from the date of their installation.

The counting programme following the start of charging will consist of the following components:

- a complete cordon count immediately following the start of charging, designed to obtain early indications of scheme effects;

- continuous trend monitoring (against available 2002 data) provided by automatic traffic counters located on the charging zone boundary;
- Spring and Autumn neutral period counts, designed to be comparable to those taken during 2002, and to result in a definitive annualised estimate of vehicle entries and exits for the post-charging situation in 2003.

Again, the congestion charging programme cannot produce directly comparable estimates of traffic flow across the boundary cordon for years prior to 2002. The most consistent long-term dataset in this regard is provided by the TfL Central London cordon described above. Supporting evidence is provided by the CAPC and LATS cordons, by a number of detailed junction counts around the Inner Ring Road and a number of site-specific counts taken in connection with the design of the congestion charging scheme.

Traffic approaching the charging zone

Long-term trend data describing the volume and composition of traffic approaching the Inner Ring Road in the annulus around the charging zone is provided by the TfL central London Cordon, in its extended form, as described above. Corroborative evidence is provided by long-term trend data for the CAPC cordon, and from a selection of traffic counting locations on the main radial approaches to the charging zone. Changes to turning movements at the Inner Ring Road (changes to the proportion of traffic turning on to the Inner Ring Road, i.e. diverting around the charging zone) will also be of interest here.

Traffic circulating on the Inner Ring Road

For 2002, annualised estimates of traffic circulating on the Inner Ring Road are derived directly from counts taken under the congestion charging monitoring programme. Sites on the Inner Ring Road were counted on three occasions during 2002:

- during late February/March, so as to provide a 2002 dataset during the same season against which early effects of charging can be directly assessed;
- during April/May and again during September/October (the traditional Spring and Autumn neutral periods), which in combination provide the basis for an annualised (approximate) estimate for 2002;
- continuous automatic traffic counters at selected sites have been progressively brought on-stream along the road during 2002, and produce a continuous trend of total traffic volume from the date of their installation.

The counting programme following the start of charging will consist of the following components:

- a complete count of all Inner Ring Road sites immediately following the commencement of charging, designed to obtain early indications of scheme effects;
- Spring and Autumn neutral period counts, designed to be comparable to those taken during 2002, and to result in an annualised estimate of vehicle-kilometres for the post-charging situation in 2003.
- continuous trend monitoring (against 2002 data) provided by automatic traffic counters located along the Inner Ring Road;

Again, the congestion charging programme cannot produce estimates of traffic flow on the Inner Ring Road for years prior to 2002. The most effective secondary source in this regard is the large number of counts that have been taken on the Inner Ring Road since the late 1990s, often in conjunction with specific traffic schemes associated with the design of congestion charging traffic management measures. These will produce valuable site-specific change data when revisited following the start of congestion charging, but will not provide a robust historical trend of total traffic on the Inner Ring Road prior to 2002.

Orbital traffic movements outside of the Inner Ring Road

For 2002, an annualised estimate of traffic making wider orbital movements in inner London, outside the Inner Ring Road, will be provided directly from counts taken on the four radial screenlines under the congestion charging monitoring programme. These estimates will contribute to an understanding of the patterns of traffic displacement caused by congestion charging.

A partial count of the most significant sites on these screenlines was made during the 2002 Spring neutral period. A complete count of all sites on these screenlines was taken during the 2002 Autumn neutral period. Continuous automatic traffic counters at selected sites have been progressively brought on-stream along the screenlines during 2002, and produce a continuous trend of total traffic volume from the date of their installation.

Following the start of charging, the 2002 Spring neutral period counts will be repeated to obtain early indications of change with these movements. This will be followed by a full count during Autumn 2003, with the aim of obtaining an annualised estimate of change for the post-charging situation in 2003. Continuous trend monitoring will be provided by automatic traffic counting sites on these screenlines.

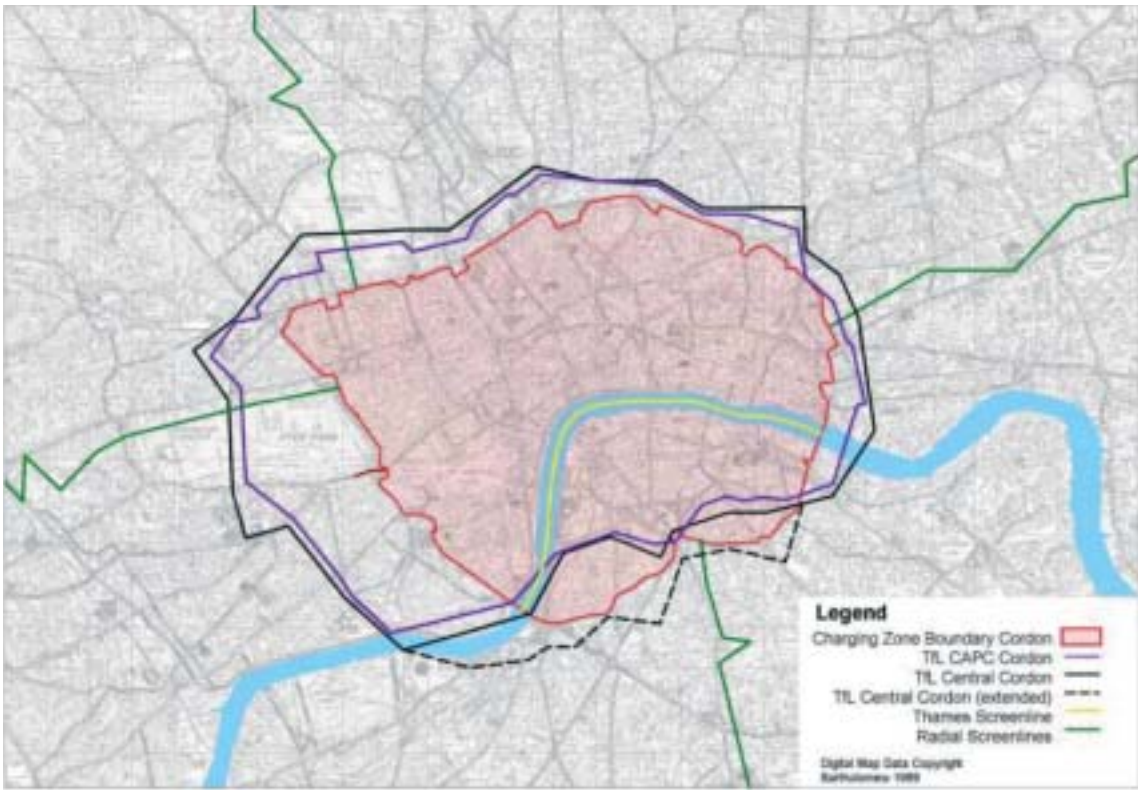
Wider traffic trends in London

Established surveys of traffic at the inner London and London Boundary cordons will continue according to their long-term programme. This reflects the forecasts of scheme impacts that suggest that traffic change at these distances resulting from the scheme will be very small, such that they would not be readily detectable. Nevertheless, the programme retains flexibility to undertake intensified counts at these cordons should there be indications of traffic change larger than that forecast, and of course the relevant historical trend data are readily available.

Count sites forming part of the DfT National Traffic Census are located throughout inner and outer London, and these will provide early indications of any significant traffic change in these areas corresponding to the introduction of congestion charging. Figure A5.1 illustrates the main line-based traffic counting programmes described above.

Appendix 5

Figure A5.1. Map of traffic survey cordons and screenlines.



Traffic on local roads

Additional counting capacity on local roads was introduced at a relatively late stage during 2002. It will not, therefore, be possible to produce annualised estimates for traffic during 2002 from this source. However, for all sites involved, a sufficient counting window exists prior to introduction of the scheme that will allow assessments of traffic change coincident with the introduction of congestion charging to be monitored. Where permanent automatic counters are in place (approximately half of the sites involved), these will remain in-place for the medium-long term, and will produce continuous traffic flow data from the date of their installation. Where temporary (i.e. tube-based) automatic traffic counters are being used (the remaining half) a 'pre-charging' period of at least 6 weeks duration will be repeated at suitable intervals after the introduction of the scheme. Manual counts can be deployed at any time to investigate specific issues not covered by the pre-defined programme.

A5.8. Statistical precision and seasonal effects

Estimates derived from traffic counts, like all sample surveys, are subject to errors. In simple terms, the error associated with an estimate is inversely proportional to the intensity of the survey. In addition, the intensity of effort required to confidently detect a change increases as the size of the expected change gets smaller. All of this means that a view has to be taken regarding the intensity of survey effort that is appropriate to address each of the key traffic changes that are expected to result from congestion charging.

In terms of longer-term trend monitoring and the key surveys described above, indicative 95 percent confidence limits applying to each of the main traffic quantities to be measured are shown in Table A.5.1

Table A5.1. Indicative 95 percent confidence limits (percentage points) for changes in all-vehicle traffic flow.

Sector and movement	Year-on-year	Quarter-on-quarter	Month-on-month
Traffic entering charging zone	0.5%	1%	2%
Traffic within charging zone	2.5%	5%	9%
Thames crossings within charging zone	4%	7%	12%
Inner Ring Road	1%	2%	4%
Traffic approaching the charging zone (uni-directional)	5%	n/a	n/a
Wider orbital movements	1%	2%	4%

In measuring and interpreting traffic change, particularly over short timescales, it is also necessary to take account of the 'background' variation in traffic levels across the year, owing primarily to seasonal factors (e.g. the general fall-off in traffic over the summer holiday period).

Ideally, we would have a comprehensive set of 'seasonality profiles', derived from intensive, continuous counts taken over several years. These would enable 'annual average' estimates to be derived from counts taken at any particular point during the year. However, for the majority of traffic indicators considered here, such comprehensive profiles are not available, as traffic in and around the charging zone has not traditionally been measured to the level of intensity required.

Appendix 5

Whilst the traffic survey effort has been stepped up considerably during 2002, the coverage of 2002 by continuous automatic traffic counters is still partial, as these only produce a continuous trend of data from the date of their installation. Therefore, a complete understanding of seasonal variation of traffic in and around the charging zone will not be available to us for 2002.

A simpler way of approaching this matter is to rely on a combination of counts taken during the Spring and Autumn 'neutral counting periods' (April/May and September/October respectively). This relies on the fact that traffic levels during these periods have been found to approximate most closely to annual average flows. Combining counts taken during these periods (avoiding any incidental school or public holidays) should give a reasonable approximation to true annual average flows and it will also be sensible to compare the Spring and Autumn periods of 2002 directly with the corresponding periods in later years. Although the extent to which this is true cannot be tested at present, it is important to realise that - for the purposes of congestion charging monitoring - the quantities of primary interest relate to observed changes rather than the absolute values. Provided that surveys are undertaken on a comparable basis each year, then the measured change between them should be unaffected by seasonal effects, and this therefore provides a valid indicator of change. This idea also extends to counts taken outside of the Spring and Autumn neutral counting periods. For example, a set of counts taken in February 2003 will be directly comparable (in terms of measuring change and all other things being equal) to the equivalent set of counts taken during February 2002.

The general approach taken for congestion charging monitoring is to repeat counts at equivalent times of year wherever possible to control for 'seasonal' effects. Where annualised totals are quoted, these represent a combination of Spring and Autumn 'neutral period' counts, rather than a true 'annual average daily flow'.

Our understanding of seasonal variation in traffic in central London will continue to develop over the coming months as further data accumulates.

Appendix 7
Special inquiries

Special inquiries are being used to investigate the impacts of the scheme upon groups that are likely to provide particular insights into congestion charging. Generally, the work takes the form of a focus group or set of qualitative discussions with individuals with a common set of characteristics. Discussed in more detail below are findings from the following groups: parking attendants, traffic and transport wardens, frequent drivers using the future charging zone and it's boundary, bus drivers, couriers, emergency service workers, minicab and private hire car drivers, disabled people, delivery drivers and key workers.

A7.1. Parking attendants, traffic and transport wardens

Research was undertaken with local authority parking attendants, whose current role is to enforce parking restrictions on borough roads, (including residents' parking and parking in bus lanes) and Metropolitan Police/TfL traffic wardens.

Traffic wardens were in the process of being reorganised to divide responsibilities for traffic (including parking enforcement on the TLRN and assisting the police with emergencies and events) and transport (enforcing parking restrictions in bus lanes and contributing to enhanced on-bus security).

Members of these groups perceived that they had an important role in enhancing the scheme by ensuring that parking enforcement and traffic management are adequate. Wardens who were joining the new Transport Operational Control Unit would be responsible for enforcing parking restrictions in bus lanes and recognised that this was an essential contribution to the complementary measures for congestion charging. However, parking attendants fear that the abuse they already experience may be exacerbated and make their job more stressful. There was some cynicism about congestion charging; for example:

'Five years down the line it will be back to today's congestion.'

All participants shared the concern that 'unregistered' vehicles would evade the congestion charge:

'What about unregistered cars? If you buy an old banger for £300 it will get you around and if you run it for 6 months, you are in pocket even if it does get towed away.'

There was speculation about the consequences of the scheme upon commuting activities of these staff, particularly for those working at depots outside the zone where current available on-street parking will either become restricted or will be taken up by the demand from other commuters.

A7.2. Frequent drivers using the future charging zone and its boundary

Drivers who used the Earl's Court one-way system perceived congestion to be a significant problem and felt that something had to be done about it:

'The number of cars in London is growing at about 100,000 a year so the figures say. Well that can't go on. We have to stop the number of cars coming into London and I think that charging is the way to do it.'

Drivers who used Kennington Lane considered that levels of congestion on the Inner Ring Road would increase once the scheme was introduced, although they thought it unlikely that it could be worse than the current situation, which was exacerbated by major roadworks:

'When I thought about traffic hot-spots most of these are associated with major roadworks that are being done - and I presume that these will be only temporary – like Trafalgar Square, Vauxhall Cross and Kings Cross? They've got to be done and in the end will make things better.'

Drivers who used the A41 were environmentally conscious and for the most part defensive about the use of their car for commuting journeys because they either had complex trip patterns or had to carry heavy equipment. Others had tried using public transport but because they had free parking at work had not switched.

In common with participants who used the Earl's Court one way system, they concluded that public transport was too expensive and unreliable to be a viable alternative. However, half of the surveyed users of the A41 said that they would be switching to public transport once the scheme had started and would adjust journey planning and times accordingly.

'I have no other choice on my salary, I'll have to use the bus but it will take twice as long.'

A7.3. Bus drivers

Those based or living in inner London were more cynical about the scheme, perceiving it to be another form of taxation. Bus drivers and their managers, who were based in outer London, were generally positive about congestion charging. However, there were some concerns about the impact of displaced traffic on outer London bus routes and increased demand for parking in outer London that might affect staff commuting to work by car.

Managers responsible for routes that run through central London recognised that congestion charging provided a chance for the bus industry to show it can deliver a good service because some relief in congestion will allow buses to keep to time and operators to run an evenly spaced service. The use of bus lanes by taxi drivers was seen as detracting from this, as taxi behaviour was viewed as impeding buses and endangering other road users.

It was noted that the programme of complementary measures for congestion charging has facilitated investment in new buses and will lead to more quality bus corridors, increased frequencies and passenger security. One driver suggested that bus services were part of the 'carrot' side of the equation:

'When they (passengers) get on a new bus you can see their face light up – let's get this going and add better lighting to make people feel safer and perhaps videos or music to pass the time – we are the carrot – that's what you need.'

A7.4. Couriers

Managers of courier companies were aware of the future scheme and had considered how the charge could be passed on to customers without becoming too uncompetitive. It was considered unlikely that business will be transferred from vans and cars to motorcycles and pedal cycles because the former tend to be used for larger items and more prestigious customers. However, there was some suggestion that courier companies may consider switching to alternative fuel vehicles in time.

The most important factor for couriers was to be competitive in terms of 'time' – both in terms of picking up goods and delivering them. Route controllers and schedulers have 'rule of thumb' journey times for different types of journey, which vary depending upon the time of day and the route taken and they factor in delays from congestion. Any measure that will make journey times shorter and more predictable will assist the courier sector, which was, in turn, viewed as:

'Oiling the wheels of commerce and making London tick.'

Drivers and riders have tried and tested strategies for avoiding congested main roads in central London, although 'rat runs' are becoming increasingly used:

'I've got my routes but then everyone else knows them as well.'

One motorcyclist observed that if congestion charging worked it might detract from the essential character of London:

'Don't ruin London - people come here because the traffic, the noise and the crowds are part of the buzz.'

A7.5. Emergency service workers

Staff from the three emergency services (Metropolitan Police, London Fire Brigade and London Ambulance Service) shared the view that currently congestion in London was getting worse and impedes the emergency services in meeting Home Office targets to get to emergencies. This was stressful for staff and inevitably leads to the concern that there might be an avoidable fatality:

'Someone might die because I can't get to them.'

For the Fire Brigade and Metropolitan Police there are significant problems at night because illegal parking, particularly in the West End, exacerbates congestion. They felt that the scheme would do little to help this:

'The traffic is worse at night when parking is allowed and Piccadilly can be 'nose to tail.'

Although congestion charging was welcomed in some respects, there were fears that it may lead to increased traffic on the Inner Ring Road and in areas immediately outside, that will impede the emergency services in getting to emergencies. There were views that the scheme should be more extensive and that public transport should be improved before the scheme is implemented:

'It should be extended over a wider area and should be 24 hours not just eleven and a half, and seven days a week.'

'If the Mayor really wanted to ease London's appalling congestion he should provide more bus and cycle lanes and ban cars in London altogether.'

'Sort the transport out, then deal with the cars.'

They felt that the change in the make-up of road users (e.g. more motorcycles) and the increasing speed of traffic might lead to a greater call upon the emergency services. Increasing numbers of pedestrians could lead to more 'crime on the streets'.

It was considered that congestion charging would have a very negative impact upon those on low salaries who have to commute to work by car, either because they live some considerable distance from London and/or work anti-social shift hours when public transport services are unreliable or non-existent. It was considered that this could lead to an increase in applications for transfers out of central locations.

A7.6. Minicab and private hire car drivers

Drivers operating within the future charging zone were more positive about the scheme than those working outside its boundary. All referred to time constraints and the need to get customers to their destination on time. Traffic congestion can impede this process and, in turn, cut income:

'I think it is a good idea, I've lost money through traffic; last week, I had a pick-up off Russell Square, and there was grid lock. I ended up dropping the fare off at Paddington, for £8 instead of £25 to the airport.'

One firm had already made plans for purchasing people carriers to take advantage of the anticipated increase in custom for 'ferrying people in and out of the zone' as part of their journeys to and from work. Others were considering switching to alternative fuel vehicles.

There was some scepticism about the scheme as it would have little impact on people who worked in the City, who had free parking places or whose employers would pay the charge:

'Most of them can afford to pay £5 – they already have to pay for parking which is far more than that – if you pay £27 a day for parking what's £5?'

A7.7. Disabled people

Disabled people had a fairly positive attitude towards congestion charging and many hoped that it would deter private car journeys. Respondents felt that the scheme would not work as well as greater pedestrianisation and bans on private cars, because the charge was too low and people would continue to use their cars. They were particularly concerned about the impact on low paid essential workers like carers and nurses who would suffer financial hardship.

Some anticipated that, if the scheme worked, there would be a greater demand for public transport and taxis and that this would have a negative impact on disabled people, some of whom are dependent on these transport modes. They felt that this is exacerbated because disabled people consider that they are not a priority and their needs are often not met.

For the most part the Blue or Orange Badge exemption from the charge was welcomed. Although one person pointed out that 'special treatment' could make non-disabled people antagonistic towards disabled people.

There was one major area of confusion about whether those exempt from vehicle excise duty would have to register for exemption from congestion charging. Even though they did not have to register for exemption from the congestion charge they had been sent packs and reminders about registration which had caused confusion.

The findings indicate that none of the respondents were planning to change mode or change their travel patterns as a consequence of congestion charging. One participant observed that:

'Most of my friends are disabled and have badges and are therefore exempt or are using public transport anyway.'

Several non-drivers without Blue or Orange Badges considered applying for these to allow friends and carers, who gave them lifts, to claim exemption from the charge.

A7.8. Delivery drivers

Delivery drivers who made unpredictable, ad hoc deliveries were very concerned about congestion, and elements of driver behaviour were perceived to be the greatest contributory factor:

'It's people who don't know London who cause congestion – they hold everything up because they don't know the 'code' (informal code of driving behaviour), they hesitate, they're looking for non-existent road signs and parking places.'

Drivers making regular deliveries were more concerned about the 'lorry ban' and considered that, in certain areas near the Inner Ring Road, it had the potential to conflict with congestion charging:

'The lorry ban conflicts with the congestion charges. Not only does this add to the pollution and traffic volumes and delays, but the public will also crowd this long roundabout route in order to beat the cameras etc. It is now time to remove the lorry ban for legitimate London business.'

Both groups of drivers welcomed any alleviation of congestion in London, as this would have a positive impact on driver behaviour, which would in turn make travelling more predictable and their work easier.

There was virtually a consensus amongst smaller businesses that the charge would be passed onto customers, although this was perceived to be inflationary in the long run because other firms would also pass on the charge. The larger businesses were prepared to absorb the cost in order to remain competitive and recognised that it would detract from profitability.

The delivery drivers and line managers considered that they were providing an essential service and felt that it was unfair that they were to be treated on the same basis as private car commuters and not be exempt like taxi and licensed minicab drivers.

A7.9. Key workers – travel diary survey

A panel of 36 people was established before congestion charging began, comprising a mix of teachers, health sector workers, cleaners and home carers who worked within the congestion charging zone. Respondents were invited to complete questionnaires and seven-day travel diaries about commuting and work-related journeys for four periods (one before and three at monthly intervals after the start of the scheme). The sample comprises a mix of mode users including car drivers (in the majority), public transport users and cyclists.

In the pre-congestion charge survey, the majority of car drivers reported that the scheme would have a negative impact upon them financially and that they could not switch to public transport because of the nature of their jobs, the time penalties involved or concerns about safety travelling during anti-social hours:

'It will mean less money when working nights as I will have to pay the charge. I anticipate traffic being worse than before at 07:00. when I am travelling to work, as many will leave home earlier to miss the charge. If this happens I will be forced to get another job, as I am not prepared to use public transport given the hours I work and after being mugged twice from the station to work.'

Several respondents contemplated switching mode but recognised that this would impact on journey times and family life:

'Before the congestion charges I will drive to work and leave home at 06:20. But now I will have to leave home at 05:30. From where I live to the nearest station I have to use two buses, which means not being able to spend time with the children.'

However, those who used other modes considered that it would either have no effect or were optimistic about the impact on London as a whole:

'If it means fewer cars, more efficient public transport, more (wider) road space for cycling, then central London will be a much healthier place to work, visit and travel through.'

Diary data from the first phase indicate that teachers and some health sector workers who lived in outer London had free parking at or near work and tended to use their cars to travel to work, even if they had no work-related journeys in the day. However, some varied their mode from day to day and used public transport on occasion. Where this occurred journeys took longer and people had to leave home earlier.

Carers living nearer to central London who were on lower wages, walked, cycled or used public transport to get to work or travel between clients in the zone. Some called on as many as seven clients in a day. Cleaners tended to work at anti-social hours very early in the morning or later in the evening and used their cars or were given a lift in a company vehicle in order to visit dispersed client premises in the zone.

Appendix 8
Traffic management impacts

A8.1. Introduction

Traffic management measures are required as part of the central London congestion charging scheme in order to:

- give effect to the Scheme Order, the legal document that defines how the scheme operates, through traffic signs and road markings that indicate the boundary of the charging zone and provide information to drivers;
- handle the new patterns of traffic that may be expected as a consequence of the scheme; in particular to ensure that drivers seeking to avoid the charging zone can choose appropriate alternative routes and that new patterns of traffic, especially on the Inner Ring Road, can be effectively accommodated.

A8.2. Traffic signing

A comprehensive traffic signing strategy was developed to provide a full awareness of the congestion charging boundary to drivers approaching central London and to complement the public information campaign that provided details of the scheme's operation through media advertising (see Appendix 9).

The signing strategy had to strike a balance between avoiding unnecessary street clutter and the need to ensure a clear signing message. Transport for London consulted the London boroughs and English Heritage on the operational and aesthetic aspects of the signing strategy. Early discussions took place with the Department for Transport with a view to obtaining authorisation for new traffic signs and road markings.

The strategy involved three different types of advance information signs for drivers approaching central London on the main radial routes as well as and signs and road markings to indicate the boundary of the charging zone. The various traffic signing 'levels' can be summarised as follows:

- **Boundary point signing.** Every entry point is to have at least one charging zone entry sign and most are to have two. This is the regulatory element of the signing strategy and is essential to legally enforce the scheme. Following installation, these signs were only exposed just prior to the first day of charging.
- **Other boundary signing.** In addition, there have to be combined charging zone/enforcement camera signs, required for data protection purposes. All exit points to have a 'zone ends' sign and the main exits also to have reminder signs 'Have You Paid?'.
- **Road markings.** A 'C' symbol formed by the road surface on a white background to be provided on traffic lanes approaching the zone and a white 'C' symbol on red background to be provided at each entry point to the zone.
- **Direction/advance direction signs.** Primary route direction signs at the boundary junctions have been modified to incorporate the charging zone 'C' symbol against destinations within the zone.

- **'R' repeater signs.** Inner Ring Road 'R' repeater plates and additional 'Ring Road' signs to be placed at key points around the boundary route to reassure drivers who want to remain on that route to avoid entering the charging zone.
- **Charging zone and camera repeater signs.** Small 'repeater' signs to be placed inside the zone to act as a reminder.
- **Advance information signs.** Signs to be placed along the main radial routes giving the operational hours of charging and introducing the 'C' symbol. On the routes under the direct control of TfL signs are to be placed up to 20 kilometres from the zone. On borough roads the signs are to be largely within the North and South Circular Roads. At around 1 kilometre from the boundary a slightly different version of this sign is to be used, showing the amount of the charge.

In total over 900 traffic signs and nearly 300 road markings were installed. Details are given in Table A8.1.

Where signs were placed on borough roads TfL entered into legal agreements with all 22 affected boroughs. Maintenance and replacement arrangements were put in place.

A sample review of the congestion charging traffic signing installed within the Westminster area is planned to be included in a wider streetscape case study due to be commissioned by TfL.

It is expected that a full review of the congestion charging signing strategy would be undertaken by TfL after about 1 year. If it is judged that certain signs no longer make a useful contribution to the signing strategy they would be removed.

Table A8.1 Traffic signs and road markings.

Sign/road marking type	Total
Zone entry	215
Zone exit	137
Other boundary signs (except 'Have you paid?')	105
'Have you paid?' signs	28
Modified direction/ advance direction signs	99
Repeater signs within zone	136
Information signs approaching zone	133
Advance boundary markings (white)	136
Boundary markings (red/white)	145

Figure A8.1. Examples of congestion charging signs.

Regulatory sign at zone entry

Advance direction sign on Inner Ring Road

Advance information

Advance information

Reminder within the charging zone

End of the charging zone

Road markings at zone boundary

Road marking on traffic lane approaching charging zone

A8.3. Coping with new traffic patterns

Congestion charging is expected to result in a reduction in the volume of traffic in central London and a related reduction in the volume of traffic using the major radial roads that enter the central zone. However, there may be an increase in the number of vehicles that will be circulating in areas immediately outside the central zone. This traffic will need to be effectively managed.

A range of traffic management measures have been introduced as part of the scheme to ensure that it operates efficiently and effectively from day one. These measures include:

- provision of appropriate signs across London to inform drivers about the congestion charging scheme and to mark the boundary of the central zone where charges apply (see above);
- managing the operation of the road network immediately surrounding the central zone, particularly the Inner Ring Road;
- managing the operation of the radial approaches to the central zone boundary;
- complementary initiatives to mitigate the impact of congestion charging on the areas surrounding the boundary and local roads.

A8.4. Managing traffic on the Inner Ring Road

The Inner Ring Road provides the boundary for the charging zone and a diversion route for displaced through traffic.

The route of the Inner Ring Road, in both directions, has been subject to detailed study:

- to assess its operational capacity and where possible to introduce measures to make it more effective at accommodating traffic diverted from the charging zone;
- to accommodate the changed patterns of radial and orbital traffic on the Inner Ring Road;
- to provide particularly for the movement of business traffic and bus services around the charging zone.

Prior to the start of charging TfL had:

- developed junction designs and traffic signal control strategies around the Inner Ring Road to take account of projected traffic patterns. This included extensive upgrades of the traffic signal coordination arrangements around the Inner Ring Road to improve efficiency and provide better flexibility of traffic control;
- reviewed various proposed priority measures for buses on the Inner Ring Road to ensure that the measures were properly integrated with the objectives of the charging scheme;
- adjusted a number of on-street loading areas to meet the needs of the new traffic arrangements;

- improved conditions for pedestrians and cycles at a variety of locations;
- reviewed each of the minor boundary points, considering whether one-way traffic arrangements should be introduced, or if the boundary point should be closed.

At some locations specific measures were introduced. Three examples are:

- **Old Street roundabout.** Signalisation of the junction and an eastbound bus lane west of Old Street roundabout.
- **Bricklayer's Arms.** Signalise roundabout. Improved pedestrian and cycle access to also enable north west bound traffic to be managed entering the roundabout.
- **The Oval.**

At the Kennington Park Road junction with Harleyford Road improved pedestrian, cycle facilities and bus priority were introduced as part of the overall adjustment to this junction complex.

A8.5. Managing traffic on the radial approach roads

In devising traffic management measures to support the scheme, guidance has been taken from the policy regarding the allocation of street space set out in the Transport Strategy. The role of the hierarchy of roads in London is set out in Chapter 4G – Policy 4G.2.

In balancing the use of street space, account should be taken of the objectives of the Transport Strategy and the current London road hierarchy. On the Transport for London Road Network (TLRN) and most other 'A' Roads there is a general presumption in favour of distribution, particularly for those making business journeys, bus passengers and commercial vehicle operators. On other London roads there is a presumption in favour of access and amenity, particularly for residents, buses, pedestrians and cyclists, and where necessary, business access.

It is expected that there will be a general reduction in traffic on the radial routes approaching the Inner Ring Road. The operation of each radial route has been examined and appropriate modifications to junction designs and signal control strategies have been devised to accommodate the expected revised traffic patterns. Various junctions were brought under the centralised traffic control arrangements that apply to many of the traffic signals across London.

Examples of measures on the radial approach roads include:

- **Upper Street junction with Islington Green.** New signalised junction with improved pedestrian facilities centralised junction traffic control;
- **Scotch House Corner.** Junction re-modelling to simplify traffic movements and reduce bus turning delays from and to Sloane Street;
- **Eversholt Street junction with Oakley Square.** Introduction of all red pedestrian phase to improve safety and discourage traffic from using inappropriate residential streets.

A8.6. Real Time Traffic Management

A comprehensive Real Time Traffic Management Strategy was put in place to provide both detection and response mechanisms for traffic signal adjustments or other interventions that may be required as a result of the introduction of charging.

The information that will be available from this source falls into three broad categories:

- **information from the traffic signal control system** - that has been extensively upgraded using SCOOT (the traffic control system that provides the capability to automatically adjust traffic signal timings in response to traffic conditions);
- **information from Automatic Number Plate Recognition (ANPR) Cameras** - located on the Inner Ring Road and at selected locations on the main radial approaches to the charging zone;
- **intelligence** - the interpretation of the monitoring data in the context of traffic management interventions that could be applied.

Real Time Traffic Management is supported by:

- SCOOT traffic control system;
- bus priority and signal schemes to allow flexible traffic management;
- signal timing plans to cater for a range of traffic flow scenarios;
- Comet (real time database).

SCOOT

- The SCOOT traffic signal control system monitors traffic on each approach to a junction and uses the information to optimise the signal timings of a group of neighbouring signals. SCOOT models delay, flow and congestion based on the information gathered by the SCOOT detectors. ASTRID (Automatic SCOOT TRaffic Information Database) captures the modelled information and stores it in a database for later retrieval and analysis.

Bus priority and traffic signal schemes

A number of bus priority and traffic signal schemes were introduced giving a capability for flexible traffic management. These include 88 signal installations put under SCOOT control.

Signal timing plans - London Traffic Control Centre (LTCC)

The LTCC is a key mechanism for monitoring problems arising on the Inner Ring Road and key radial routes into the city. The LTCC monitors the output from an extensive network of CCTV cameras and traffic conditions and journey times from the COMET real time database.

The LTCC has central computer control over groups of signals and can adjust plans and strategies to deal with traffic related incidents and events. Before the start of congestion charging, contingency plans and strategies were developed for the Inner Ring Road and radial approaches for a range of traffic scenarios.

Once congestion charging is introduced the LTCC will monitor changes in traffic conditions over time, adjusting signal timing plans and applying revised signal plans to maintain an appropriate level of service for road users.

COMET:

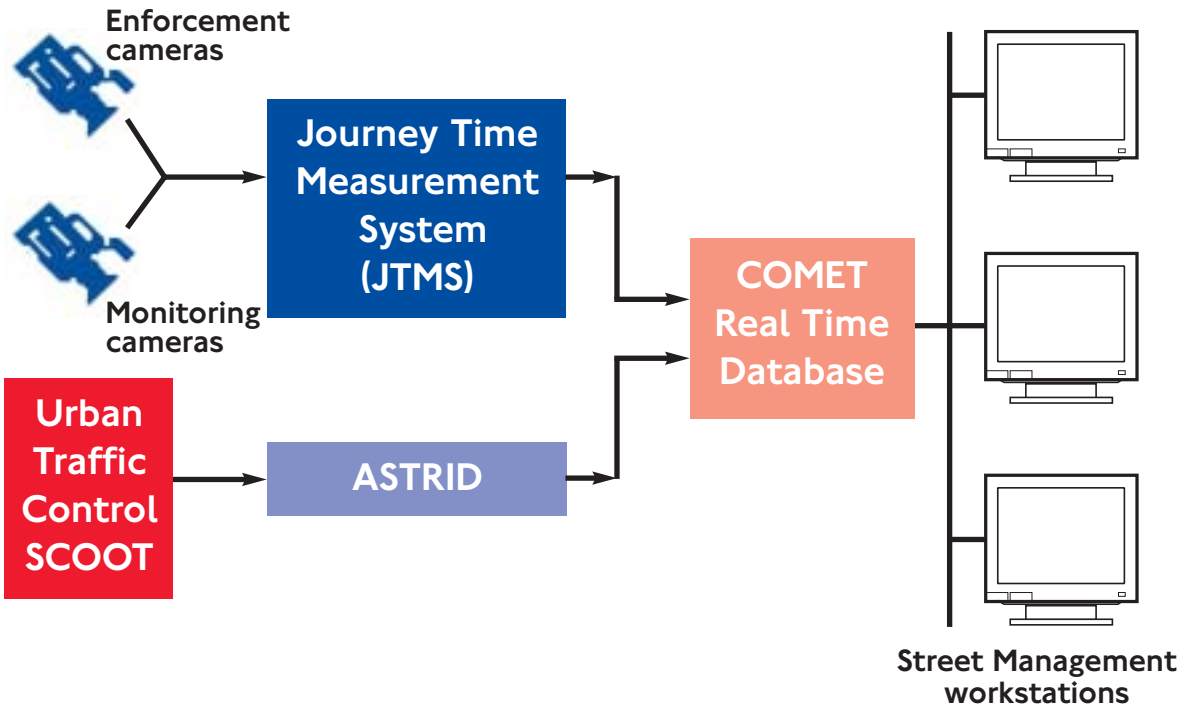
Real time database

The COMET system provides staff in the LTCC and elsewhere within TfL with a 'window' into a number of systems providing congestion and traffic flow information. COMET gives access to:

- SCOOT based congestion information from the existing UTC systems, updated on a 5 minute basis and displayed on both large and small scale maps. Colour codes are used to highlight areas of congestion;
- journey time information, based on a new Journey Time Measurement System (JTMS) that uses data from ANPR cameras now. These ANPR cameras cover the Inner Ring Road, the charging zone and key radial access routes;
- a range of equipment status information, covering traffic signals, pelicans, CCTV cameras and ANPR cameras.

From the users perspective, COMET provides a single mechanism for viewing a range of real time information. It also allows the operators to set thresholds for congestion related information and to be alerted as congestion levels or journey times change.

Figure A8.2. COMET system overview.



A8.7. Complementary initiatives

In addition to the traffic management measures that are primarily related to the implementation of the scheme itself, a number of other complementary initiatives were introduced. These will combat any adverse effects of congestion charging, particularly where traffic might divert to unsuitable local roads or where inappropriate parking may occur. These initiatives have been implemented by the London boroughs and TfL. Examples include:

Controlled Parking Zones (CPZs) - to discourage unwanted commuter parking in areas in and adjacent to the congestion charging zone or around rail or Underground stations. Many of the CPZs extend the existing coverage in and around the charging zone and introduce a consistent approach to parking management in central and inner London.

Environmental Traffic Management (ETM) schemes - to protect 'sensitive areas' from unwanted 'rat-running' traffic in and adjacent to the charging zone. Many of the ETM initiatives are 20mph zones (with associated traffic calming and traffic management measures), consistent with the policies and proposals within the Transport Strategy for improving safety in sensitive residential areas.

As part of the introduction of congestion charging, a total of approximately 217 local borough transport schemes have received some level of funding support through the complementary measures programme - either for design and consultation work and/or implementation. These include ETM schemes, CPZs and pedestrian and cycling improvements. Funding is provided in a staged approach, with implementation funding only confirmed following a review of the scheme's design, consultation results and continued relevance to the impacts of congestion charging.

A limited number of complementary transport measures (CTM) have also been introduced to help promote the use of sustainable modes of transport such as cycle, pedestrian, bus and public transport interchange improvements into and around the charging zone. These measures are complementary to the policies and proposals outlined in the Transport Strategy. To date, a total of 29 transport schemes have received funding support from TfL within this category.

Funding was also made available to TfL Street Management Services to help accelerate transport works on the TLRN so that they could be completed before the introduction of congestion charging. This included road maintenance schemes, road safety schemes, capacity-enhancement schemes and major transport schemes on the Inner Ring Road (e.g. Shoreditch Triangle, Vauxhall Cross).

Appendix 9
The public information campaign

A9.1 Challenges

The public information campaign has been a key feature of the implementation of congestion charging. A number of challenges existed in introducing a mandatory scheme which bore little relationship to any existing schemes. The two main challenges were achieving maximum public understanding of the key scheme details, and maximum compliance from day one of charging.

There have been many publicity campaigns that address controversial issues, and combine the need of imparting information and encouraging compliance (e.g. wearing of rear seat belts and TV Licensing). However, there were no direct parallels to guide the development of the communications strategy. Insights were drawn from similar projects e.g. The Millennium Bug and TV Licensing (compliance topics), income tax self assessment (an immovable deadline with penalties attached) and other TfL campaigns i.e. prompting decisions about modal shift and possible changes of route. But none of these have all, or even most, of the hallmarks of the task to launch congestion charging.

One of the most useful precedents was privatisation. The public would need to go through a steep learning curve, and there would be no second chance. Privatisation campaigns (particularly British Gas) were used as a model for unfurling complex messages gradually; using a carefully timed multi media approach; and regular tracking to monitor and adjust the campaign on an on-going basis.

Achieving public understanding of the scheme before its launch required careful explanation and frequent repetition. There are over 15 basic aspects of the scheme that needed to be featured in the information campaign and clearly understood by the public.

Every effort was needed to ensure compliance from all drivers from day one. Failure to understand how the scheme operated could result in drivers jamming the call centre on day one with general enquires or to register for a discount or exemption, and thereby creating a 'bow wave'. A key planning criteria was to avoid this bow wave. In addition there was a need to ensure that drivers did not inadvertently incur penalty charge notices in the first days of operation. Widespread non-compliance would have discredited the scheme and could have damaged public confidence in its operation.

A9.2 Scope

Londoners were the main target audience, but they were not an exclusive target group. Affected drivers came from within Greater London, the Home Counties and the wider UK and even as far afield as Europe. Whilst TfL therefore had to broaden its targeting it concentrated on the main audience, Londoners. Numerous sub-groups e.g. Blue or Orange Badge holders, zone residents and fleets, required specific communication on exemptions and discounts and would need to be prompted to register.

A9.3 Structure

In order to achieve the aims of the public information campaign a large-scale multimedia campaign was planned using advertising, direct marketing, field marketing, public relations and a telephone/internet based enquiry service. The campaign needed to ensure that those not affected would consciously 'opt out' of receiving any messages and those who would be affected consciously 'put their hands up' and engaged with the messages.

Advertising was the primary medium as its strengths allowed TfL to penetrate the consciousness, create involvement with compliance topics, very quickly reach the majority of the population and galvanise widespread action.

Direct marketing was used to reinforce the advertising messages and deliver greater detail, and to target discrete sub-groups. Public relations was used to ensure the media coverage was accurate and informed, added depth to the understanding of the scheme, and provided highly targeted local advice through local media, or to specific sub-groups e.g. Blue and Orange Badge holders or key stakeholders in addition to extending the depth of national coverage.

A9.4. What we did

Figure A9.1. The shape of the public information campaign.

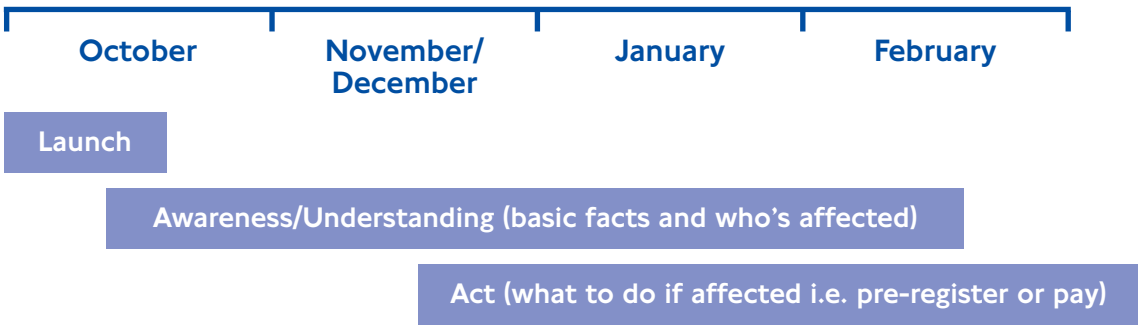
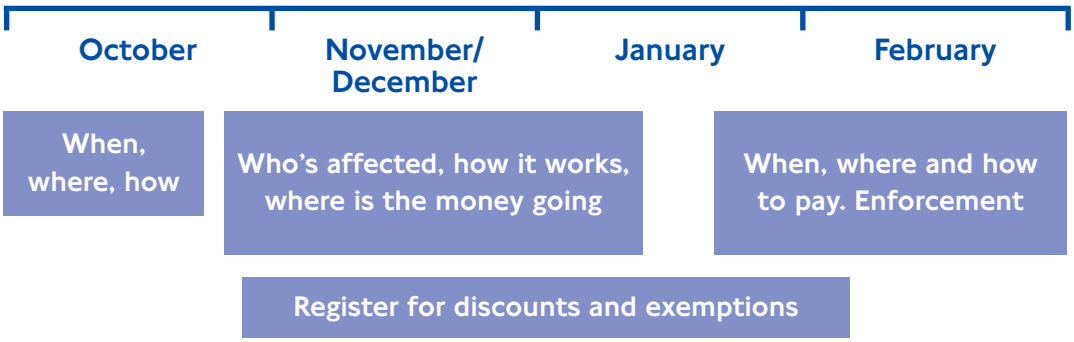


Figure A9.2. The message phasing over time.



A9.5. Key issues affecting delivery of the campaign

The timetable for the project, and some of the key milestones within it, created severe limitations on how the public information campaign could be developed and when it could start. In outline, these were as follows:

Confirmation of the Scheme Order	21 Feb 2002
Judicial review hearing	15 Jul 2002
Decision on hearing	31 Jul 2002
Launch of enquiry services	12 Aug 2002
Final readiness report to The Mayor	2 Sep 2002
Provisional start date confirmed	14 Sep 2002
Mayor confirms Variation Order	27 Sep 2002
Confirmation of start date	7 Oct 2002
Launch of registration services	14 Oct 2002
Confirmation of extended waiver	20 Dec 2002
End of waiver for early registrations	24 Dec 2002
Launch of retail solution	13 Jan 2003
Launch of SMS registrations	13 Jan 2003
End of registrations extended waiver	26 Jan 2003

In addition, it was important that the necessary infrastructure was in-place to receive enquiries from the public that would be prompted at various stages of the campaign. The key event here was the launch of 'pre-go-live services' in mid-October 2002. This meant that the information campaign had 2 months prior to the Christmas break and only 6 weeks in the new year leading up to the implementation of the scheme on 17 February.

A9.6. Outcomes

The public information campaign used both quantitative and qualitative feedback to continually fine-tune the strategy. A survey of public awareness undertaken just prior to implementation revealed the following:

- Awareness of the scheme was at 'saturation level' at around 97 percent of Londoners. This was consistent across most groups, including key targets such as drivers in the zone and residents.
- Over 75 percent of Londoners knew they were not directly affected by the scheme (non-drivers, and those exempted and discounted) and this meant they would be unlikely to jam the call centre on the day of implementation.
- Knowledge of key facts about the scheme was exceptional. Most key measures (e.g. cost, implementation date) were running well above the 80 percent mark.
- Drivers had self-identified, i.e. they knew who they were and whether or not they were likely to be eligible for discount or exemption (85 percent).
- Awareness of the penalty charge was high at 80 percent, probably helped by the profusion of lead stories in the press.

- Two thirds of Londoners did not think it would be easy to 'dodge the system'. A good result given the level of negative press coverage on this issue prior to implementation.
- Eighty three percent of Londoners knew that the funds raised would go towards improving transport in London.

There were a few exceptions to the overall positive results obtained.

- There was confusion over hours of operation of the scheme. Only 19 percent of drivers could correctly state both the start and the end of the charging period in the zone.
- There was also marginal confusion over where the zone boundary was, but this was a function of experiencing the zone on driving in, and the physical signage has helped clarify the boundary with drivers.

Perceived advertising effectiveness

Londoners perceived the advertising campaign to have been successful in communicating with them about how to prepare for day one.

"You'd have to be living on the moon not to have seen any of the advertising"

"The advertising has worked, they haven't just hit us with it, it's been out there for a while now".

However, as substantiated with the quantitative feedback, it has not been straightforward conveying where the boundary to the zone lies. But as stated earlier, this seems to be self-correcting as people experience driving into the zone for themselves.

"They've done really well, but the charge area itself has not been publicised enough".

Mitigation of the bow wave

When asked how they felt about the first days of the scheme, most of the drivers interviewed stated that it had been a very easy process, in terms of payment and in terms of generally getting used to a new routine.

"It's been a breeze".

Managing expectations and attitude

Managing the expectation of Londoners in the face of rampant media activity with a heavy negative bias (e.g. it was going to be chaos, and a 'bloody day' to quote the Mayor of London) was one of the toughest remits for the public information campaign. However, according to those drivers interviewed in the second week of the scheme, things had gone very much according to what they had been led to expect by the advertising:

"Pretty much as I expected, with less traffic around".

Appendix 6
Boundary case study area

A6.1. Introduction

The boundary case study area consists of an area adjacent to the Inner Ring Road to the north-east of the charging zone. The area covers parts of the boroughs of Islington and Hackney, as shown in the following maps. Broadly, the area is bounded:

- in the west, by The Angel and Upper Street, Islington;
- in the north, by St Pauls Road and Balls Pond Road;
- in the east, by Kingsland Road and the Shoreditch Triangle;
- in the south by the Inner Ring Road (City Road).

This definition is not absolute. For example, surveys considering the effects of the scheme on businesses and other organisations located around the charging zone boundary will cover areas on both sides of the Inner Ring Road. The monitoring of public transport changes will need to take account of Underground and rail stations and bus routes surrounding the study area. Further monitoring work will take place at other locations around the boundary of the charging zone, as appropriate for each specific monitoring theme. Work within this area will take place under three headings. These are:

- road traffic impacts;
- public transport impacts;
- social, economic and environmental impacts.

The scope of each of these activities is described below.

A6.2. Road traffic impacts

The boundary case study area includes a number of local traffic schemes planned by the relevant London borough as measures to complement congestion charging. In addition to data gathered through the main traffic survey programmes, the site provides the opportunity to examine the local impacts of these schemes in some detail.

Proposed schemes that fall within this area are shown on Figure A6.1, and described in Table A6.1. Although some of these schemes are still in the planning process, the intention is to include within the formal approval for each scheme sufficient funding to enable comprehensive before and after monitoring of local traffic effects, in the context of wider changes brought about by congestion charging. This should allow a more detailed understanding of the interaction between strategic-level traffic change brought about by congestion charging, and that caused by local initiatives.

Figure A6.1. Local traffic schemes in the boundary case study area.

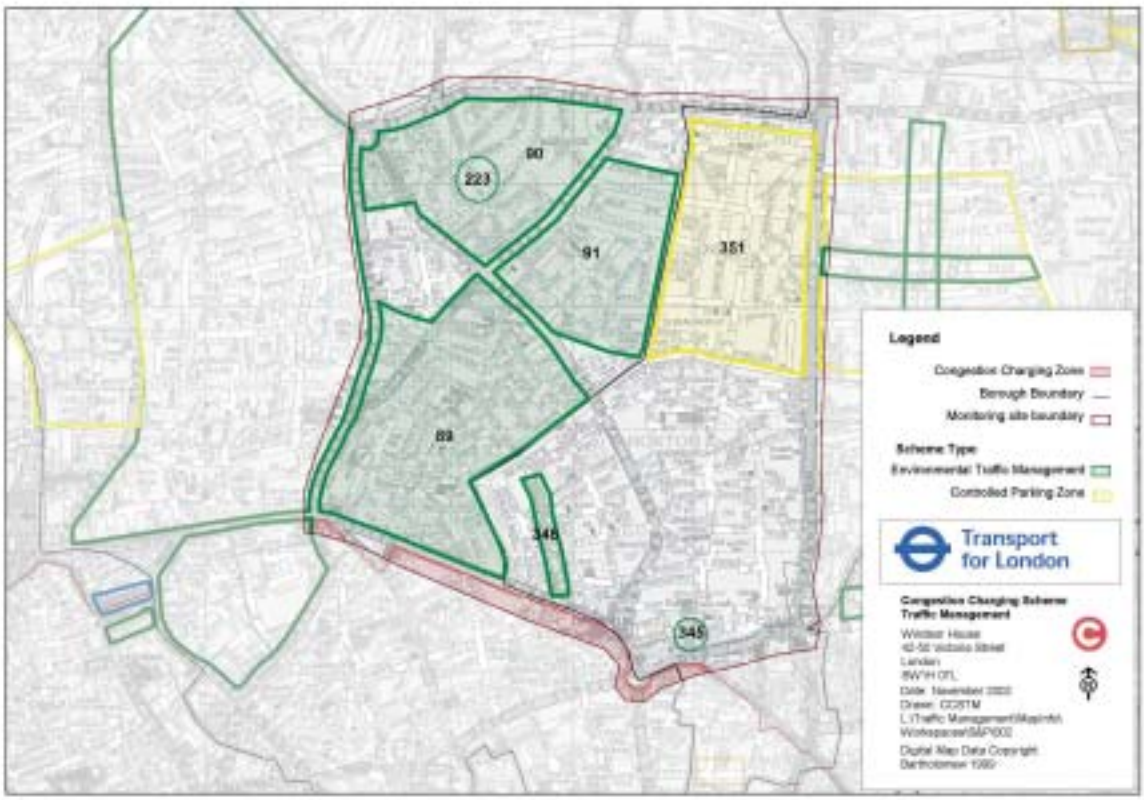


Table A6.1. Local traffic schemes in boundary case study area.

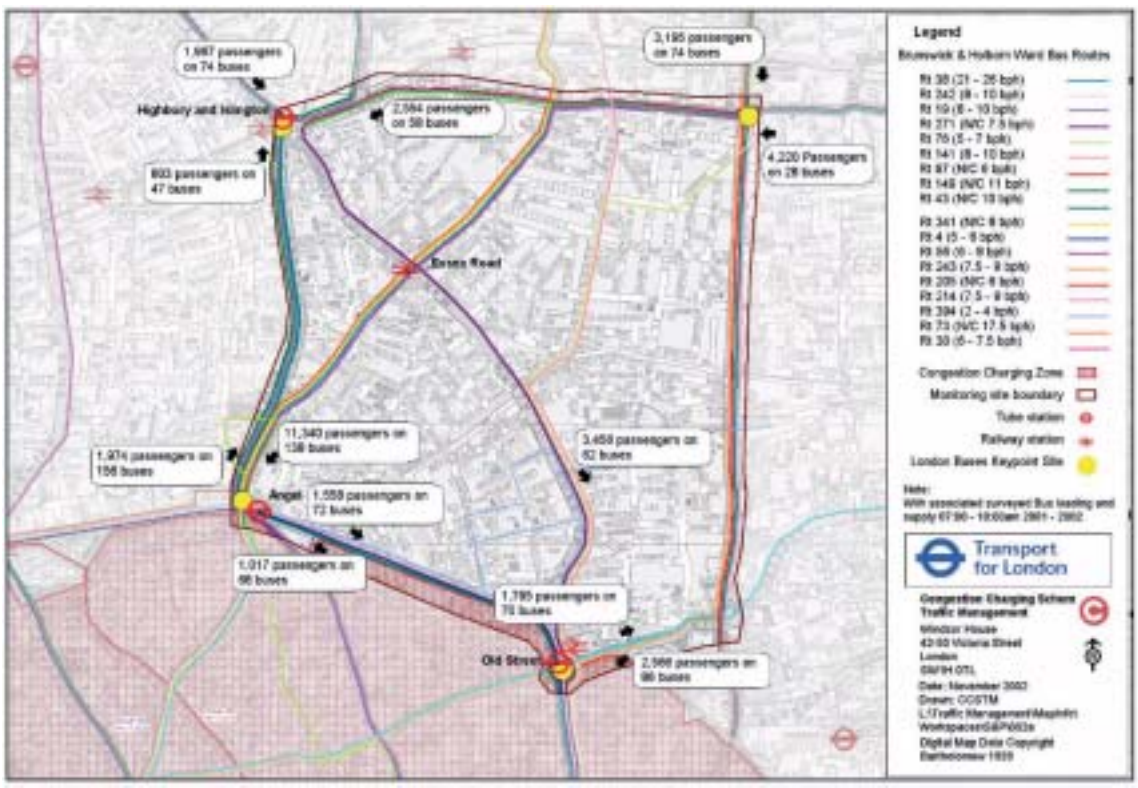
Ref	Borough	Scheme	Description	Current status
89	Islington	St. Peters area traffic reduction scheme	20mph zone with traffic calming measures.	Preliminary design and consultation completed. Scheme planned for completion May 2003.
90	Islington	Canonbury West traffic reduction scheme	20mph zone with traffic calming measures.	Preliminary design and consultation completed. Scheme planned for completion May 2003.
91	Islington	Canonbury East traffic reduction scheme	20mph zone with traffic calming measures.	Preliminary design and consultation completed. Scheme planned for completion May 2003.
223	Islington	Willow Bridge permanent closure	Permanent closure of Willow Bridge to through traffic except pedestrians and cyclists.	Funding approved for all stages of scheme. Completion expected December 2002.
351	Hackney	De Beauvoir controlled parking zone	A controlled parking zone in the De Beauvoir area.	Funding has been approved for design and consultation. Subject to positive consultation and further funding approval, the controlled parking zone is due to be in place by April 2003.

Ref	Borough	Scheme	Description	Current Status
345	Hackney	St Charles Square environmental traffic management scheme	Traffic management scheme in the St Charles Square area to reduce potential "rat-running".	Funding approved for preliminary design and consultation. Subject to positive consultation and further funding approval, the scheme is due to be in place by February 2003.
348	Hackney	Shepherdess Walk environmental traffic management scheme	Traffic management scheme along Sheperdess Walk to reduce potential "rat-running".	Funding approved for preliminary design and consultation. Subject to positive consultation and further funding approval, the scheme is due to be in place by March 2003.

A6.3. Public transport impacts

The boundary case study area has good public transport accessibility. There are three Underground stations, five National Rail stations and 18 bus routes serving the area shown on Figure A6.2. The bus network in the area has been reviewed by London Buses in respect of congestion charging. As a results enhancements have been introduced to carry additional passengers. As part of the wider public transport monitoring programme, changes to these public transport facilities can be specifically monitored.

Figure A6.2. Public transport facilities in the boundary case study area.



Appendix 6

To illustrate some of the data that will be available, Figure A6.2 is annotated with bus frequencies at Autumn 2002 and the loadings data taken from the London Buses 'Keypoints' surveys conducted during 2001 and 2002. Figures A6.3 and A6.4 show recent trends in peak-period passenger entries and exits at the three Underground stations within the area.

Figure A6.3. Average Underground passenger entries at stations within the boundary case study area during weekdays between 07:00 and 10:00, January 2002 to February 2003.

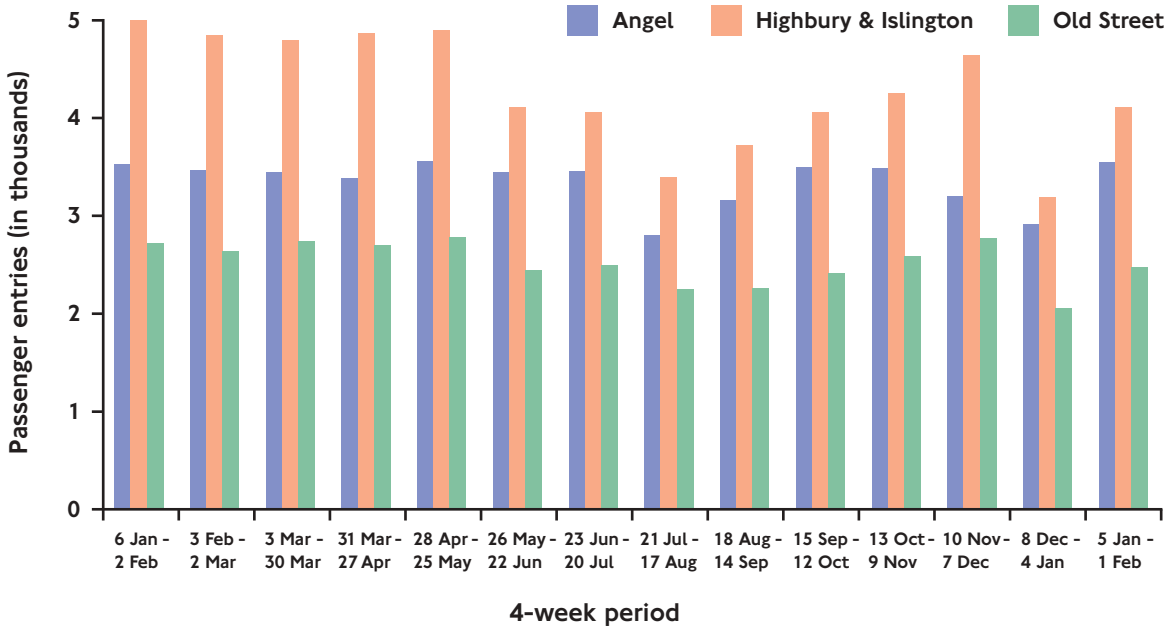
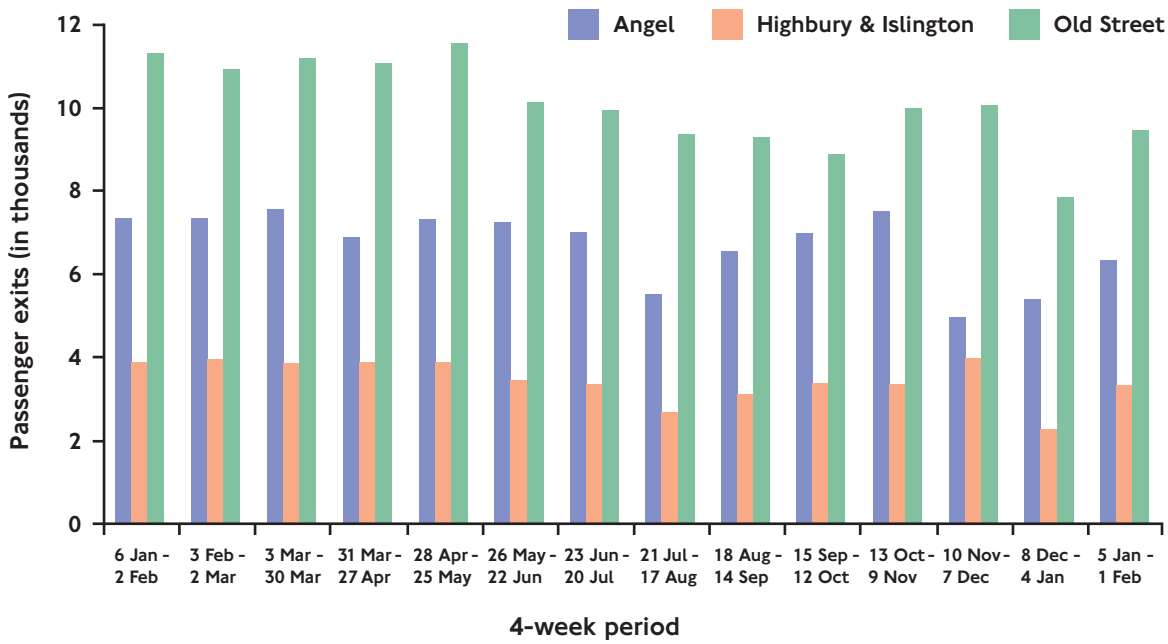


Figure A6.4. Average Underground passenger exits at stations within the boundary case study area during weekdays between 07:00 and 10:00, January 2002 to February 2003.



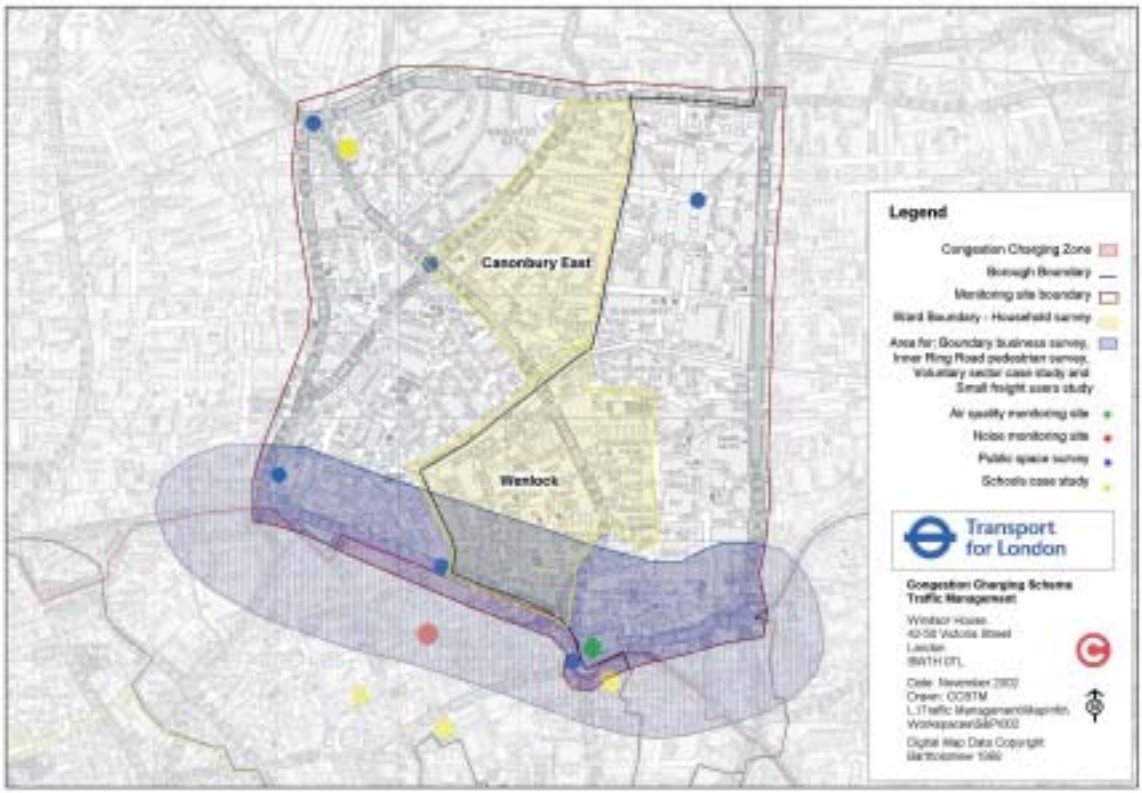
A6.4. Social, economic and environmental impacts

The boundary case study area provides a useful focus for a variety of social, economic and environmental monitoring initiatives. Surveys that are being undertaken in this area are described below, and shown graphically on Figure A6.5. The boundary case study area will continue to be a focus for additional specific monitoring exercises and research over the next few years.

- Social Impacts - General Household Survey. The electoral wards of Wenlock[1] and Canonbury East[1] were chosen as part of a wider stratified sample of wards inside the charging zone and inner London. Over 300 household interviews have been carried out in these wards, each involving all adult members of each household, and as part of a larger sample of around 2,300 households across the charging zone and inner London. These households will be revisited after the scheme has started.
- The boundary case study area has been chosen for an intensive study of small and medium-sized businesses located in the vicinity of the charging zone boundary, straddling the Inner Ring Road. Fifty businesses in this area have been surveyed before congestion charging, and will be re-visited at intervals after the scheme is in operation. The aim of this survey is to gauge the impacts of the scheme on these businesses, with particular reference to boundary-related effects.
- The case study area will be the focus for work on the effects of congestion charging on schools. Four schools within the case study area are involved.
- A count-based survey of pedestrians will be undertaken along and across the Inner Ring Road in this area, intended to detect and quantify possible boundary effects on pedestrian volumes crossing the Inner Ring Road.
- On-street public space surveys will be deployed at key locations across the boundary case study area.
- An existing air quality monitoring site, close to Old Street roundabout and operated by the London Borough of Hackney, will be brought into the London Air Quality Network (LAQN), providing high-quality data directly to the monitoring programme from this site. A similar site exists in Upper Street, Islington.

- An existing ambient noise monitoring site just inside the charging zone will be monitored and supplemented by further sites before charging starts.
- Other research relating to social or economic issues, such as parking behaviour and issues relating to carers and key workers.

Figure A6.5. Social, economic and environmental surveys in the boundary case study area.



Technical notes

1 The ward boundaries in Islington and Hackney changed from May 2002. From this date, the former Wenlock and Canonbury East wards were amalgamated with surrounding wards to form the new Hoxton and Canonbury wards respectively. Owing to the requirement to draw a sample of wards for the wider social impacts studies (described in Chapter 8) using a range of socio-economic data, and the unavailability of these data for the new wards, the sampling arrangements for this survey were based on the old ward boundaries. This arrangement will continue for the life of these surveys.

6. Travel behaviour and secondary transport effects

6.1. Introduction

In addition to congestion, traffic volumes and public transport, congestion charging will to some degree affect many other aspects of transport in London. This chapter sets out a variety of data and indicators that will be used to determine the impact of congestion charging on aspects of wider travel behaviour in London. It provides a link between the foregoing chapters dealing directly with key volumetric indicators, and the following chapters dealing with the impacts and implications of these changes on people, businesses and the environment. The following material is considered:

- overall travel behaviour with respect to trips to and from central London;
- available indicators for specific road-based modes of travel, giving more detail for these modes than is possible in Chapter 4;
- indicators describing conditions before congestion charging starts for road traffic accidents;
- indicators of pedestrian activity in and around the charging zone.

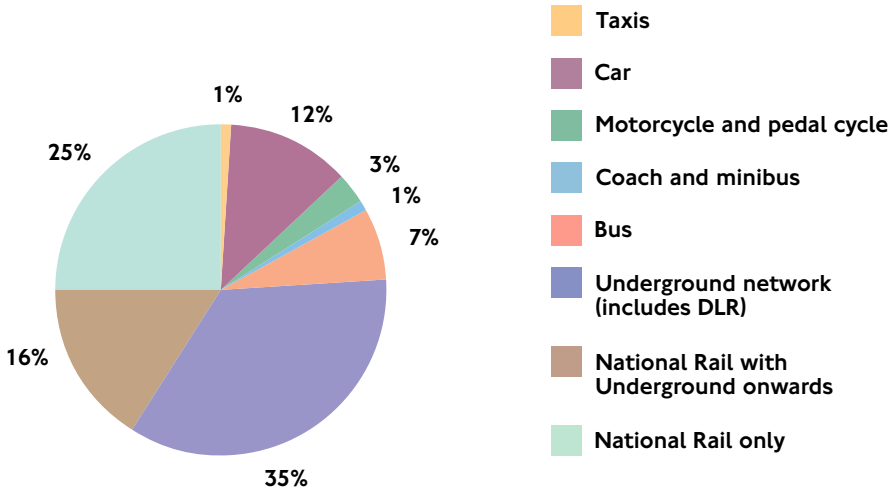
For each of the above, an overview of monitoring arrangements is given, concentrating on the detection and quantification of more strategic effects. The expression of these changes at the level of the individual or organisation (as well as the reasons for these and the consequent effects of them) are considered further in Chapters 7 and 8.

6.2. Travel to and from central London

The method of travel (excluding walking) used by people entering central London during the morning peak period has been recorded on a consistent basis since the mid 1950s through the Central Area Peak Count (CAPC) survey. The definition of central London used for CAPC is not identical to the charging zone (see Appendix 5), but this source is the best available indicator of long-term trends in peak-period personal travel to central London. Full data are available for the 2001 CAPC survey, upon which the material below is based. Partial and provisional data for 2002 is also shown where available.

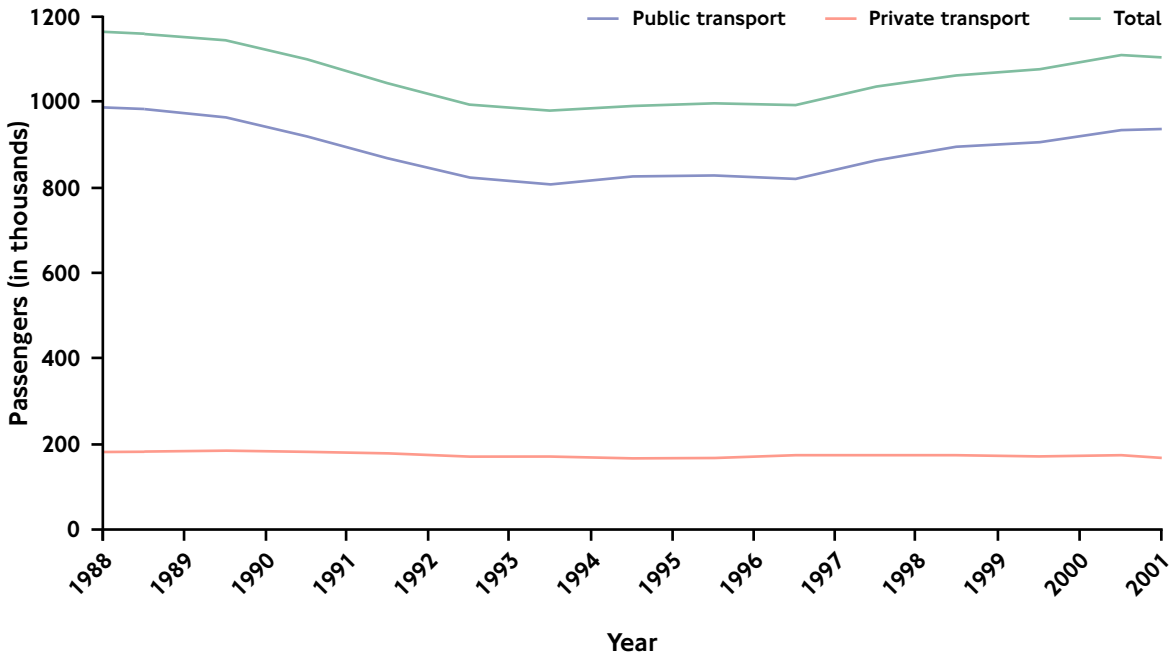
The 2001 CAPC survey recorded a total of almost 1.1 million people entering central London between 07:00 and 10:00 on a typical weekday. The overall modal share for 2001 is shown in Figure 6.1.

Figure 6.1. Mode shares for people entering central London, typical weekday, 07:00 to 10:00, 2001.



The longer-term trend of passenger volumes and mode shares is shown in Figure 6.2. In terms of total number of trips, the decline during the late 1980s and early 1990s has been only partly reversed during the last decade, the total number of trips for 2001 being 5 percent below that recorded in 1988. In comparison with 2000, figures for 2001 show a 1 percent decline in total volumes.

Figure 6.2. Passenger traffic entering central London, 07:00 to 10:00, 1988 to 2001.



Between 2000 and 2001, the use of private transport fell sharply by 9 percent. Car users dropped by 11 percent, motorcycle and taxi numbers also fell, while bicycle trips increased by 4 percent compared with 2000. Public transport saw a marginal increase of 0.1 percent, with a 10 percent increase in bus use being offset by decreasing numbers of (net)[1] Underground and coach passengers. Use of National Rail rose slightly, but the increase in (gross)[1] Underground passengers was more than accounted for by more people transferring from National Rail to Underground. Overall in 2001, public transport (excluding taxi) accounted for 85 percent of trips.

Provisional data for 2002 show a continuation of these trends, with a further 14 percent drop in car travel. Also noteworthy is a further sharp rise in the number of people using buses, up 21 percent between 2000 and 2002.

Table 6.1. Mode share comparison for people entering central London during the morning peak, 2000, 2001 and 2002* (person-trips, in thousands).

Method of transport	2000	2001	2002	Percentage change 2000/1	Percentage change 2001/2
National Rail (South East)	438	441	n/a	+0.6	n/a
National Rail (Inter City)	27	26	n/a	-2.9	n/a
Total National Rail	465	467	n/a	+0.4	n/a
Underground (gross)	568	573	n/a	+0.9	n/a
Less also counted National Rail/DLR	196	205	n/a	+4.3	n/a
Underground (net)	372	368	n/a	-0.9	n/a
Docklands Light Railway (DLR)	11	11	n/a	-3.4	n/a
Total rail	847	845	n/a	-0.2	n/a
London buses	73	81	88	+10.3	+9.4
Coach/minibus	15	10	10	-31.2	-4.0
Total public transport	935	935	n/a	+0.1	n/a
Car	137	122	105	-10.7	-14.0
Motorcycles	17	16	15	-3.3	-8.3
Pedal cycle	12	12	12	+4.0	-2.7
Taxi	8	7	7	-10.5	-1.7
Total personal transport	173	158	139	-9.0	-11.8
Total all modes	1108	1094	n/a	-1.3	n/a

* Partial data (provisional) for 2002 survey.

In terms of how these trips are distributed in time across the morning peak, Table 6.2 shows that passengers entering central London are at their peak between 08:30 and 09:00. The peak hour for bus and car-based travellers is between 08:00 and 09:00, but between 08:30 and 09:30 for Underground-based trips. Car and taxi-based trips are the most evenly distributed of the modes over half-hour bands, and Underground traffic is the most peaked. Data for 2002 are not yet available in this form.

Table 6.2. Mode share by time period in 2001. Percentage of passengers.

Mode	07:00 - 07:29	07:30 - 07:59	08:00 - 08:29	08:30 - 08:59	09:00 - 09:29	09:30 - 09:59	Passengers (in thousands)
National Rail	8	16	27	27	14	8	467
Net Underground (inc. DLR)	6	12	18	26	24	15	379
Bus	11	15	19	21	19	15	81
Car	14	16	19	19	16	15	122
Motorcycle & pedal cycle	8	15	17	25	19	13	29
Taxi	15	16	17	19	18	19	7
Coach and minibus	10	21	22	15	13	19	10
Overall volume	8	14	22	25	18	12	1094

Table 6.3 shows average occupancy (persons per vehicle) of buses and cars at the CAPC cordon in the morning peak period, for 1997 to 2002.

Table 6.3. Average occupancies (persons per vehicle) for buses and cars at the CAPC cordon AM peak, 1997 to 2002.

Mode	1997	1998	1999	2000	2001	2002
Bus	28.8	30.3	30.4	34.4	37.5	37.2
Car	1.34	1.34	1.36	1.39	1.35	1.36

This table shows that the increase in car occupancy recorded in 2000 has not been repeated. However, the mean occupancy of buses has been increasing, with the introduction of larger buses on some routes.

6.3. Specific road-based modes

The following sections look in more detail at available indicators describing conditions relating to specific road-based modes of transport. These build upon the material presented in Chapter 4, which presents basic volumetric data in relation to these modes, and give greater detail in relation to issues of specific interest.
The following topics are considered:

- licensed taxis;
- motorcycle activity;
- pedal cycle activity.

6.4. Licensed taxis

Taxis would be expected to benefit significantly from improvements to congestion arising from the scheme. Increased travel to central London by public transport may result in some increased patronage of licensed taxis. More generally, with reduced congestion and licensed taxis being exempt from the congestion charge, taxis are likely to be perceived as a more attractive mode for journeys in and around the charging zone. Some increases in both taxi supply and use may therefore be anticipated.

The Public Carriage Office records will provide numbers of licensed vehicles, but these trends may be quite different from changes observable on the network. Gross changes to taxi volumes will also be apparent from the traffic counting programmes described in Appendix 5, although there are specific difficulties here associated with the identification of unlicensed private hire vehicles in conventional traffic counts.

The LATS surveys of licensed taxis undertaken in 2001, consisting of a series of screenline-based counts of taxis and driver trip-diaries, completed by a panel of appropriately-incentivised drivers, will provide valuable additional information, and the count element is planned to be repeated in Autumn 2003.

The progressive licensing of private hire vehicles, and the interaction between this process and the effects of congestion charging, will be the subject of a specific case study under the economic and business programme described in Chapter 7.

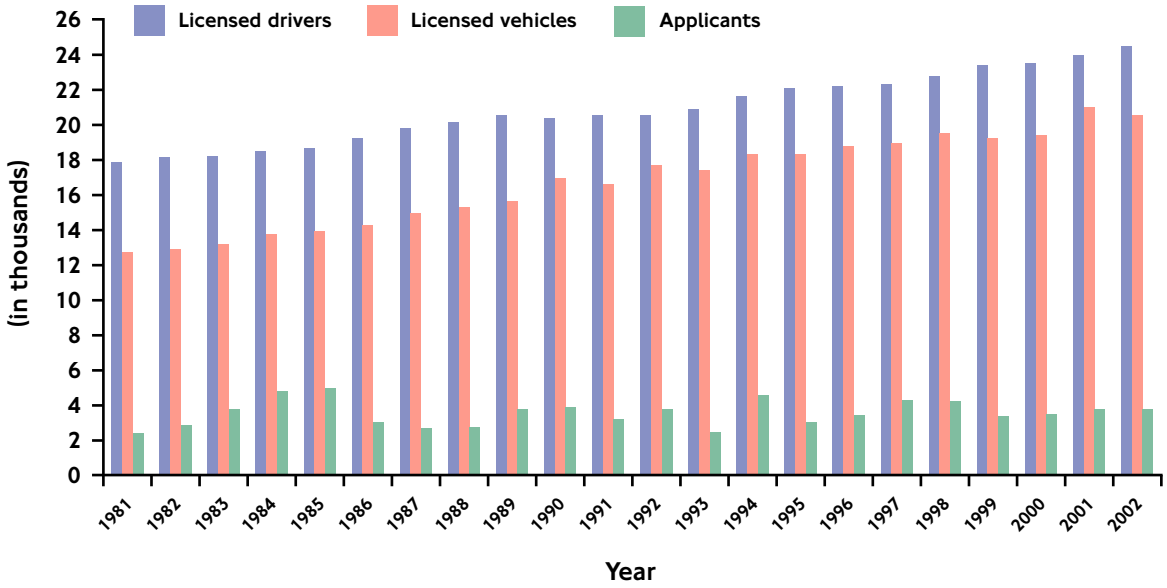
Selected pre-charging indicators

- Recent years have seen a steady increase in the number of licensed taxis and drivers operating in London, with 24,400 drivers and 20,500 licensed taxis operating in April 2002.
- At April 2002, there were 1,600 licensed, and an estimated 40,000 unlicensed private hire vehicles operating in London.
- During an average 2002 weekday during future charging hours, a total of 57,500 licensed taxis entered the charging zone (including multiple crossings by the same vehicle).

Licensing

The recent historical trend in the numbers of licensed taxi drivers, taxis and applications to take 'The Knowledge'[2], required to gain a taxi driver licence, are illustrated in Figure 6.3. These figures apply to the whole of Greater London.

Figure 6.3. Taxi driver licensing in Greater London, 1981 to 2002.



There is a long-standing upward trend in the numbers of licensed drivers and vehicles. There was an increase in both of around 500 between 2001 and 2002 making 24,400 licensed drivers, comprised of 21,700 all-London ('Green Badge') and 2,700 suburban ('Yellow Badge'), and 20,500 licensed vehicles operating in London.

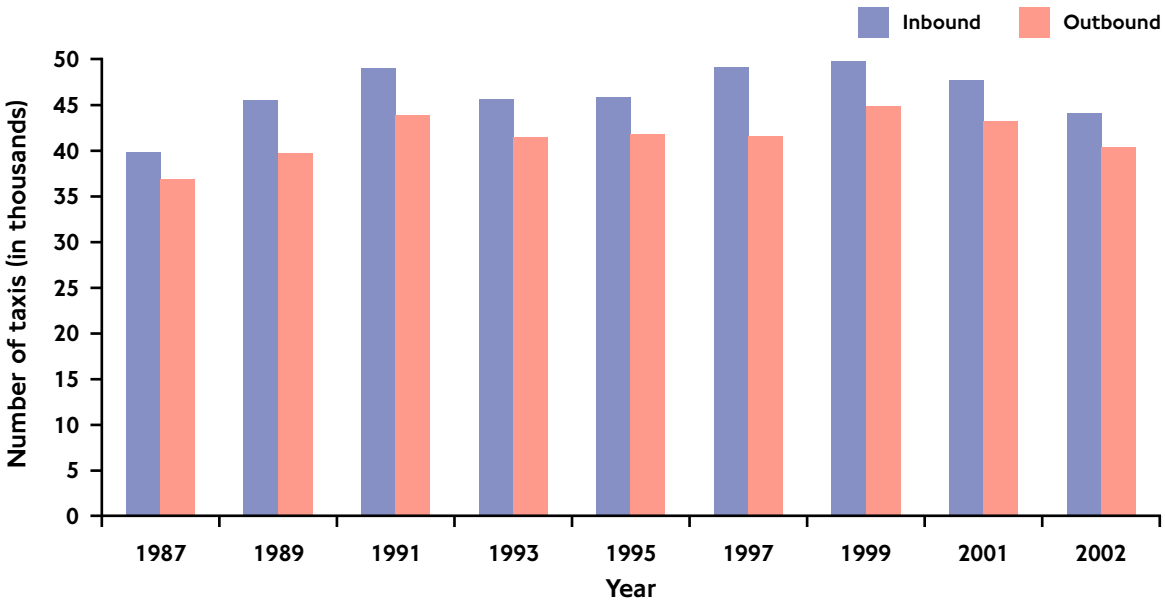
Taxi fares

Congestion suffered during a taxi journey potentially has a direct cost implication for the passenger. The tariff card outlines the charging structure as set by the PCO. During the charging day it costs £1.40 to travel the first 390 yards and then £1.80 every mile. If the taxi is moving at less than 10 mph the charge is in terms of time taken rather than distance; £1.40 for the first 75 seconds and then 30 pence every minute. This means that congestion will typically cost a taxi passenger 30 pence per minute – or £1.80 for every mile that the taxi has to divert to avoid congested conditions.

Taxi volumes

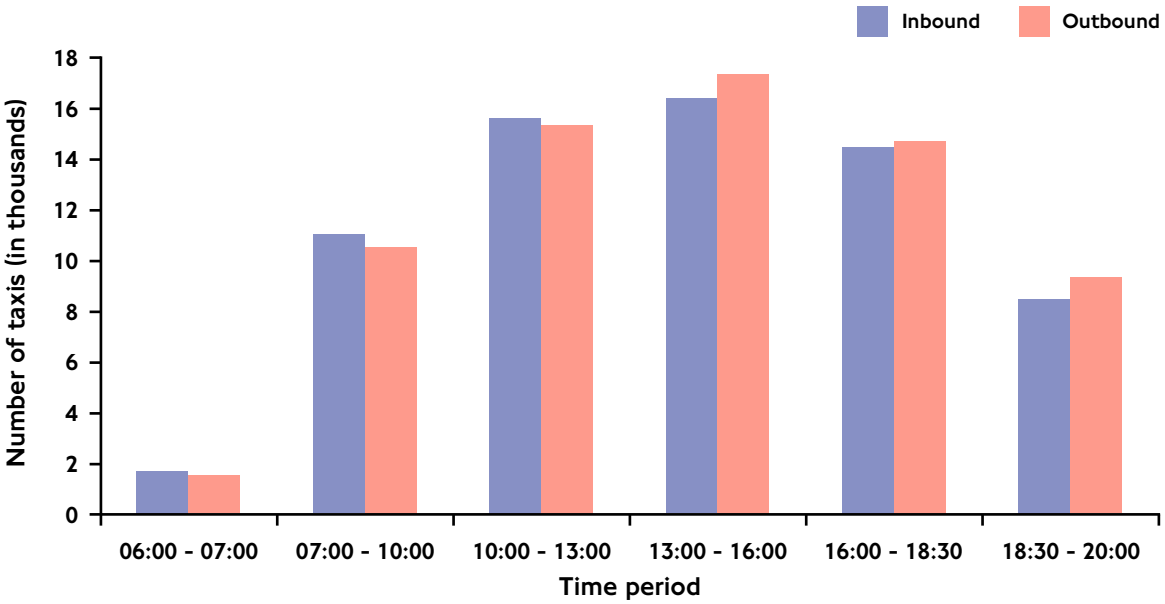
There is no comprehensive data available from the PCO on the pattern or scale of licensed trips made in taxis in London. Good indications can however be obtained from the range of traffic counting surveys described in Chapter 4. Most relevant are the counts of traffic crossing the charging zone boundary and counts of traffic at the TfL central London cordon (Figure 6.4). A historical trend of slowly-increasing licensed taxi movements is evident, with an increase from 40,000 crossings in 1987 to 48,000 in 2001 (including, of course, multiple crossings by the same vehicle). For 2002 this pattern appears to have reversed, with a significant reduction in crossings between 2001 and 2002.

Figure 6.4. Taxis crossing the TfL central London cordon, typical weekday, 07:00 to 18:30, 1987 to 2002.



The 2002 counts at the charging zone boundary provide additional detail. On a typical 2002 weekday during charging hours 57,500 licensed taxis entered the charging zone (including multiple crossings by the same vehicle), with 57,800 crossing the boundary in the outbound direction. Figure 6.5 shows how these movements were distributed across the day.

Figure 6.5. Licensed taxis crossing the charging zone boundary, typical weekday, 06:00 to 20:00, 2002.



Taxi occupancy

The 2001 LATS Taxi Survey counted licensed taxis and their occupancy across two traffic counting screenlines within central London during the morning peak period. The taxi vehicle counts from this survey and their occupancy status is shown in Table 6.4.

Table 6.4. Number of taxis and occupancy status. LATS Taxi Survey screenlines, typical weekday, 07:00 to 10:00, Spring 2002.

Screenline	Number of taxis	Percentage hired	Percentage unoccupied	Percentage not in service	Percentage hired with 1 passengers	Percentage hired with 2 passengers	Percentage hired with 3 passengers
East/West: Northbound	5,404	51	37	12	40	9	2
East/West: Southbound	6,385	56	32	12	48	6	2
North/South: Eastbound	4,386	58	27	15	47	9	2
North/South: Westbound	5,571	72	20	8	58	11	3

Whilst of intrinsic interest in themselves, repeats of this survey after congestion charging starts will allow significant changes and trends in occupancies to be identified. Additional surveys of taxi occupancies at a random sample of points within the charging zone were also undertaken during 2002, and these will also provide valuable material for comparison after congestion charging has started.

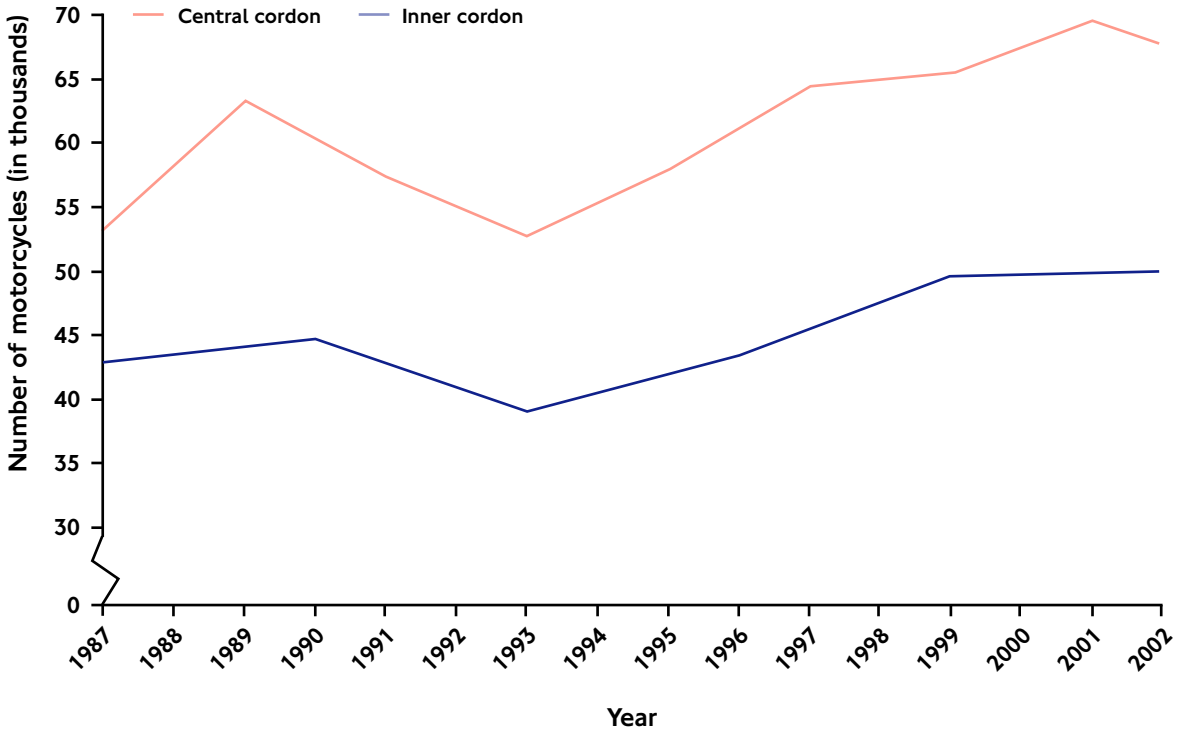
6.5. Motorcycle activity

Motorcycles[3] are exempt from the congestion charge, one reason being their much smaller contribution to congestion in central London. They therefore offer an alternative to car users who do not want to pay the charge. However, because of the higher accident involvement rates associated with two-wheeled vehicles there are some concerns that any significant shift to motorcycles would be reflected in increased traffic accidents. Transport for London has suggested that there could be a small increase in motorcycle activity as a consequence of congestion charging, though distinguishing such a change from 'background' trends may be difficult.

Volumes of motorcycle traffic

The congestion charging boundary traffic counts undertaken during the Spring and Autumn of 2002 give an annualised estimate of 28,000 motorcycles entering the future charging zone during charging hours (07:00 to18:30 weekdays). Although this statistic is only available for 2002, a longer-term indication of trends in motorcycle use can be gained from the central and inner London cordon surveys (Figure 6.6).

Figure 6.6. Motorcycles crossing the central and inner London cordons (both directions combined), 07:00 to 18:30.

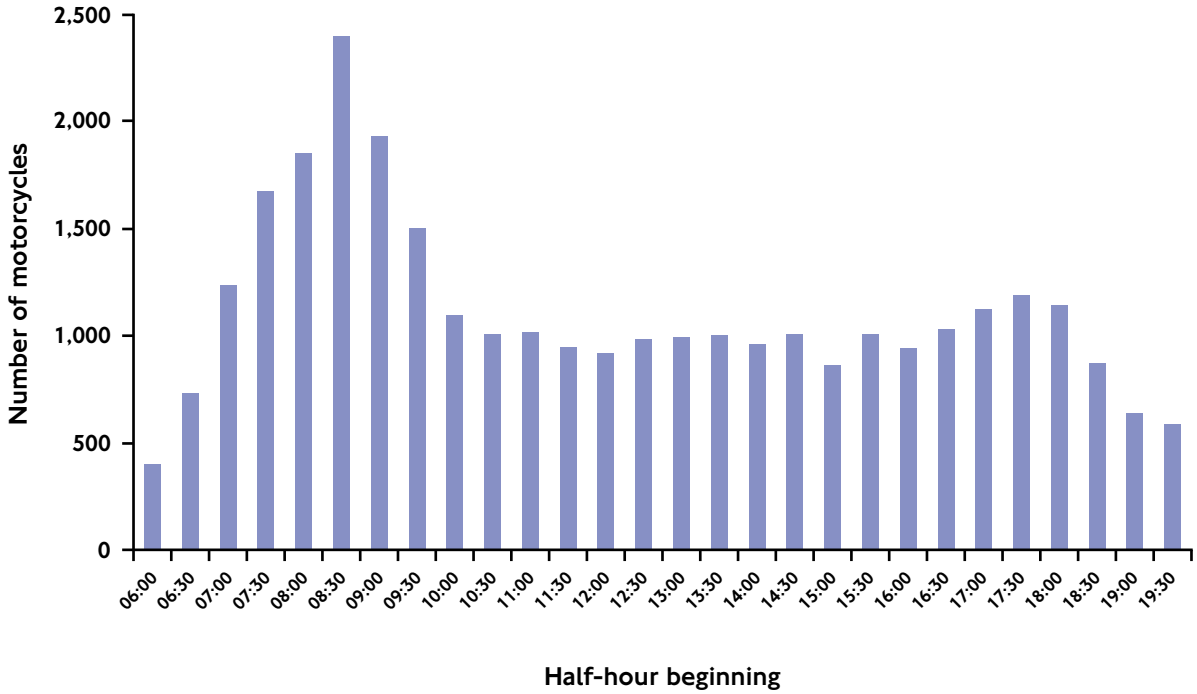


A trend of slowly-increasing motorcycle traffic is evident. When compared against trends over recent years for all other vehicle types (Chapter 4), the relative share of trips undertaken by motorcycles has also been increasing over recent years.

Temporal patterns at the charging zone boundary

The way in which motorcycle trips entering the charging zone are distributed across the day is shown in Figure 6.7. There is a sharp peak during the period 08:30 to 09:00.

Figure 6.7. Motorcycles entering the charging zone, typical weekday, 06:00 to 20:00, 2002.



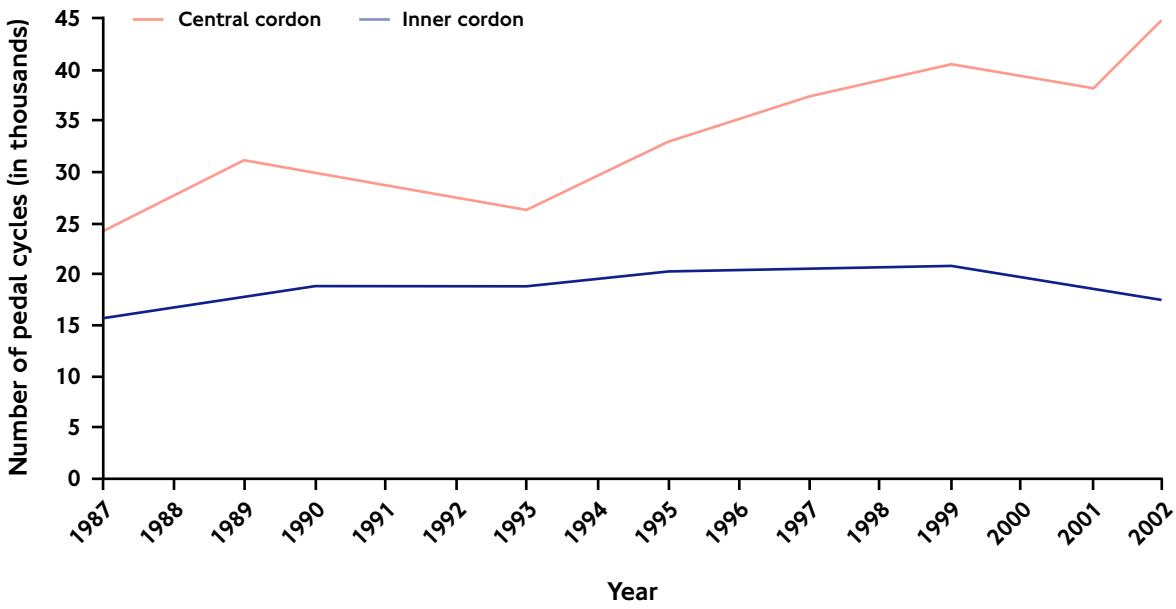
6.6. Pedal cycle activity

Pedal cyclists will not be directly affected by congestion charging. However, changes to traffic conditions resulting from less traffic and congestion may increase the attractiveness of cycling as a means of travel to, from and around central London. As with motorcycles, pedal cycle volumes are monitored through the general traffic counting framework described in Appendix 5. Recent data from these surveys are set out below.

Trends in pedal cycle use

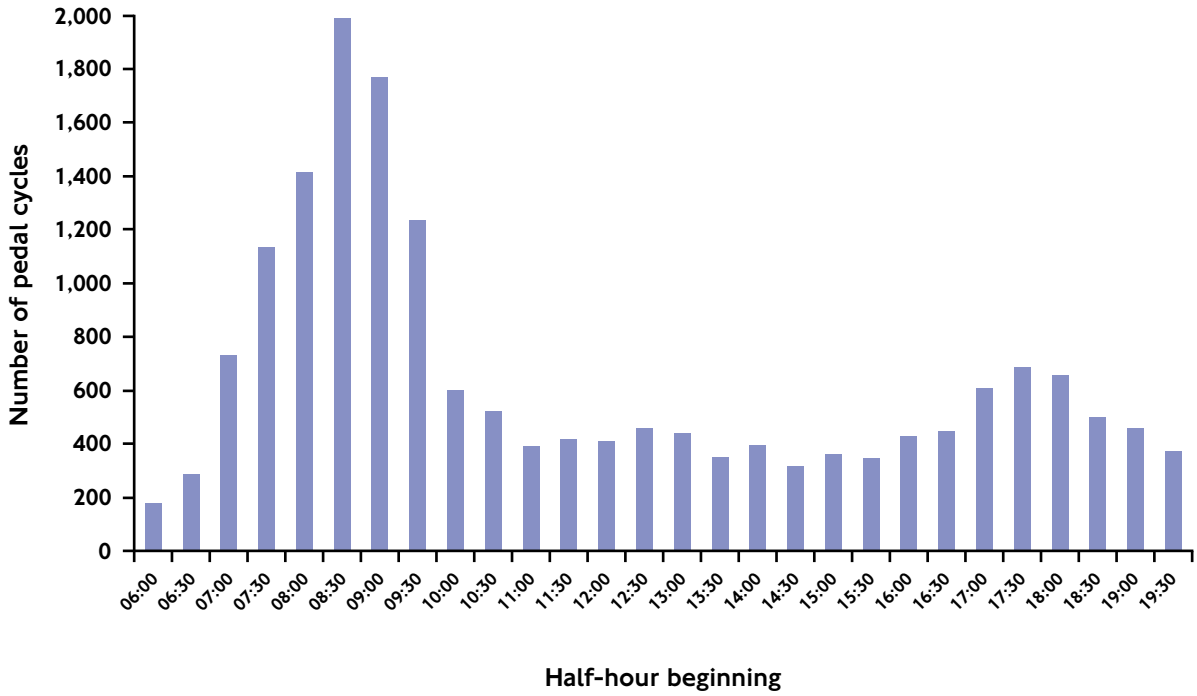
Figure 6.8 shows recent trends in pedal cycle activity at the TfL central and inner London cordons. Again, a long-term trend of increasing use is evident at both cordons. As with motorcycles, the total volume of pedal cycles is higher across the central than the inner cordon. In total, 45,000 cyclists crossed the central cordon (in both inbound and outbound directions) during future charging hours in 2002.

Figure 6.8. Pedal cycles crossing the central and inner London cordon (both directions combined), typical weekday, 07:00 to 18:30.



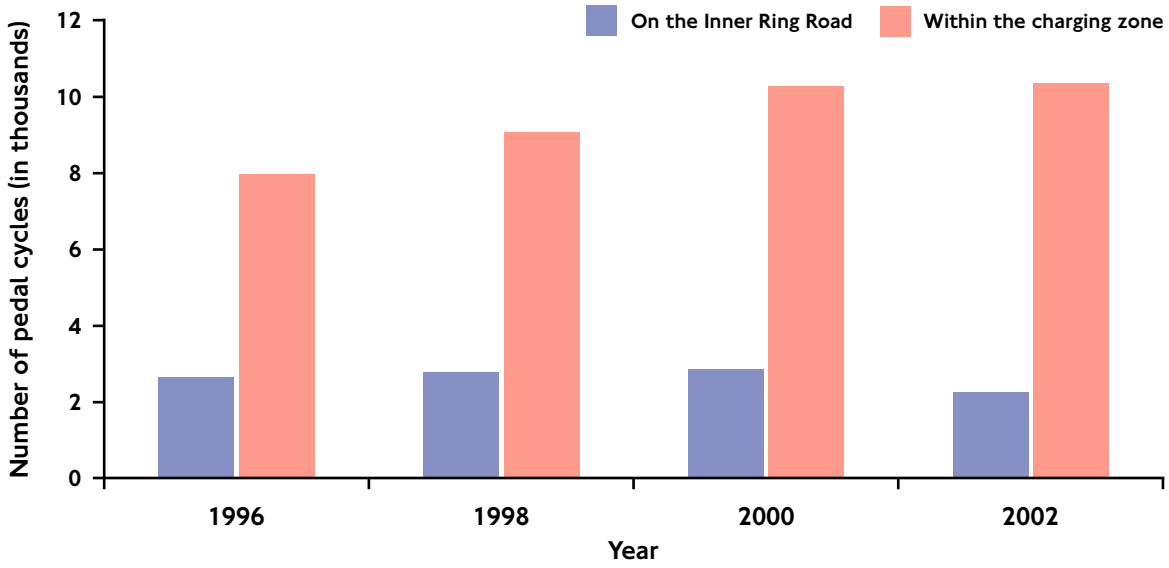
Counts of pedal cyclists crossing the congestion charging boundary have been made for a typical weekday in 2002. This reveals that 16,000 cycle movements were made into the charging zone, during the charging hours. The way that inbound cycle trips are distributed throughout the day is shown in Figure 6.9.

Figure 6.9. Pedal cycles entering the charging zone, typical weekday 2002.



The most consistent long-term dataset describing cycle use within the charging zone is the Thames Screenline. Figure 6.10 shows recent trends in the number of pedal cycles crossing the six Thames bridges located wholly within the charging zone, as well as the two bridges on the Inner Ring Road.

Figure 6.10. Pedal cycles crossing the Thames Screenline, typical weekday, 07:00 to 19:00.



6.7. Road safety

Expected impacts of congestion charging

Changes to the number and type of road traffic accidents may occur through the combination of changed traffic levels, changed routes, reduced congestion and an altered vehicle mix. Transport for London has estimated that there could be between 150 and 250 fewer accidents per year across Greater London as a result of the scheme. There are currently about 34,000 reported road accidents each year in Greater London involving personal injury. Of these accidents, 1,900 (or 6 percent of the Greater London total), occur within the charging zone or on the Inner Ring Road during charging hours.

Congestion charging could affect road safety in several ways. First, the traffic volume changes associated with the scheme could induce a change in accident rates. Any shift towards increased use of pedal cycles or motorcycles could also result in net increases in accidents, although the relationship is complex and the scheme will be accompanied by a range of traffic management measures that could have the effect of reducing the number of accidents. Further, changes to network speeds of traffic resulting from the scheme could have an effect, although reduced congestion will primarily be experienced as reduced queuing time at junctions.

Monitoring framework

Reported accidents involving personal injury have been monitored by the London Accident Analysis Unit (LAAU) for the last 20 years. This dataset will continue to accumulate and should meet the primary needs of the monitoring programme.

Data relating to accidents can be examined by location, time period, vehicle involvement and severity, all of which will allow the comprehensive tracking of trends in accidents after congestion charging starts, and its comparison with previous years (e.g. to exclude seasonal effects). The principal issue with this dataset is the relatively lengthy time required for all accidents in a given time period to appear on the database, owing to the variable periods required by the Police to process accident reports. This means that special attention will need to be paid to any emerging short-term trends after congestion charging starts.

Recent trends in road traffic accidents

The following section sets out recent trends in road traffic accidents in and around the charging zone. Road traffic accidents can be categorised in various ways. This section considers accidents in terms of personal injuries and in terms of accident involvement by vehicle type.

Accidents involving personal injury

A basic indicator of change is the absolute number of personal injury accidents that are recorded on the London road network. These can be categorised in various ways (e.g. in terms of the severity of the injury), and data can be extracted for various time periods and geographical areas. Table 6.5 sets out recent trends in reported personal injury accidents within the charging zone, on the Inner Ring Road and in other parts of London.

Table 6.5. Total reported personal injury road traffic accidents, 1999-2002.

		Charging Zone	Inner Ring Road	Inner London	Outer London	Total
1999	Weekdays 07:00-19:00	1,882	579	9,516	10,229	22,206
	Weekdays 00:00-07:00;19:00-24:00	550	210	3,928	3,234	7,922
	Weekends all day	495	180	4,584	4,287	9,546
	Total	**2,927**	**969**	**18,028**	**17,750**	**39,674**
2000	Weekdays 07:00-19:00	1,790	551	9,264	9,791	21,396
	Weekdays 00:00-07:00;19:00-24:00	519	216	4,027	3,146	7,908
	Weekends all day	448	217	4,692	4,355	9,712
	Total	**2,757**	**984**	**17,983**	**17,292**	**39,016**
2001	Weekdays 07:00-19:00	1,657	536	9,114	9,597	20,904
	Weekdays 00:00-07:00;19:00-24:00	475	214	3,871	3,129	7,689
	Weekends all day	487	199	4,512	4,257	9,455
	Total	**2,619**	**949**	**17,497**	**16,983**	**38,048**
2002	Weekdays 07:00-19:00	1,452	446	8,161	8,834	18,893
	Weekdays 00:00-07:00;19:00-24:00	444	179	2,937	3,174	6,734
	Weekends all day	440	201	3,447	4,180	8,268
	Total	**2,336**	**826**	**14,545**	**16,188**	**33,895**

Generally there has been a year on year decrease in the number of reported personal injury accidents in all areas. Although this has been most significant in the area within the charging zone where there has been a 20 percent decrease between 1999 and 2002.

To illustrate the types of analyses that are possible with data, Table 6.6 shows a breakdown by casualty type (pedestrian and non-pedestrian) for all road traffic accidents within the charging zone. This shows that, between 1999 and 2002, there has been an overall reduction in all types of casualty and the proportional split between them has remained fairly constant.

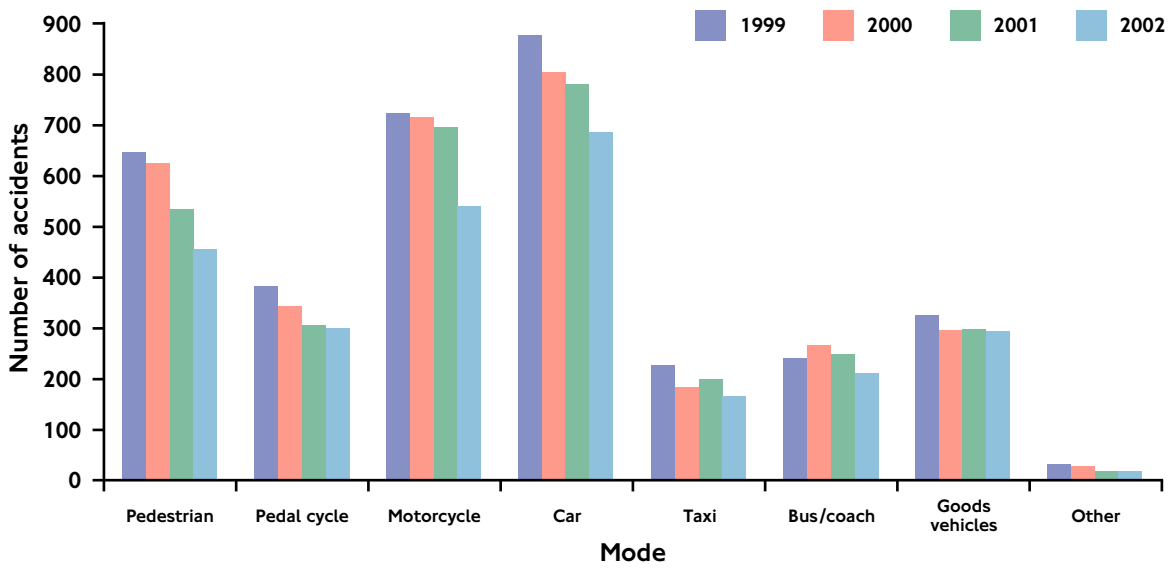
Table 6.6. Accidents involving personal injury within the charging zone, 07:00 to 19:00, 1999 to 2002.

	Pedestrian accident	Non-pedestrian accident
1999	644 (34%)	1238 (66%)
2000	624 (35%)	1166 (65%)
2001	534 (32%)	1123 (68%)
2002	454 (31%)	998 (69%)

Accident involvement

Accident records also include data describing the types of vehicle involved in an accident. Duplication can occur where more than one category of road user are involved. However, this indicator does give a "mode-specific" accident involvement rate. Figure 6.11 shows involvement in accidents by vehicle type within the charging zone.

Figure 6.11. Accident involvement by vehicle type within the charging zone, 07:00 to 19:00, 1999 to 2002.



All road user types have seen a reduction in the number of accidents that they are involved in between 1999 and 2002. Motorcycles have seen a significant drop in the number of accidents they were involved in, over 20 percent from 2001 to 2002.

6.8. Pedestrian activity

The effects of congestion charging on pedestrian activity will be both diverse and subtle. For example, walking within the proposed charging zone or across the boundary might increase, as ex-car-users transfer to public transport or directly to walking. On the other hand, better buses may attract pedestrians to that mode, and many public transport trips involve a significant amount of walking.

There are also severe practical difficulties in measuring walking, including defining what actually comprises a 'walk trip', counting across a boundary that is effectively unconstrained, and accounting for the weather.

For all of these reasons, measurements of changed pedestrian activity in relation to the scheme can only be indicative. Two specific initiatives have been put in place.

The first of these are a series of On-Street Public Space Surveys that were undertaken at a selection of 'high-profile' locations in and around the charging zone. These surveys are multi-purpose, including (as one element) a controlled count of pedestrians in relation to fixed survey points, which can be revisited. Other functions of these surveys, described more fully elsewhere, are to understand the social mix and usage of key public locations, and to examine how attitudes towards aspects of the central London environment change as congestion charging is introduced (see, for example, Chapter 9).

The second initiative is designed to quantify changes to pedestrian activity along and across the Inner Ring Road. This work took place over the winter of 2002/2003 in the boundary case study area (see Appendix 6), and consisted of controlled pedestrian counts along both footways, as well as counts of pedestrians using crossing facilities across the Road.

Public space surveys - pedestrian counts

A survey of about 8,500 people was conducted during Autumn 2002 at 24 'On Street Public Places' within and at the edge and just outside of the boundary of the future charging zone. The aim was to profile the social mix of people that visit the charging zone and identify the experiences, perceptions and types of activities that people carry out there.

To build up a picture of the level of pedestrian activity at each place, a ten minute two way pedestrian count was conducted every hour from 08:00 until 20:00, alongside the interviews. These counts were necessarily constrained to include only people passing through a defined corridor. They do not, therefore, give a complete picture of pedestrian volumes at each site. However, they can be re-visited and sampled on a similar basis, giving a consistent indicator of flow volumes. In total, over 1,000 10-minute pedestrian flow counts took place.

The pedestrian counts were conducted at a variety of locations inside, at the edge of and just outside of the boundary of the charging zone. The places were chosen to capture people engaged in different types of activity in and around the charging zone and covered the following six categories:

- retailing locations;
- major tourist attractions;
- theatre/cinema areas;
- locations with a high concentration of restaurants;
- business areas;
- areas at the edge and just outside of the charging zone.

Figure 6.12. Mean 10 minute two-way counts by type of site, 08:00 to 20:00 weekday/Saturday, Autumn 2002.

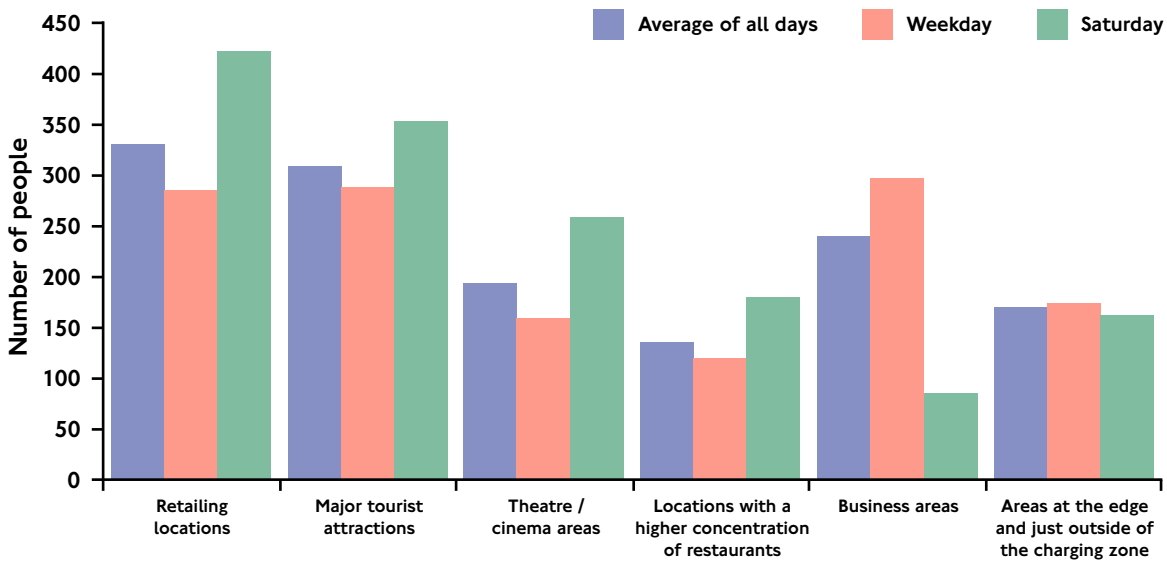
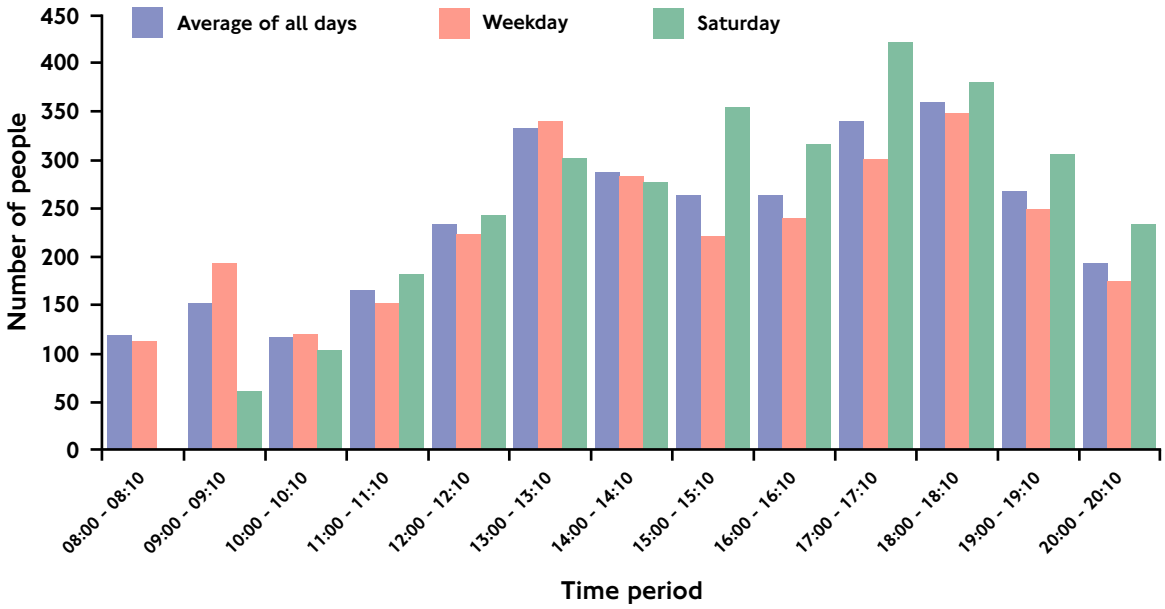


Figure 6.12 shows summary pedestrian flow totals across all sites, categorised by type of location. This shows that the highest pedestrian throughput is at 'retail' sites and the lowest at 'restaurant' sites. At all sites except areas outside of the charging zone, there are marked differences in flows between weekdays and Saturdays. At 'business' sites on weekdays, flows are over three times their Saturday equivalent. The opposite applies at the other types of site within the charging zone, with Saturdays being 20 to 50 percent busier than on weekdays.

The volume of pedestrians observed at these locations varies throughout the day. Figure 6.13 shows the observed pattern of hourly variation across all survey sites within the charging zone[4]. Because of circumstances particular to the survey day (e.g. the weather) and the fact that all survey sites are aggregated, these data are no more than illustrative. However, any consistent changes across groups of sites after charging starts may highlight behavioural changes or issues for further investigation.

Figure 6.13. Mean 10 minute counts by hour for count sites within the charging zone, 08:00 to 20:00 Weekday/Saturday, Autumn 2002.



Technical notes

1 A potential double-counting issue arises from passengers who cross the CAPC cordon by National Rail and continue their journey by Underground. The term 'gross' signifies figures for affected modes that are not adjusted to compensate for this potential double-counting. 'Net' figures are adjusted to take this into account.

2 The test requires detailed geographical knowledge of London within a 6 mile radius of Charing Cross and is based on 320 routes (or 'runs').

3 The term 'motorcycle' as used in this report includes all powered two-wheeled vehicles.

4 Counts on Saturday began at 09:00.