Transport for London

Central London Congestion Charging

Impacts monitoring

Fifth Annual Report, July 2007

MAYOR OF LONDON

Transport for London

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Part 1: Recent developments with the central London congestion charging scheme

Overview

Congestion charging was introduced into central London in February 2003. In February 2007 the original central London congestion charging zone was extended westwards, creating a single enlarged congestion charging zone.

Congestion charging contributes directly to the achievement of four of the Mayor's transport priorities, as set out in the Mayor's Transport Strategy:

- to reduce congestion;
- to make radical improvements to bus services;
- to improve journey time reliability for car users;
- to make the distribution of goods and services more efficient.

Furthermore, by reducing traffic levels it has also contributed to reduced vehicle emissions. It also generates net revenues to support the Mayor's Transport Strategy more generally.

This is the fifth in a series of annual impacts monitoring reports describing the impacts of congestion charging in and around central London.

In June 2003 Transport for London (TfL) published the *First Annual Impacts Monitoring Report*. This described the scope of the monitoring work that had been put in place to ensure that the impacts of congestion charging were comprehensively measured and understood. Conditions applying before charging across a range of key indicators were set out, and information given describing how and when any changes to these indicators would be measured.

The *Second Annual Impacts Monitoring Report* was published in April 2004 and described the available information on the impacts of the scheme after approximately one year of operation.

TfL's *Third and Fourth Annual Impacts Monitoring Reports* were published in 2005 and 2006. These updated and extended the assessment of the impacts of congestion charging based on two and three further years of data following the start of the scheme.

This *Fifth Annual Impacts Monitoring Report* draws on the most recent data for 2006, reflecting four years of operation of the scheme, alongside previously published findings. It is in three parts.

- Firstly, it extends and consolidates the body of knowledge and understanding now available in relation to the original central London scheme, enabling commentary on the development of post-charging trends and the significance of charging to them, as well as comparisons with conditions before charging started in 2002. It also provides a fuller analysis and valuation of the benefits of the original congestion charging scheme in central London.

- Secondly, it also provides details of the monitoring approach adopted by TfL for the western extension scheme, and sets out key indicators describing conditions before the implementation of the extension across the range of monitoring indicators involved. It builds on experience with the original scheme.
- Finally, it also allows consideration of some early findings from the monitoring work following the introduction of the western extension in February 2007. These emerging results generally accord well with TfL's expectations for the extension of the scheme.

This Overview summarises the key contents of this *Fifth Annual Impacts Monitoring Report*.

Part 1

Developments in the original central London congestion charging zone during 2006

- During 2006, congestion charging continued to meet its principal traffic and transport objectives; and the scheme continues to operate well.
- Traffic patterns in and around the charging zone remained broadly stable during 2006. Traffic entering the charging zone (vehicles with four or more wheels) was 21 percent lower than in 2002, creating opportunities over this period for re-use of a proportion of the road space made available.
- Traffic circulating within the zone and on the Inner Ring Road, the boundary route around the zone, remained comparable to previous years following the introduction of the scheme.
- During 2006, TfL has observed a sharp increase in congestion inside the central London charging zone. This has occurred despite the fact that traffic levels have continued to remain stable. Congestion levels are being influenced by an increase in activity that has affected the capacity of the road network for general traffic – particularly an increase in roadworks in the latter half of 2006, notably by utilities.
- In addition, there is some evidence, as first reported in TfL's *Fourth Annual Impacts Monitoring Report*, of a longer-term 'background' trend of gradual increases to congestion. This is likely to reflect a combination of traffic management programmes that have contributed to fewer road traffic accidents, improved bus services, a better environment for pedestrians and cyclists, and improvements to the public realm and general amenity. But these interventions have also reduced the effective capacity of the road network to accommodate general vehicular traffic.
- The impact of congestion charging therefore needs to be assessed in this context. The reduced levels of traffic mean that, when compared to conditions without the scheme, congestion charging is continuing to deliver congestion relief that is broadly in line with the 30 percent reduction achieved in the first year of operation.
- The factors discussed above mean that a comparison of congestion levels in 2006 against pre-charging baseline is potentially misleading. However, carrying this comparison through, congestion was 8 percent lower in 2006.

- The scheme generated net revenues of £123 million in 2006/2007 (provisional figures). These are being spent on transport improvements across London, in particular on improved bus services.
- Public transport continues to successfully accommodate displaced car users; and bus services continue to benefit from the reduced congestion and ongoing investment of scheme revenues.
- The overall buoyancy of the London economy has contributed to growth in public transport patronage, although volumes of travel to the charging zone by Underground in 2006 were only slightly higher than those that prevailed in 2002.
- Further economic trend data and comparative analyses continue to demonstrate that there have been no significant overall impacts from the original scheme on the central London economy. General economic trends are considered to have been the predominant influence on the performance of central London businesses over recent years. The central London economy has performed particularly strongly since the introduction of congestion charging, with recent retail growth (value of retail sales) in central London at roughly twice the national growth rate.
- Reductions in road traffic casualties and in emissions of key traffic pollutants in and around the charging zone continue to be apparent, alongside continuing, favourable 'background' trends in both of these indicators for 2006.
- The operation and enforcement of the scheme continue to work well, with several further improvements and innovations introduced during 2006, alongside TfL's preparations for the introduction of the western extension scheme in early 2007.
- The availability of five years of monitoring data in relation to the original central London congestion charging scheme allows a longer-term perspective on the role of congestion charging.
- In general, charging is seen to have helped accentuate trends that were positive, such as reduced road traffic accidents and emissions; to have helped counteract trends that were negative, such as increasing congestion; whilst having a broadly neutral impact on general economic performance.
- A cost-benefit analysis of the central London scheme suggests that the identified benefits exceeded the costs of operating the scheme by a ratio of around 1.5 with an £5 charge, and by a ratio of 1.7 with an £8 charge.

Part 2

Monitoring arrangements and baseline for the western extension scheme

- TfL has put in place a comprehensive programme of impacts monitoring work for the western extension to the central London congestion charging scheme. This builds on experience with the monitoring work for the original charging scheme, adapted to take account of lessons learned, stakeholder comment and specific local issues. This will work in conjunction with the existing monitoring arrangements for the central zone, which will continue.

- Extensive traffic counts in and around the western extension measure the amount of traffic entering and leaving the extension zone; circulating inside the zone; on the boundary routes; approaching the zone through inner London, and the interactions between the two components of the extended central London charging zone. Key measurements representing conditions before the introduction of the extension zone are given for each of these indicators in 2005 and 2006.
- Congestion trends in the western extension are being measured through a programme of moving car observer surveys; these are complementary to those already in place for the original central London zone. Measurement of baseline conditions commenced at the start of 2005, giving a robust time-series of data against which changes observed following the introduction of the extension can be set.
- Monitoring arrangements for the impacts of the western extension on aspects of public transport patronage, road traffic accidents, vehicle emissions and air quality generally build upon similar arrangements for the original central zone, and good baseline datasets are available.
- TfL's arrangements for monitoring the impacts of the western extension zone on business and economic activity have developed, following experience with the original central zone and stakeholder engagement. Maximum use has been made of available macro-economic trend datasets, adapted where possible to give a robust differentiation between the western extension zone and other parts of London. Several new quantitative indicators of key trends, such as retail footfall to measure shopper activity, have been created specifically for this task.
- The impacts of the extension on individuals' travel behaviour and wider daily lives will be examined through a new programme of social and behavioural surveys. These include a large-scale programme of quantitative roadside interview surveys, designed to quantify the disaggregate components of observed net travel change.
- Information relating to aspects of the operation and enforcement of the extended scheme will be provided, as with the original central London scheme.

Part 3

Western extension zone: the first three months

- The western extension to the central London congestion charging zone was successfully introduced on schedule on 19 February 2007. From this date, the extension zone operated alongside the existing central London zone, creating an enlarged central London congestion charging zone.
- From the outset all major operational elements of the scheme functioned well, and there were no traffic or other problems of significance.
- Early findings from the monitoring work indicate a set of outcomes that accord closely with TfL's expectations for the scheme. However, these results must still be regarded as provisional and more data is required to confirm and consolidate the longer-term picture.

- Traffic entering the extension zone over the first three months of operation is typically down by between 10 and 15 percent against equivalent levels in 2006
- The volume of traffic circulating within the extension zone is typically down by 10 percent against comparable values in 2006.
- Traffic on the free passage route running between the original and extended zones (Edgware Road to Vauxhall Bridge via Park Lane) is effectively unchanged in aggregate terms by the extension scheme.
- Traffic on the remainder of the western extension boundary route has increased in aggregate by a small amount (generally up to 5 percent), as expected by TfL. There is no evidence of any significant traffic operational problems on this key route.
- There is some evidence from counts of traffic entering the original central zone of small increases (generally up to 4 percent) following the introduction of the scheme, as anticipated by TfL. However, indicators of traffic circulating within the original charging zone are tending to indicate small reductions.
- TfL's current assessment would therefore be that aggregate traffic volumes in the original central zone have not changed significantly as a result of the extension scheme. Similarly, congestion levels in the central zone during this period are commensurate with those in 2006, and do not appear to have been affected by the introduction of the western extension zone.
- The first comprehensive survey of congestion in the western extension suggests that congestion has reduced by between 20 and 25 percent against comparable values in 2005 and 2006. A value for excess delays of 1.2 minutes per kilometre for March/April 2007 compares to a value for equivalent months in both 2005 and 2006 of 1.5 minutes per kilometre.
- Overall, these early results are highly encouraging. TfL's monitoring of the impacts of the western extension will continue throughout 2007.

1. Introduction

1.1 Orientation

This is the fifth in a series of annual impacts monitoring reports describing the impacts of congestion charging in central London.

As with previous reports in this series, it provides a summary and interpretation of the growing body of evidence and insight from across the monitoring programme relating to the central London congestion charging scheme. It makes comparisons with conditions before charging started and, where appropriate, with Transport for London's (TfL's) expectations for the scheme before it was launched. This report also considers the impact of important variations to the original scheme, such as the increase in the daily charge from £5 to £8, implemented in July 2005.

February 2007 saw the successful implementation of the western extension to the original central London congestion charging zone. As with the original scheme, TfL has put in place an extensive programme of impacts monitoring, designed to measure and assess the key impacts of the extension scheme. This report outlines the monitoring approach employed by TfL, and sets out key indicators of conditions before the implementation of the extension, against which emerging data representing conditions after implementation can be set.

Finally, this report allows consideration of some initial data representing conditions in the early months of 2007 following the implementation of the western extension zone. These 'early results', reflecting approximately three months of operation of the western extension scheme, are summarised in the latter part of this report.

The contents of this report reflect the Mayor's and TfL's commitment to a comprehensive programme of monitoring of TfL's road user charging schemes. TfL's monitoring covers not only the more immediate traffic and transport impacts of charging, but also the wider social, economic and environmental impacts. It consolidates information from a large number of specially-designed surveys, whilst making full use of already established surveys and data resources.

The scope of the material now available to TfL far exceeds what it is possible to publish in a report of this nature. This report therefore provides a summary of key findings and emerging appreciations that are likely to be of general interest.

1.2 Report contents

The remainder of this section summarises the key features of the original central London congestion charging scheme, and outlines key developments to the scheme during 2006. This report is then presented in three parts.

Part 1 (Sections 2 to 7) summarises findings for 2006 from the continuing monitoring programme for the original central London scheme. It contains the following sections:

- Section 2: traffic patterns considers trends in traffic volumes and characteristics in and around the central London zone during 2006, in relation to key changes and trends observed since the start of the monitoring programme in 2002.
- Section 3: congestion considers changes to traffic congestion, drawing on extensive surveys and research during 2006.
- Section 4: business and economic impacts summarises the latest evidence relating to the impacts of the scheme on business and economic activity in central London.
- Section 5: public transport, accidents and air quality looks at developments in public transport patronage, road traffic accidents and air quality during 2006.
- Section 6: scheme operation, enforcement and revenues reviews indicators relating to the operation and enforcement of the scheme during 2006.
- Section 7: a retrospective look at the central London congestion charging scheme looks back at TfL's experiences with developing, implementing, operating and monitoring the original central London scheme over the period 2001 to 2007, to a point just before the introduction of the western extension scheme.

TfL's continuing work in respect of the social impacts of charging schemes is considered in the context of the western extension below.

Part 2 (Sections 8 to 13) sets out TfL's approach to monitoring the impacts of the western extension, and summarises key indicators describing traffic and other conditions during 2005 and 2006 before the implementation of the scheme. These exemplify the benchmarks available to TfL to assess changes brought about by the extension zone as data relating to conditions after implementation become available. It contains the following sections:

- Section 8: a description of the western extension zone describes the main features of the western extension to the central London congestion charging zone. It summarises how the scheme operates and its key interactions with the original central London zone.
- Section 9: traffic patterns describes how TfL is measuring the traffic impacts of the extension and sets out available indicators of traffic conditions prior to implementation.
- Section 10: congestion sets out available indicators of congestion in and around the western extension zone, and explains the methods and definitions being used.
- Section 11: public transport, accidents and air quality sets out TfL's approach to measuring changes in public transport patronage, road traffic accidents and air quality resulting from the western extension.
- Section 12: business and economic impacts explains TfL's approach to understanding the impacts of the western extension on business and economic activity, and describes the range of available data outlining conditions before implementation.
- Section 13: social and behavioural impacts describes work designed to help TfL understand the implications of the western extension for individuals and households, and to examine how travel behavioural change contributes to the aggregate traffic changes observed elsewhere.

Part 3 (Section 14) presents a summary of emerging scheme operational indicators and findings from the traffic and congestion monitoring work describing the early impacts of the western extension, reflecting approximately three months of operation of the extended scheme.

1.3 Overview of the monitoring programme and incorporation of the western extension scheme

The scope of the monitoring work for the central London congestion charging scheme was described in TfL's *First Annual Impacts Monitoring Report*. This consisted of five key work streams, designed to assess the range of traffic, other transport, social, economic and environmental impacts of congestion charging.

Subsequent reports have provided updates on key methodological developments as the monitoring work has evolved. The basic approach has proved satisfactory, and has provided many insights into both the immediate impacts of charging, and the general background evolution of trends in road traffic, congestion, economic activity and many other aspects of life in and around central London.

The findings for 2006 described in Part 1 of this report reflect the continuation of these initial arrangements. During 2006, conditions in the central London zone were essentially unaffected by preparations for the western extension, but were subject to a wide range of other influences.

Following some preliminary monitoring work in the western extension zone during 2003 and 2004, TfL's monitoring work was significantly extended during 2005 and 2006 to gather comprehensive baseline 'before' data in anticipation of the implementation of the western extension.

From the start of 2005, a comprehensive programme of measurements was put in place to gather 'baseline' information, against which data obtained following implementation of the extension scheme could be set. The general approach adopted for this closely followed that used for the central zone, taking account of lessons learned. The scope and intensity of this work also took into account specific features of the western extension scheme that required adaptations to the ongoing programme for the original central zone. An example of this was the change to the charging hours from 07.00-18.30 to 07.00-18.00, which accompanied the introduction of the extension zone on 19 February 2007. Findings from this work are described in Part 2 of this report.

The western extension may have consequential impacts on the original central zone. Although TfL expects these to be relatively small in scale, they may be significant for the monitoring work. One example is the possible impact of the residents' discount, with residents of the western extension zone able, from the date of approved registration of their discount application, to drive within the original central zone at the 90 percent discounted charge rate.

On implementation of the extension zone in February 2007, the area of the western extension zone underwent a 'step' change, reflecting the transition from uncharged

area to charged area. Monitoring in the western extension during 2007 will therefore focus on detecting change in this area, as well as any consequential impacts in the original central zone. From 2008 onwards, the monitoring will track developments in the operation of the extended zone from a 2007 baseline in both components of the extended central London congestion charging scheme.

1.4 The central London congestion charging scheme

Congestion charging was successfully introduced in central London on 17 February 2003. It contributed directly to four of the Mayor's transport priorities, as set out in the Mayor's Transport Strategy:

- to reduce congestion;
- to make radical improvements to bus services;
- to improve journey time reliability for car users;
- to make the distribution of goods and services more efficient.

It also generated revenues to support the Mayor's Transport Strategy more generally, and has led to environmental and safety improvements.

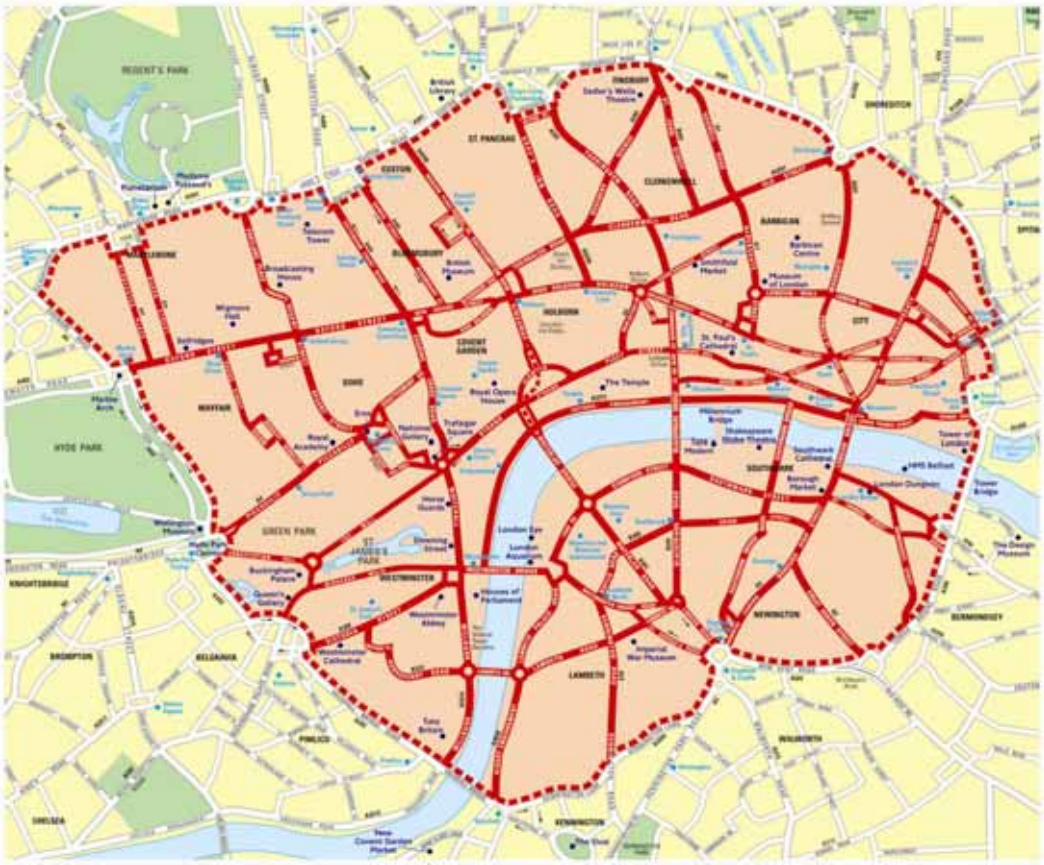
Until July 2005 the congestion charge was a £5 daily charge for driving a vehicle on public roads within the congestion charging zone between 07.00 and 18.30, Monday to Friday, excluding weekends and public holidays. Since July 2005 the basic daily charge has been £8, with a discount for monthly and annual payments, and for vehicles registered on the TfL 'fleet scheme'.

The original central London congestion charging zone is shown in Figure 1.1. It covers 22 square kilometres in the heart of London, including centres of government, law, business, finance and entertainment.

The Inner Ring Road forms the boundary of the congestion charging zone, and no charge applies to vehicles using this route.

Certain categories of vehicle, notably taxis, London licensed private hire vehicles, motorcycles, pedal cycles and buses, are wholly exempt from the charge. Certain categories of vehicle users can register for discounts. For example, residents of the central London congestion charging zone can register for a 90 percent discount (for a minimum weekly payment), and disabled persons' Blue Badge holders and drivers of certain alternative fuelled vehicles are eligible for a 100 percent discount and pay no charge.

Figure 1.1 The original central London congestion charging zone.



1.5 Key developments to the original central London congestion charging scheme

The original central London congestion charging scheme – including its associated traffic management and complementary public transport measures – is kept under continual review by TfL.

Various adjustments have been made to the scheme since it was first formally proposed in a Scheme Order made by TfL in 2001 and confirmed by the Mayor in 2002. The Scheme Order is the legal framework for the congestion charging scheme and contains the definitions of what the charge is, where it applies, details on discounts and exemptions, penalty charges, refunds and so on. Scheme Orders are made under the powers set out in Schedule 23 of the *Greater London Authority Act 1999*.

Changes to the Scheme Order are made through a procedure known as a Variation Order. Each Variation Order is subject to public consultation before the Mayor considers TfL's response to the representations received and decides whether or not to confirm the change (with or without modifications) and make it part of the Scheme Order.

TfL's *Fourth Annual Impacts Monitoring Report*, published in June 2006, listed three variations to the Scheme Order that had been consulted upon during the previous year. These were:

- Variation Order 2005: introducing the western extension (which is dealt with elsewhere in this report) and confirming the 'Pay Next Day' facility to commence in September 2006 (subsequently further amended).

  Following consultation, the Mayor confirmed this Variation Order on 29 September 2005.

- Variation Order (No. 2) 2005: removing an anomaly and ensuring that a resident could not benefit from monthly or annual charges at the discounted rate for a period beyond which their vehicle was registered for the discount.

  Following consultation, the Mayor confirmed this Variation Order on 9 December 2005.

- Variation Order 2006: bringing forward the implementation date for the Pay Next Day facility from October 2006 to June 2006, and providing an incentive for residents in the western extension residents discount zone and Blue Badge holders to apply for their respective discounts early. This was intended to avoid excessive demand on the congestion charging contact centre close to the start date of the western extension.

  Following consultation, the Mayor confirmed this Variation Order on 5 May 2006.

Two further Variation Orders were made and confirmed in 2006. These dealt with minor changes to the boundaries of the original congestion charging zone and the proposed western extension, removed some administration charges, and amended the eligibility for some exemptions and discounts.

The Variation Orders were:

- Variation Order (No. 2) 2006: changing the boundary of the original central London congestion charging zone at North Carriage Drive to allow egress from the car park operated by National Car Parks under Hyde Park.

  Following consultation, the Mayor confirmed this Variation Order on 23 August 2006.

- Variation Order (No. 3) 2006: changing the boundary of the western extension, exempting certain three-wheeled vehicles, removing administrative charges for adding 9+ seat vehicles to the fleet scheme, adding emergency response vehicles to the categories of vehicles eligible for 100 percent discounts and generally clarifying the wording within the Greater London (Central Zone) Congestion Charging Order 2004.

  Following consultation, the Mayor confirmed this Variation Order on 29 September 2006.

TfL will continue to keep all elements of the congestion charging scheme under review and will consider making further changes to the Scheme Order where appropriate.

1.6 Findings from the monitoring work so far

Since the introduction of congestion charging, TfL has produced a series of reports detailing emerging results from the monitoring work. This *Fifth Annual Impacts Monitoring Report* is informed by a further year of evidence from the monitoring work, enabling a more thorough appreciation of the impacts of the original central London scheme to date. In general, the key traffic impacts of the scheme have been maintained, despite other factors now combining to erode the decongestion benefits from the scheme. The main elements of the scheme continue to operate satisfactorily, and there remains a general absence of traffic or other problems arising from the scheme.

Congestion charging was introduced against a backdrop of wider changes to travel patterns in London, brought about by 'background' social and economic change and by the implementation of other elements of the Mayor's Transport Strategy and other policies. All of these will have had an effect on the measurements described in this report, which in general will reflect the net out-turn of a combination of traffic, transport and other effects, many of which are completely unrelated to congestion charging. It has not therefore usually been possible to identify precisely a 'congestion charging effect', although in many cases the available evidence allows a reasonable judgement to be made.

The key volumetric changes to travel patterns arising from the introduction of the scheme in 2003 established themselves very quickly. Traffic adjusted almost overnight, and changes in the period since have tended to reflect wider traffic trends that are visible both in the longer-term data time series and in other parts of London. In some cases these 'background' trends, which continue to develop year-on-year, are now becoming the more pervasive influence on traffic and other patterns, rather than charging itself, and this tendency is apparent throughout this report. In most cases, however, charging-related impacts have either contributed significantly to positive background trends (such as reduced road traffic accidents and vehicle emissions), or reversed, to some degree, negative background trends (such as the tendency towards increasing in congestion throughout London).

The scale of the monitoring work in central London in connection with the congestion charging scheme was unprecedented. Many new indicators were measured, and the frequency and intensity of the traffic survey effort was such that patterns and relationships that were previously unrecognised (such as the seasonal variability in congestion levels) became visible for the first time. This provided valuable new insights while at the same time compounding the interpretation task. Furthermore, as time passes since the introduction of the original scheme in February 2003, the data gathered by TfL increasingly reflect the influence of other developments and background trends in central London unrelated to the scheme itself.

To be set against this is the possibility that the introduction of charging and other traffic and transport schemes in London also have effects that develop more slowly over the longer-term. Charging may well have been a factor in people's location and lifestyle choices; but changes that people make in pursuit of these choices, for example, moving employment location, are not often made immediately.

Consequently, although the impacts would not show up clearly in the aggregate traffic and transport data, any interpretation of longer-run or 'background' trends must take them into account. A section of this report takes a retrospective view of the insights gained from the monitoring work and experiences with the original scheme over four years, and begins to address some of these wider issues.

Part 1:

Recent developments with the central London congestion charging scheme

2. Central zone: traffic patterns

2.1 Introduction

This section reviews trends in traffic activity in and around the original central London congestion charging zone during 2006. It builds upon previous analyses and now provides a perspective on four years of operation of congestion charging in central London.

2.2 Developments during 2006

During 2006, the operation of the scheme in central London was largely unaffected by preparations for the introduction of the western extension in February 2007. Following the variations to the scheme in July 2005, in which the basic daily charge was increased from £5 to £8, and the central London bombings at about the same time, 2006 saw no major changes to the operation of the scheme or significant disruption to the transport network.

From late October 2006, residents of the western extension zone and certain clearly defined buffer areas were able to register for their residents' discount for this zone. This also conferred discounted status for trips to, from and within the original central London zone at the discounted charge from the date of approved registration. This would have been expected to lead to some increases to trips in the original charging zone by these residents, perhaps working through to small net increases to traffic in the zone during the latter weeks of 2006.

2.3 Key findings from previous reports

Congestion charging was expected to deliver decongestion benefits by reducing the volume of traffic entering and circulating in and around the central London charging zone during charging hours.

After one year of operation, TfL observed that:

- Traffic had adjusted rapidly to the introduction of charging and there had been few operational traffic problems. Post-charging traffic patterns became established quickly and had remained relatively stable throughout 2003.
- Traffic circulating within the charging zone had reduced by 15 percent during charging hours (vehicle-kilometres driven by vehicles with four or more wheels). Vehicles entering the charging zone during charging hours had reduced by 18 percent (vehicles with four or more wheels). Both of these outcomes were towards the top end of the range of TfL's prior expectation.
- Although overall increases in traffic had been observed on the Inner Ring Road, these were smaller than TfL had expected and were not leading to traffic operational problems on this key diversionary route.
- There was no systematic evidence of significantly increased traffic outside scheme operational hours or in the area surrounding the charging zone. Traffic approaching the zone on radial routes had reduced, and the balance of evidence

was pointing to an overall 'background' decline in traffic in central and inner London.

- On selected local roads in boroughs around the charging zone there was no significant change observed in overall traffic levels.

After two years of operation, TfL observed that:

- Traffic patterns in and around the charging zone had remained broadly stable throughout 2004. The main indicators of traffic volumes were comparable to those recorded in 2003, and therefore the traffic changes observed with the introduction of charging had been maintained.
- The total volume of vehicles entering the charging zone during charging hours during 2004 was identical to 2003, still representing a reduction of 18 percent against 2002 pre-charging levels. Indicators of traffic circulating within the charging zone for 2004 suggested broadly stable or slightly-declining traffic levels.
- Measured vehicle-kilometres driven on the Inner Ring Road fell very slightly during 2004, compared to 2003.
- Volumes of radial traffic approaching the charging zone during Autumn 2004 across a cordon surrounding central London were almost identical to those recorded in 2003 following the introduction of charging, maintaining the reductions observed in relation to 2002.
- Traffic levels on selected local roads in boroughs around the charging zone decreased slightly overall in 2004 compared to 2003.
- There was increasing evidence of small but consistent year-on-year 'background' declines to traffic in central and inner London, complicating the assessment of charging impacts.

Key findings for 2005, after three years of operation of the scheme, increasingly reflected incremental changes such as the increase in the daily charge to £8, and were that:

- The main indicators of traffic volumes were comparable to those previously observed in 2003 and 2004, with evidence of modest overall reductions in traffic coinciding with the increase to the charge in July 2005.
- Counts of traffic entering the central London zone gave an average 'annualised' reduction for 2005 of 3 percent against 2004, notionally representing the impact of the charge increase to £8, which represented an overall reduction of 21 percent compared to pre-charging levels in 2002.
- Available indicators of traffic circulating within the charging zone for 2005 suggested broadly stable or slightly declining traffic levels.
- Measured vehicle-kilometres driven on the Inner Ring Road again fell slightly during 2005, returning to levels closely comparable to pre-charging values in 2002.
- There continued to be no evidence of any adverse traffic impacts on roads surrounding the charging zone, and the previously-noted tendency towards small

year-on-year 'background' declines to traffic in and around central London appeared to have persisted.

2.4 Key findings for 2006

TfL's traffic monitoring has continued throughout 2006, providing a comparable set of indicators to those previously reported.

Key findings for 2006 are that:

- Most key measures are indicating traffic conditions closely comparable to 2005, the balance of evidence suggesting further small incremental declines in total traffic in and around the central London charging zone. The overall patterns of traffic established following the introduction of the scheme in 2003 have again remained largely unchanged.
- The relatively indistinct aggregate traffic volume response to the charge increase to £8 in July 2005, previously noted in TfL's *Fourth Annual Impacts Monitoring Report*, has persisted into 2006, with a general trend towards small increases in non-chargeable vehicles counterbalancing small declines in potentially chargeable vehicles.
- Traffic entering the central London charging zone during charging hours in 2006 was 21 percent lower than before charging in 2002 (vehicles with four or more wheels).
- Road network issues continue to affect the comparability of counts for traffic circulating within the central London charging zone. TfL's assessment is that aggregate traffic circulating in the zone in 2006 was very marginally down on 2005, maintaining the potential benefits from reduced traffic originally seen in 2003 with the introduction of the scheme.
- Traffic on the Inner Ring Road remained stable during 2006, aggregate flows now being virtually unchanged compared to 2002 before the introduction of charging.
- As in previous years, available traffic indicators outside the central London charging zone have continued to indicate small background declines to overall traffic levels, with no evidence of significant adverse effects.

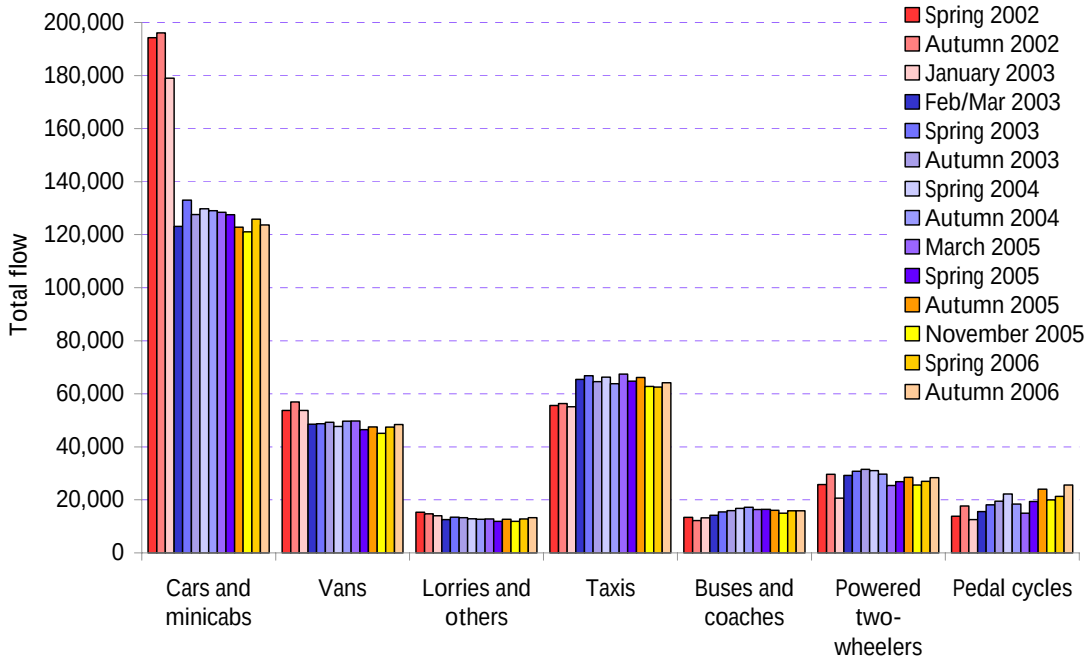
2.5 Traffic entering the charging zone

Comprehensive manual classified counts of weekday traffic entering and leaving the central London charging zone across all road-based entry and exit points are conducted each Spring and Autumn. The combined counts provide an 'annualised' estimate of traffic volumes for each year, ie the average of Spring and Autumn counts in each year. These were complemented by 16 permanent automatic traffic counters located at a sample of high-flow entry points to the zone. Additional manual classified counts have also been undertaken at other times, particularly before the introduction of the scheme in 2002, and before and after the July 2005 Variations to the scheme.

Figure 2.1 shows the available time-series from manual classified counts for vehicles entering the charging zone. Counts relating to the period before charging taken in

2002, those relating to the period of the £5 charge, between February 2003 and July 2005, and those following the July 2005 variations are separately identified.

Figure 2.1 Traffic entering the central London charging zone during charging hours (07.00-18.30).



The overall picture for 2006 is of broadly comparable levels of traffic to previous post-charging years. Headline 'annualised' results for 2006 in relation to pre-charging conditions in 2002 are: reductions of 16 percent in total vehicles, 21 percent in vehicles with four or more wheels and 30 percent in potentially-chargeable vehicles (see also Table 2.1). The significant reductions to traffic entering the original charging zone observed after the introduction of charging in 2003 therefore continue to be maintained.

In relation to the July 2005 charge increase, and noting that this indicator was then counted twice in both Spring and Autumn, traffic entering the zone in 2006 across most vehicle types was slightly higher than in the latter half of 2005, but slightly lower than in the first half of 2005. However, most of these changes are within the statistical precision of this indicator for total traffic of plus/minus 4 percent at the 95 percent confidence level, and normal seasonal variation and on-going background declines to traffic will also be factors. The precise traffic impact of the July 2005 Variations therefore remains relatively unclear in these counts.

Table 2.1 Key year-on-year changes in traffic entering the central London charging zone during charging hours (07.00-18.30).

	Change in inbound traffic				
Vehicle type	2003 vs 2002	2004 vs 2003	2005 vs 2004	2006 vs 2005	2006 vs 2002
All vehicles	-14%	0%	-2%	0%	-16%
Four or more wheels	-18%	0%	-3%	0%	-21%
Potentially chargeable	-27%	-1%	-3%	+1%	-30%
- Cars and minicabs	-33%	-1%	-3%	0%	-36%
- Vans	-11%	-1%	-3%	+2%	-13%
- Lorries and other	-11%	-5%	-4%	+6%	-13%
Non chargeable	+18%	+1%	-4%	-1%	+16%
- Licensed taxis	+17%	-1%	0%	-3%	+13%
- Buses and coaches	+23%	+8%	-4%	+3%	+25%
- Powered two-wheelers	+12%	-3%	-9%	0%	0%
- Pedal cycles	+19%	+8%	+7%	+8%	+49%

Note: values for 2005 in the table above are based on the established 'Spring' and 'Autumn' pair of counts only. To allow examination of the impact of the July 2005 Variations, additional counts for 2005 were undertaken in 'early Spring' and 'late Autumn'. Some changes between 2004 and 2005 quoted in *TfL's Fourth Annual Impacts Monitoring Repo*rt were based on an average of all four counts, and will therefore differ slightly from those quoted in the table above.

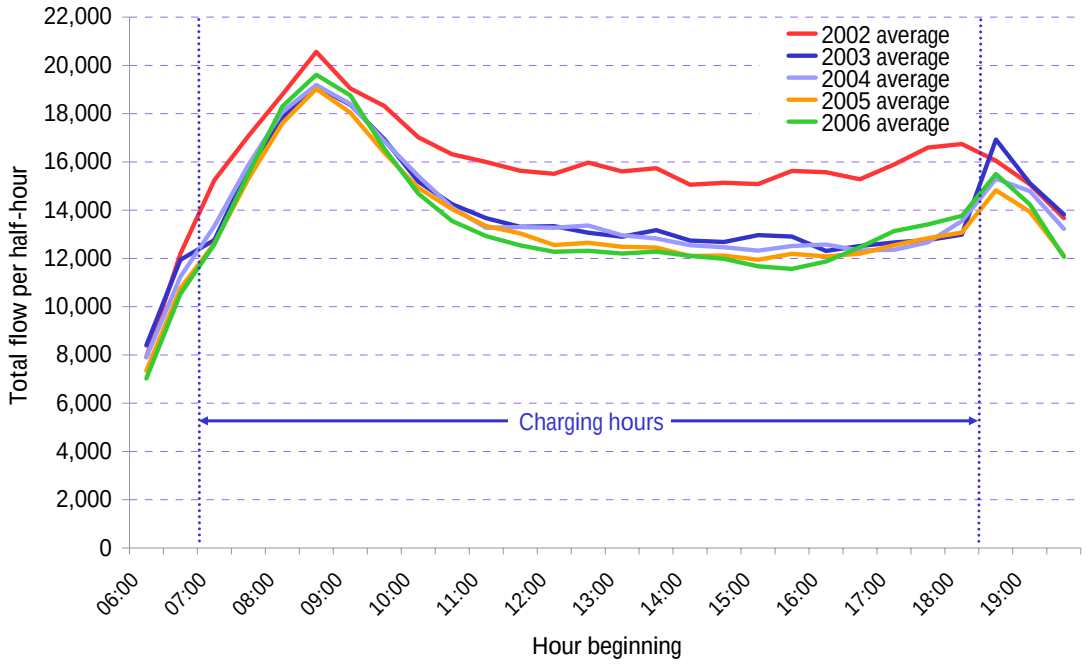
Table 2.2 shows the absolute number and percentage share of total traffic for each of the main types of vehicles entering the central London charging zone during charging hours in 2002 (before charging), 2003 (immediately after charging) and 2006. The immediate impacts of charging in 2003 are clear, in reducing the number and proportion of potentially-chargeable vehicles. Conversely, non-chargeable vehicles such as licensed taxis, buses and two-wheelers have all increased, although in lower absolute terms. Comparing values for 2006 against those for 2003, further declines across most vehicle types are seen, reflecting on-going background declines to traffic in and around central London and factors such as the increase to the charge in July 2005, and perhaps longer-term adaptations to the original £5 charge.

Figure 2.2 shows how volumes of traffic entering the central London charging zone are distributed across the day. Noting that the 'counting day' extends either side of charging hours (from 06.00 to 20.00) and that the five lines represent 'annualised' counts for 2002, 2003, 2004, 2005 and 2006 (comparable Spring and Autumn counts only), the sustained effect of charging in reducing traffic levels is clear, as is the continuing trend of small year-on-year reductions in traffic entering the charging zone.

Table 2.2 Trends in composition of traffic entering the central London charging zone during charging hours.

Vehicle type	2002 Vehicles (000s)	2002 Percentage share	2003 Vehicles (000s)	2003 Percentage share	2006 Vehicles (000s)	2006 Percentage share
All vehicles	378	100%	324	100%	316	100%
Four or more wheels	334	88%	274	85%	265	84%
Potentially chargeable	266	70%	193	59%	186	59%
- Cars and minicabs	195	52%	130	40%	125	39%
- Vans	55	15%	49	15%	48	15%
- Lorries and other	15	4%	13	4%	13	4%
Non chargeable	112	30%	131	41%	130	41%
- Licensed taxis	56	15%	66	20%	63	20%
- Buses and coaches	13	4%	16	5%	16	5%
- Powered two-wheelers	28	7%	31	10%	28	9%
- Pedal cycles	16	4%	18	6%	24	7%

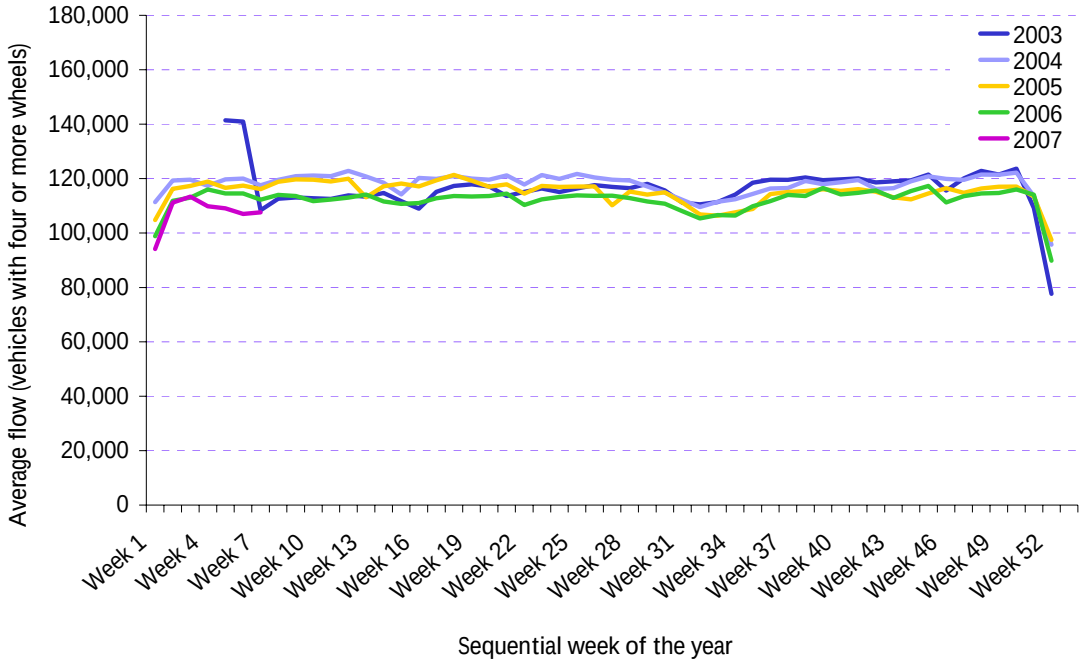
Figure 2.2 Traffic entering the central London charging zone by time of day. Annualised weekdays for 2002 (pre-charging), and 2003, 2004, 2005 and 2006 (post-charging), all vehicles.



In addition to these periodic manual classified traffic counts, traffic entering the charging zone is monitored on a continuous basis using permanent automatic counters at sixteen of the busier inbound roads. These collectively account for over 40 percent of traffic entering the zone during the morning peak period. Although biased towards the busier roads, they nevertheless provide a useful indicator of both short- and long-term variations in traffic entering the zone.

Figure 2.3 shows weekly average daily flows at these 16 locations since shortly before charging began in early 2003. Complete data are shown for every week up until mid-February 2007. At this point, the series was re-based for the introduction of the western extension (see Sections 9 and 14), taking account of the change to the operational hours of the scheme and the inclusion of some additional permanent counters for western extension monitoring purposes.

Figure 2.3 Traffic entering the central London charging zone across 16 busier inbound roads. Average weekly flows, charging hours, vehicles with four or more wheels.



The overall picture is very similar to the manual counts in Figure 2.1, with the initial reductions following the introduction of charging in 2003 clearly visible, alongside a pervasive trend towards small year-on-year reductions to traffic entering the zone for each of the subsequent years. Of particular note is the relatively indistinct response to the increase to the daily charge in July 2005, although the prevailing year-on-year 'background' decline in traffic may in part reflect longer-term responses to both the original £5 charge and the subsequent increase to £8. The unusually low flows at the start of 2007 may in part reflect poor weather conditions.

2.6 Traffic leaving the charging zone

As in previous years, very similar trends in total vehicles and for the individual vehicle types have been observed for traffic leaving the charging zone during charging hours. Figures 2.4 and 2.5 show the available data series, presented firstly by main vehicle type (from manual classified counts) and, secondly, in terms of a profile across the counting day. The shape of the profile in Figure 2.4 (outbound traffic) is noticeably and consistently different from that in Figure 2.1 (for inbound traffic), reflecting the nature of central London as a daytime trip attractor.

It is also noticeable that this indicator is suggesting that total volumes of traffic leaving the charging zone during 2006 were marginally higher than 2005, particularly in the evening peak period.

Figure 2.4 Traffic leaving the central London charging zone during charging hours (07.00-18.30).

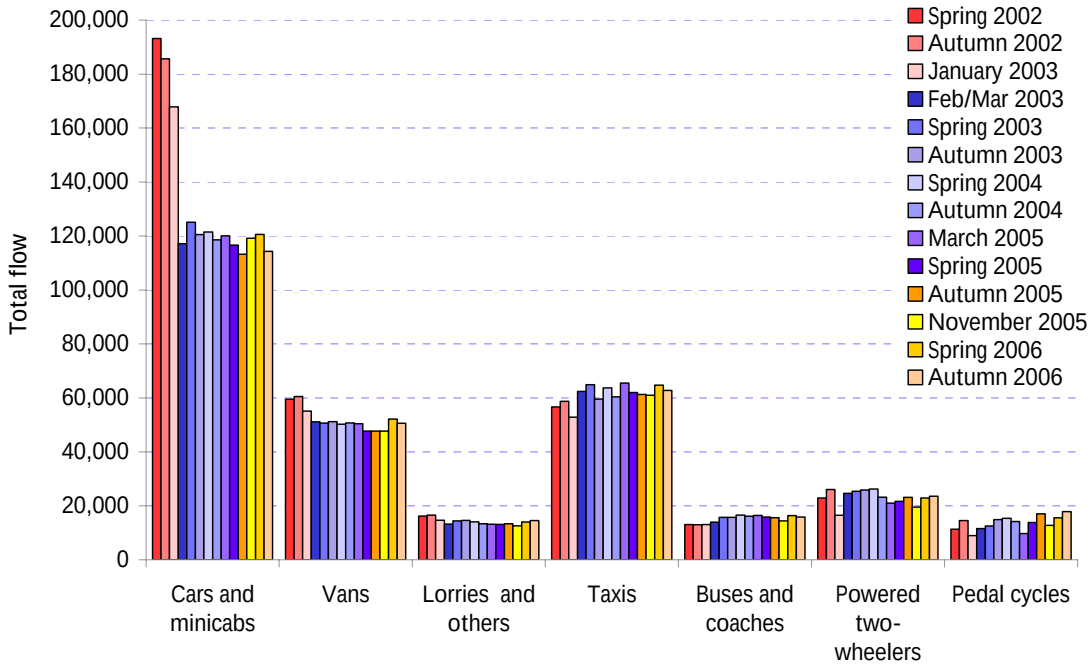
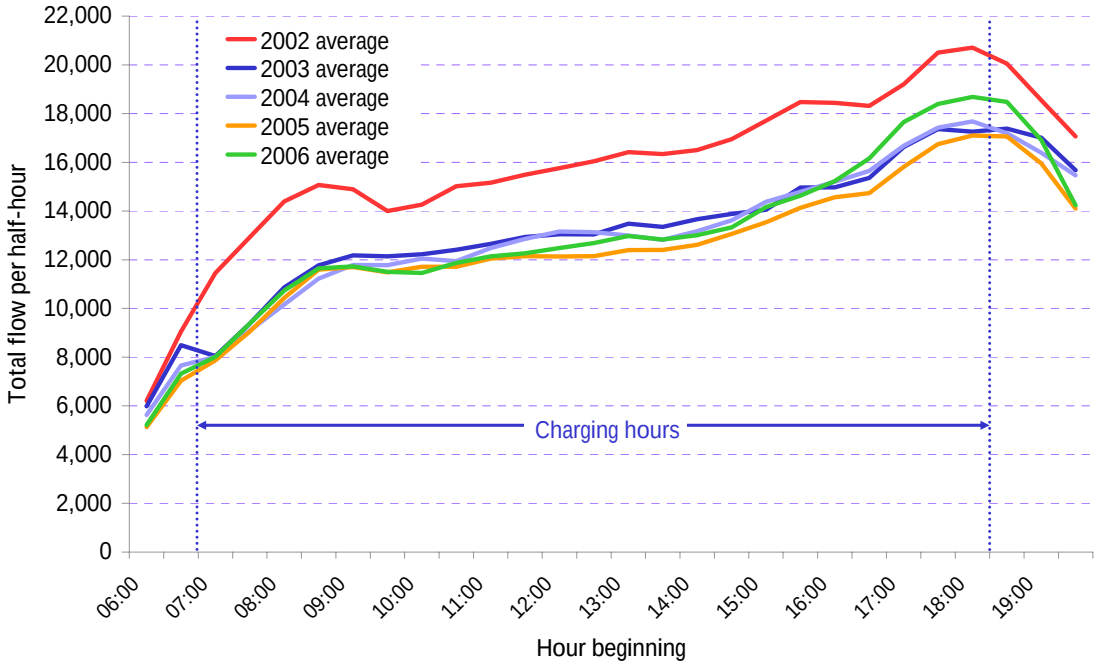


Figure 2.5 Traffic leaving the central London charging zone by time of day. Annualised weekdays for 2002 (pre-charging), and 2003, 2004, 2005 and 2006 (post-charging), all vehicles.



In considering these results for traffic entering and leaving the charging zone it should be noted that:

- The majority of the indicated changes between recent years are not statistically significant at the 95 percent level.
- The overall picture is of strong increases in pedal cyclist numbers since the introduction of charging, although cyclist volumes are particularly affected by variations in the weather at the time that different counts are taken.
- Counts for buses are particularly susceptible to sampling error as these operate to an organised (regular) service pattern, but perhaps also reflect the substitution of conventional buses by larger articulated buses on some routes over the review period.

2.7 Traffic circulating within the charging zone

TfL initially reported a decrease of 15 percent in vehicle-kilometres driven within the charging zone (vehicles with four or more wheels, during charging hours), comparing annualised estimates for 2003 with equivalent estimates for 2002. This was towards the upper end of the range of TfL's prior expectation of between 10 and 15 percent and was confirmed by independent analysis undertaken on behalf of the London boroughs

Counts during 2004 suggested further decreases in traffic circulating within the charging zone, although the available indicators were somewhat inconsistent. TfL's best estimate for 2004 was therefore that the original reductions of 15 percent had been maintained, and had probably intensified slightly during the year. Counts for 2005 suggested little overall change against 2004, despite the expected reductions to traffic following the charge increase of July 2005. TfL concluded that this reflected road network inconsistencies between the 2004 and 2005 counts, and that the indicators for 2005 were probably more representative, suggesting overall reductions of up to 20 percent in traffic circulating within the charging zone (vehicles with four or more wheels) in relation to 2002.

The findings for 2006 for vehicle-kilometres driven within the charging zone are shown in Table 2.3. The table also includes the percentage of total traffic accounted for by each of the main vehicle types as well as data for years from 2002 for comparison. Table 2.4 summarises the year-on-year changes. Note that these are central estimates, subject to significant sampling error.

Table 2.3 Vehicle-kilometres driven (millions) within the central London charging zone and percentage contribution to total traffic during charging hours. Annualised weekdays for 2002 (pre-charging), 2003, 2004, 2005 and 2006 (post-charging).

Vehicle type	2002		2003		2004		2005		2006	
All vehicles	1.64	100%	1.45	100%	1.38	100%	1.40	100%	1.41	100%
Four or more wheels	1.44	88%	1.23	84%	1.16	84%	1.16	83%	1.17	83%
Potentially chargeable	1.13	69%	0.85	58%	0.80	58%	0.79	56%	0.82	58%
- Cars and minicabs	0.77	47%	0.51	35%	0.47	34%	0.47	33%	0.49	35%
- Vans	0.29	18%	0.27	19%	0.26	19%	0.25	18%	0.26	19%
- Lorries and other	0.07	4%	0.07	5%	0.06	5%	0.07	5%	0.07	5%
Non-chargeable	0.51	31%	0.60	42%	0.58	42%	0.61	44%	0.59	42%
- Licensed taxis	0.26	16%	0.31	21%	0.29	21%	0.30	22%	0.29	20%
- Buses and coaches	0.05	3%	0.07	5%	0.07	5%	0.07	5%	0.07	5%
- Powered two-wheelers	0.13	8%	0.14	9%	0.13	10%	0.13	10%	0.13	9%
- Pedal cycles	0.07	4%	0.09	6%	0.09	7%	0.10	7%	0.10	7%

Table 2.4 Year-on-year percentage change in vehicle-kilometres driven within the central London charging zone during charging hours by main vehicle category. Annualised weekdays for 2002, 2003, 2004, 2005 and 2006.

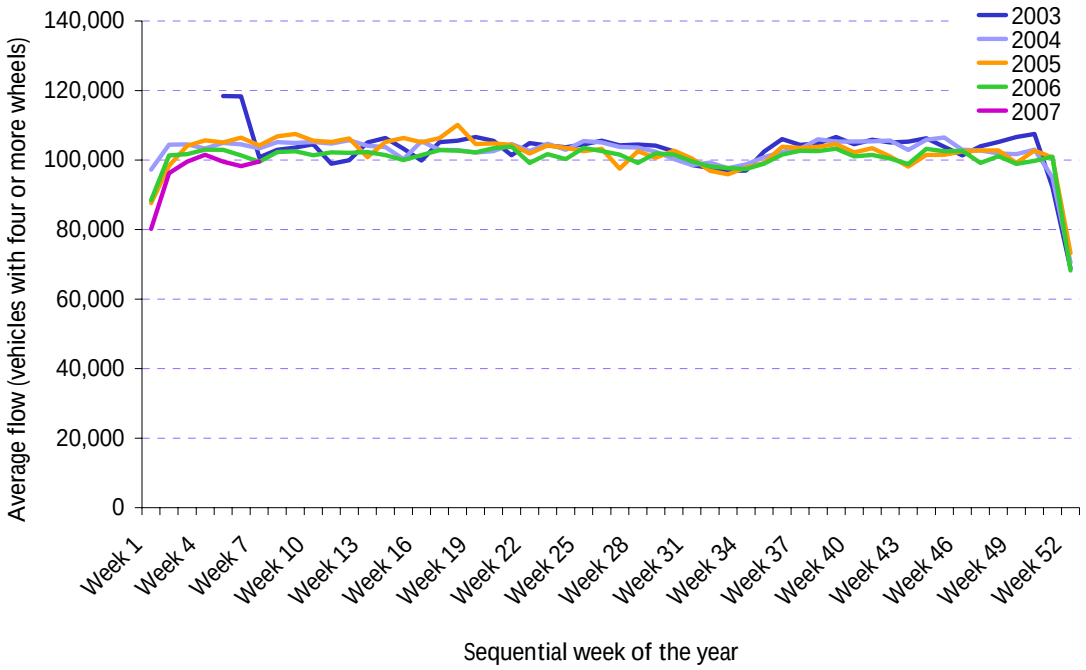
Vehicle type	2003 vs 2002	2004 vs 2003	2005 vs 2004	2006 vs 2005	2006 vs 2002
All vehicles	-12%	-5%	+1%	+1%	-14%
Four or more wheels	-15%	-6%	0%	+1%	-19%
Potentially chargeable	-25%	-6%	-1%	+3%	-28%
- Cars and minicabs	-34%	-7%	-1%	+4%	-37%
- Vans	-5%	-4%	-4%	+3%	-9%
- Lorries and other	-7%	-8%	+8%	+2%	-7%
Non chargeable	+18%	-3%	+4%	-3%	+16%
- Licensed taxis	+22%	-7%	+5%	-5%	+12%
- Buses and coaches	+21%	+5%	-1%	+3%	+25%
- Powered two-wheelers	+6%	-2%	0%	-3%	0%
- Pedal cycles	+28%	+4%	+14%	-2%	+43%

This indicator suggests that traffic circulating within the charging zone in 2006 was very similar to 2005. Most of the indicated year-on-year changes are not statistically significant, although a tendency towards small increases in potentially-chargeable vehicles in comparison to 2005 is noted.

Figure 2.6 shows equivalent data from permanent automatic traffic counters located at a representative selection of sites within the charging zone. Traffic flows are again seen to be similar to those of 2005, although in this case the indicator is pointing

towards small year-on-year decreases in circulating traffic, continuing the established trend. Although the precision of this indicator in terms of traffic at the sampled sites is much tighter than that for the manual counts in Table 2.3, the sites comprising the sample are different, and additional uncertainty arises with both counts in the degree to which the sites counted are representative of total traffic circulating within the central London zone.

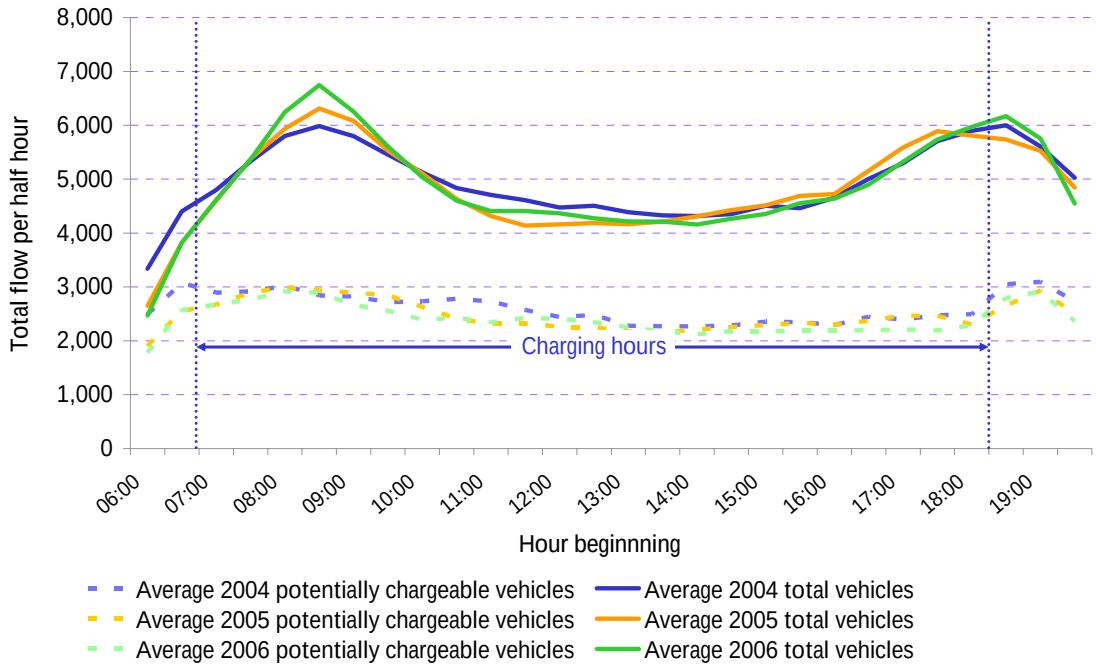
Figure 2.6 Traffic circulating within the central London charging zone across a sample of 15 one-way permanent counting sites. Average weekly flows, charging hours, vehicles with four or more wheels.



Other indicators of traffic within the charging zone are provided by counts of traffic across the six Thames bridges inside the charging zone (the Thames screenline), and also in relation to the portion of the 'northern screenline' that lies within the charging zone to the north of the Thames. TfL's *Fourth Annual Impacts Monitoring Report* noted that both of these indicators were potentially affected by road works during 2005/2006. Results for 2006/2007 are tending to confirm this hypothesis, producing an overall picture that is more in-line with established trends and other indicators of charging zone traffic.

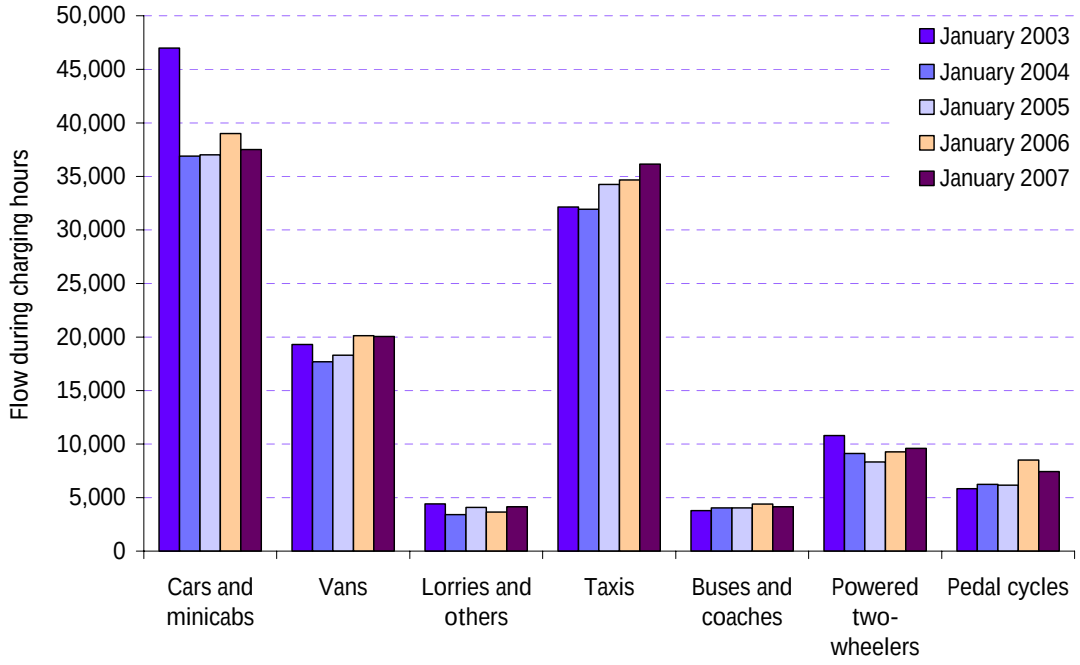
Figure 2.7 shows flows across the Thames screenline within the charging zone by time of day. Total flows in 2006 are broadly comparable to those of 2004 and 2005. However, this disguises possible discontinuities attributable to the prolonged closure of Battersea Bridge (to the west of the charging zone) during 2005, as described in TfL's *Fourth Annual Impacts Monitoring Report*. A tendency towards increased volumes in the peak periods is also noted, perhaps reflecting a similar feature to that noted in Figure 2.5.

Figure 2.7 Flows across the Thames screenline within the central London charging zone, 2004-2006.



Counts of traffic crossing the 'northern screenline', which runs from the Victoria Embankment to near St Pancras station, are taken in January of each year. The observed data series is summarised in Figure 2.8. These exclude flows on the Inner Ring Road itself at St Pancras.

Figure 2.8 Flows across the TfL northern screenline within the central London charging zone. January 2003, 2004, 2005, 2006 and 2007.



The counts for early 2007 suggest very similar flows to early 2006, with most of the indicated changes between these years not being statistically significant. However, looking across the available time series and noting that the 2005 and 2006 counts were thought to be particularly affected by road network changes in the Strand/Victoria Embankment area, it is apparent that this screenline is now tending to indicate substantially increased traffic to that seen immediately after the introduction of charging in early 2004.

Further examination of the site-by-site data (Table 2.5) confirms that major roads in the Charing Cross area carry the bulk of the traffic intercepted by the screenline and that there were substantial increases in the flow on these routes between January 2003 and subsequent years, primarily associated with network changes around Trafalgar Square.

Table 2.5 Change in flow across the TfL northern screenline within the charging zone. January 2003, 2004, 2005, 2006 and 2007 by main vehicle category. Charging hours (07.00-18.30).

Vehicle category	2003 base (pre-charging)	Percentage change 2004 vs. 2003	Percentage change 2005 vs. 2003	Percentage change 2006 vs. 2003	Percentage change 2007 vs. 2003
All vehicles	124,000	-12%	-9%	-3%	-3%
Four or more wheels	107,000	-12%	-8%	-5%	-4%
Potentially chargeable vehicles	71,000	-18%	-16%	-11%	-13%
Non chargeable vehicles	53,000	-2%	0%	+8%	+9%
- Licensed taxis	32,000	-1%	+6%	+8%	+12%
- Two wheels	17,000	-7%	-13%	+7%	+2%

As in previous years, available indicators of traffic circulating within the charging zone for 2006 provide a more mixed picture than those of traffic entering and leaving the zone. Based on the available evidence, TfL concludes that:

- Traffic circulating in the charging zone during 2006 remained broadly comparable to previous years following the introduction of charging.
- Permanent and long-term changes to the road network in the charging zone have increasingly affected the comparability of the counts, leading to a tendency for the individual indicators to diverge in relation to their respective pre-charging baselines, and between individual years in the available time series.
- The data are tending, however, to consistently suggest increases to the numbers of non-chargeable vehicles circulating within the zone. It may therefore be the case that at some locations within the zone, where traffic is particularly dominated by taxi and bus flows, traffic volumes on specific links have substantially increased over the period following the initial post-charging changes,

perhaps reflecting road network changes such as those in the vicinity of Trafalgar Square.

2.8 Traffic on the Inner Ring Road

The Inner Ring Road forms the boundary of the congestion charging zone and is the most obvious alternative route for through traffic wishing to avoid the zone. TfL expected that congestion charging might lead to some increases in traffic on this route, but that any such increases could be dealt with by better operational management, taking account of reduced traffic entering and leaving the charging zone and the consequent scope to re-balance traffic signal settings.

Comparing 2003 (after charging) with 2002 (before charging), TfL had previously reported overall increases in vehicle-kilometres of 4 percent for all vehicles, and 1 percent for vehicles with four or more wheels. It was noted that these measured changes were towards the lower end of TfL's range of expectation, and that congestion on the Inner Ring Road had actually reduced, due primarily to the implementation of effective traffic management on this key route.

Measurements taken during 2004 and 2005 suggested that traffic on the Inner Ring Road during weekday charging hours declined very slightly overall compared to 2003, and that flows in 2005 were very closely comparable with pre-charging conditions in 2002.

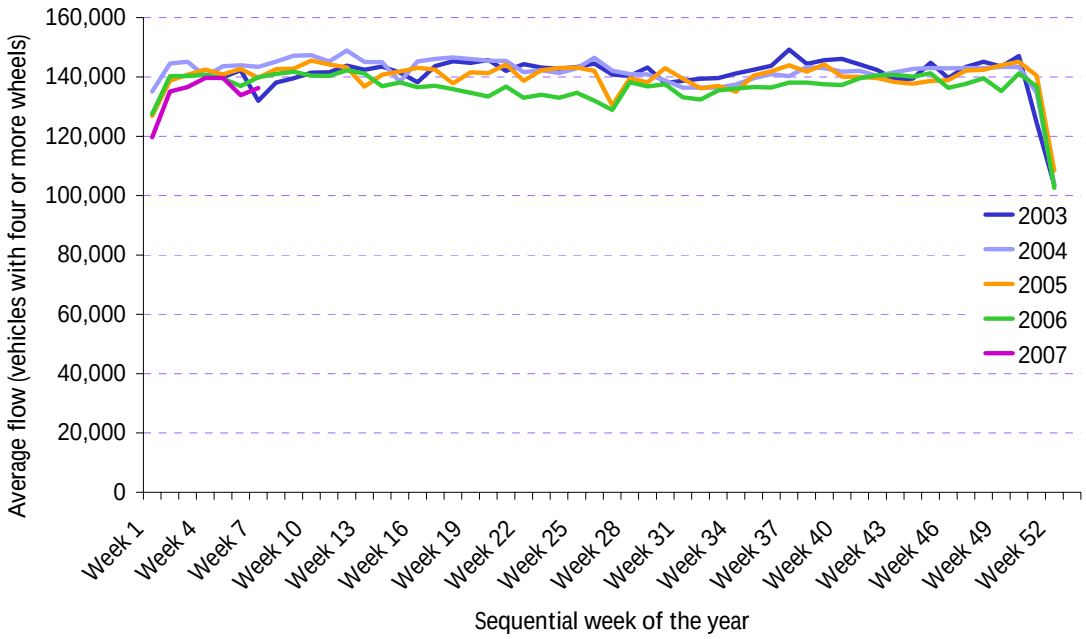
Measurements for 2006 present a similar picture, with no significant changes of note. The values in Table 2.6 are necessarily rounded to two significant figures, in view of the limited statistical precision of this indicator. Comparing un-rounded flows for 2006 with those of 2002, indicated decreases in cars (8 percent), increases in vans and lorries (both up 6 percent), buses and licensed taxis (up 12 and 20 percent respectively) and pedal cycles (up by as much as 80 percent) are particularly noteworthy, if subject to very wide statistical uncertainty. In interpreting these latter changes, it is necessary to bear in mind the varying percentage contribution of each vehicle type to total traffic. Pedal cycles, for example, account for no more than 2 percent of all vehicle kilometres travelled on this route. In addition, the aggregate changes described may conceal local changes of greater magnitude (see, for example, TfL's *Third Annual Impacts Monitoring Report*).

Table 2.6 Vehicle-kilometres driven (millions) on the Inner Ring Road during charging hours. Annualised weekday for 2002 (pre-charging) compared to 2003, 2004, 2005 and 2006 (post-charging).

Vehicle type	2002	2003	2004	2005	2006
All vehicles	0.65	0.68	0.66	0.66	0.66
Four or more wheels	0.61	0.62	0.61	0.61	0.61
Potentially chargeable	0.51	0.50	0.51	0.50	0.49
- Cars and minicabs	0.37	0.35	0.35	0.36	0.34
- Vans	0.10	0.12	0.12	0.11	0.11
- Lorries and other	0.04	0.04	0.04	0.03	0.04
Non chargeable	0.14	0.17	0.16	0.15	0.17
- Licensed taxis	0.08	0.09	0.08	0.08	0.09
- Buses and coaches	0.02	0.03	0.03	0.03	0.03
- Powered two-wheelers	0.03	0.04	0.04	0.03	0.04
- Pedal cycles	0.01	0.01	0.01	0.01	0.01

Data from permanent automatic counters located around the Inner Ring Road show a very similar picture, of continuing stability in total traffic flows (Figure 2.9). The apparent decline in traffic volumes during Spring and early Summer 2006 is thought to be related to temporary roadworks in the King's Cross area. Flows for the latter part of 2006 returned to levels consistent with a continuing small 'background' decline to traffic against 2005.

Figure 2.9 Traffic flows on the Inner Ring Road. Average weekly flows, charging hours vehicles with four or more wheels.



TfL again concludes that, although congestion charging and related infrastructure changes clearly resulted in some re-distribution of traffic on individual links, traffic volumes as a whole on the Inner Ring Road continue to be closely comparable to conditions before charging started in 2002, with no evidence of adverse traffic impacts.

2.9 Radial traffic approaching the charging zone

TfL expected that congestion charging would lead to some reduction in radial traffic on routes in inner London approaching the charging zone, particularly for cars. This would be due to fewer journeys between other parts of London and the charging zone. The primary indicator of this impact is TfL's central London cordon. This cordon was modified for congestion charging monitoring purposes in 2002 to lie wholly outside of the charging zone. The following comparisons are based on this modified version of the cordon, which is counted once per year in the Autumn.

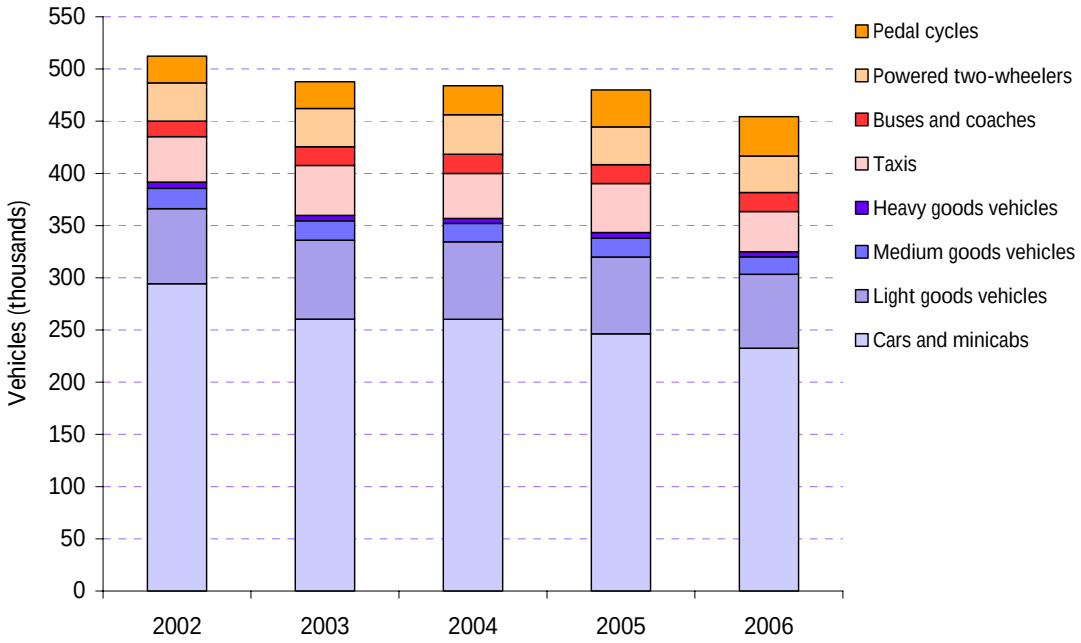
For 2003, TfL had reported overall reductions of 5 percent in inbound traffic with four or more wheels during charging hours against pre-charging levels in 2002. It was noted that the category cars and minicabs had reduced by 12 percent, and that this indicated change was towards the lower end of TfL's expectation for this cordon. Equivalent changes for the outbound direction were again 5 percent and 12 percent.

For 2004, this indicator showed a 1 percent decline in total traffic crossing this cordon during charging hours in both directions in relation to 2003. For 2005 against 2004, the equivalent figures were a 2 percent decrease inbound, and a 1 percent increase outbound. These more recent changes were again indicative of the overall pattern of small background declines in traffic observed elsewhere, but were not of themselves statistically significant.

Figure 2.10 summarises the flows observed in the inbound direction at this cordon between 2002 and 2006. The data for 2006 indicate relatively sharp further declines in comparison with 2005. Vehicles with four or more wheels declined by 7 percent in the inbound direction, and by 5 percent in the outbound direction. Equivalent reductions for potentially chargeable vehicles were 5 percent and 7 percent respectively. The largest indicated percentage reduction was for goods vehicles (down 10 percent). Buses were unchanged in each direction, and increases of 6 percent inbound and 7 percent outbound were indicated for pedal cycles.

The reason for these relatively large year-on-year declines between 2005 and 2006 at this cordon is not clear, particularly as they are not mirrored at the charging zone boundary (see Figure 2.1). The overall trend towards continuing declines to traffic in both central and inner London is, however, a consistent feature across this and other indicators.

Figure 2.10 Traffic at the TfL central London cordon (extended version wholly outside the charging zone). Inbound direction only, charging hours (07.00-18.30). Autumn surveys.



2.10 Traffic on selected local roads

Traffic on a number of roads surrounding the central London charging zone has been monitored at the request of individual boroughs (Table 2.7). These sites do not provide statistical indicators of the overall traffic change within a borough or more widely, and they may also be affected by factors other than charging. However, collectively they are a useful indicator of traffic change on local, mostly orbital, roads surrounding the charging zone that were potentially likely to experience additional traffic as a result of the scheme.

Table 2.7 Traffic changes on selected local roads surrounding the charging zone. Vehicles with four or more wheels, weekday charging hours (07.00-18.30).

Borough and number of sites	2003 vs pre-charging	2004 vs pre-charging	2005 vs pre-charging	2006 vs pre-charging	2004 vs 2003	2005 vs 2004	2006 vs 2005
Southwark (3)	+1%	+1%	0%	-1%	0%	-1%	0%
Kensington and Chelsea (10)	0%	+1%	-2%	+1%	1%	-3%	3%
Tower Hamlets (6)	-8%	-10%	-6%	-7%	-2%	+4%	-1%
Camden (3)	-9%	-10%	-12%	-13%	-2%	-2%	-1%
Westminster (7)	-2%	-2%	-3%	-8%	0%	-1%	-5%
All sites (29)	-3%	-3%	-4%	-5%	0%	-1%	0%

TfL has previously reported that the overall picture at these sites was of slowly-declining traffic, and that there was no evidence from these data of significant

adverse traffic impacts on local roads that might have resulted from charging. The indicators for 2006 continue this trend, with traffic levels on the whole noticeably down on pre-charging values in 2002. This mirrors the general background decline to traffic in central and inner London as highlighted elsewhere in this report.

2.11 Other indicators

Two indicators previously reported in this section – traffic on selected local roads in the London Borough of Wandsworth, and orbital traffic crossing the western radial screenline outside the charging zone – are fully reported in Section 9, as they are particularly relevant to the monitoring of the Western Extension. In summary, however:

- Traffic on selected local roads in Wandsworth (vehicles with four or more wheels) declined by 8 percent overall between 2002 and 2005 (charging hours, vehicles with four or more wheels). This was in contrast to the expectation of possible small increases resulting from traffic making wider orbital movements (beyond the Inner Ring Road) to avoid paying the charge. Aggregate flows for 2006 are effectively unchanged from 2005, now standing 9 percent below pre-charging levels in 2002.
- Traffic crossing the western radial screenline (measuring orbital traffic and now extended for western extension monitoring purposes) has similarly shown small but consistent year-on-year declines.

2.12 Summary of key points

There is now a substantial body of evidence characterising the traffic impacts of congestion charging in central London and the key short and medium-term impacts are now quite clear.

Traffic patterns adapted quickly to the introduction of the scheme. The post-charging period has been characterised by remarkable stability in overall traffic patterns, with a prevailing and long standing trend of 'background' declines to traffic levels in and around central London emerging as a key context to the introduction of the scheme. There remains no evidence of any significant traffic-related problems arising from the scheme. The charge variations in July 2005 appear to have had very little impact on overall traffic levels.

Traffic indicators for 2006 show little overall change on those previously reported. The traffic reduction impacts of charging have therefore been maintained and have intensified during 2006.

As time passes, however, the comparability of established indicators is increasingly being affected by changes to the central London road network. Furthermore, wider influences on vehicle use, travel behaviour and traffic composition, reflecting general economic conditions and the implementation of other elements of the Mayor's Transport Strategy and Borough Plans, are becoming increasingly important in any assessment of traffic trends over the period since 2001.

3. Central zone: congestion

3.1 Introduction

This section reviews trends in congestion in and around the central London congestion charging zone to the end of 2006, updating and extending the material presented in previous annual impacts monitoring reports.

3.2 Developments during 2006

- During 2006, congestion charging has continued to meet its principal traffic and transport objectives; and the scheme continues to operate well.
- As first identified in TfL's *Fourth Annual Impacts Monitoring Report*, there appears to be a longer-term 'background' trend of gradual increases to congestion. This is likely to reflect a combination of traffic management programmes that have contributed to fewer road traffic accidents, improved bus services, a better environment for pedestrians and cyclists, and improvements to the public realm and general amenity. But these interventions have also reduced the effective capacity of the road network to accommodate general vehicular traffic.
- TfL has observed a particular increase in congestion in the central London charging zone during 2006. This has occurred despite the fact that traffic levels have remained stable. Congestion levels are also therefore being influenced by shorter-term interventions that are also affecting the capacity of the road network, particularly an increase in streetworks in the latter half of 2006.
- The impact of congestion charging therefore needs to be assessed in this context. The reduced levels of traffic mean that, when compared to conditions without the scheme, congestion charging is continuing to deliver congestion relief that is broadly in line with the scale of reduction achieved in the first year of operation of the central London scheme – of about 0.7 minutes per kilometre.
- For the reasons set out above, any direct comparison against pre charging conditions needs to be interpreted with caution. However, comparing average congestion levels for 2006 against a pre-charging baseline, congestion was 8 percent lower in 2006. This compares with an average reduction of 30 percent in 2003, the first year of the scheme.

3.3 Key findings from previous reports

The principal objective of congestion charging is to reduce traffic congestion in and around the charging zone, mainly by reducing the amount of traffic moving to, from or through the charging zone in charging hours.

TfL's *Fourth Annual Impacts Monitoring Report* described findings to the end of 2005, drawing principally on moving car observer surveys of congestion in and around the charging zone. Comprehensive data were available covering both the year immediately before the introduction of charging (2002), and almost three full years following the introduction of the scheme to the end of 2005. Supporting data were

available for a longer-term historical time-series, and also from camera-based measurements taken in the charging zone at intervals over the period 2003 to 2005. Section 10 of this report gives an explanation of congestion and how it is measured.

TfL's key conclusions to the end of 2005 were as follows:

- During 2003 and 2004, following the introduction of the scheme, levels of congestion in the charging zone were typically around 30 percent lower than those that applied in 2002. These corresponded to TfL's expectations for the scheme, which was for reductions in the range of 20 to 30 percent, and represented a reduction in delays equivalent to about 0.7 minutes per kilometre.
- During 2005, it became apparent that there was some reduction in the level of decongestion inside the charging zone, such that the average congestion reduction, comparing 2005 with 2002, was 22 percent. Although this was still within TfL's range of expectation, the tendency towards slightly higher excess delays was a consistent feature of the 2005 data.
- It was provisionally concluded that these trends needed to be understood in the context of longer-term trends to congestion in central and inner London. It was thought that they reflected both increased levels of streetworks (which, in later analysis, have been found to be particularly significant in 2006), and progressive adjustments to the effective vehicular capacity of the road network in pursuit of other priorities by the various agencies involved in managing London's traffic over recent decades.
- These other priorities included, for example, improved safety and amenity and increased priority for buses, taxis and cyclists. In simple terms, the moving motor vehicle capacity of the network had been adjusted downwards in favour of the people-moving capacity of the network.
- In view of this longer-term trend, TfL also concluded that comparison of post-charging results against a pre-charging baseline for 2002 was increasingly inappropriate.
- By comparing with an estimated 'without congestion charging' position based on a projection of longer-term trends, TfL estimated that road users in the central London charging zone are still experiencing broadly comparable reductions in the intensity of congestion to those originally experienced, of around 0.7 minutes per kilometre.
- Continuing surveys of congestion on the Inner Ring Road and main radial routes approaching the charging zone suggested that conditions in 2005 remained comparable to 2004, with both networks continuing to show small congestion improvements relative to pre-charging conditions in 2002.
- Measurements of congestion on main roads in inner London (outside the charging zone) for 2005 showed increased congestion relative to previous surveys, with average delays of 1.5 minutes per kilometre, compared to 1.3 minutes per kilometre in 2002. Again, this appears to continue a longer-term historical trend.
- The evidence from traffic volume counts across central and inner London points to a continuing trend of small year-on-year background declines in traffic levels. Given the observed upwards trend in congestion, this suggests that changes to the effective capacity of the road network for vehicular traffic, reflecting

permanent reallocation of road space and – particularly in late 2006 – streetworks is the primary cause of the observed congestion trends since charging was introduced.

3.4 Congestion within the central London charging zone

TfL's *Fourth Annual Impacts Monitoring Report* set out a range of statistics describing trends in congestion inside the charging zone. These had been measured by regular bi-monthly moving car observer surveys, which have continued throughout 2006 into 2007. Key statistics previously reported have been:

- When congestion charging was introduced, TfL expected to observe reductions in congestion of between 20 and 30 percent against a baseline value of 2.3 minutes per kilometre prior to the introduction of congestion charging.
- Surveys in 2003 following the introduction of charging suggested that average delays were then 1.6 minutes per kilometre, representing a reduction of 0.7 minutes per kilometre over 2002, a reduction of 30 percent.
- Equivalent values for the reduction in congestion across the 2004 and 2005 calendar years were 26 and 22 percent respectively, compared with the 2002 pre-charging baseline.

Figure 3.1 Congestion in the central London congestion charging zone during charging hours (07.00-18.30). Moving car observer surveys.

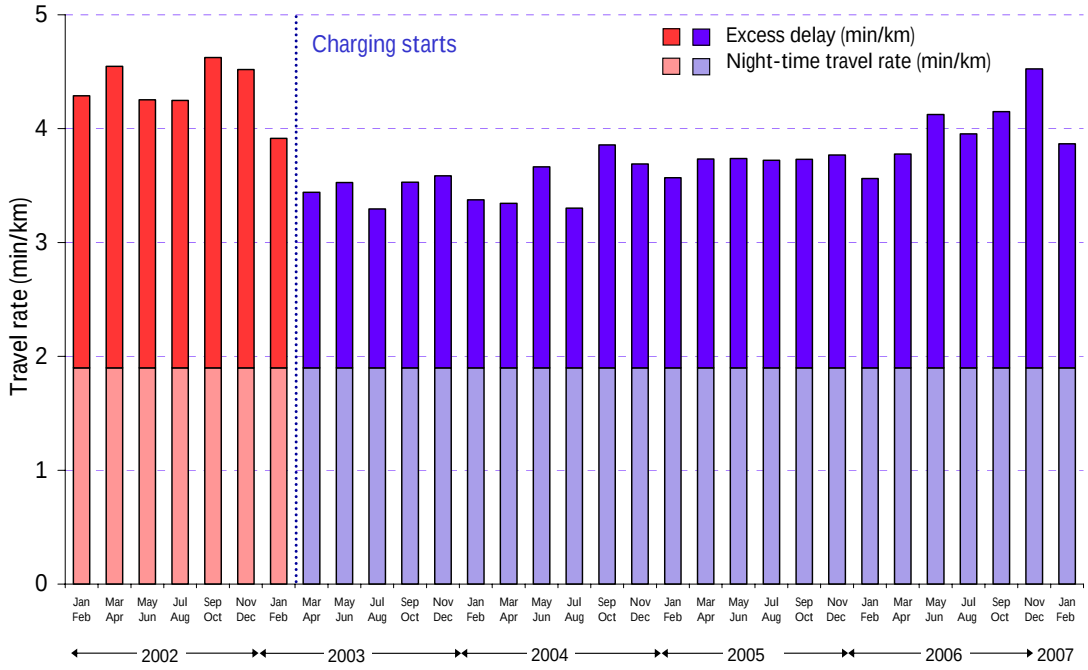
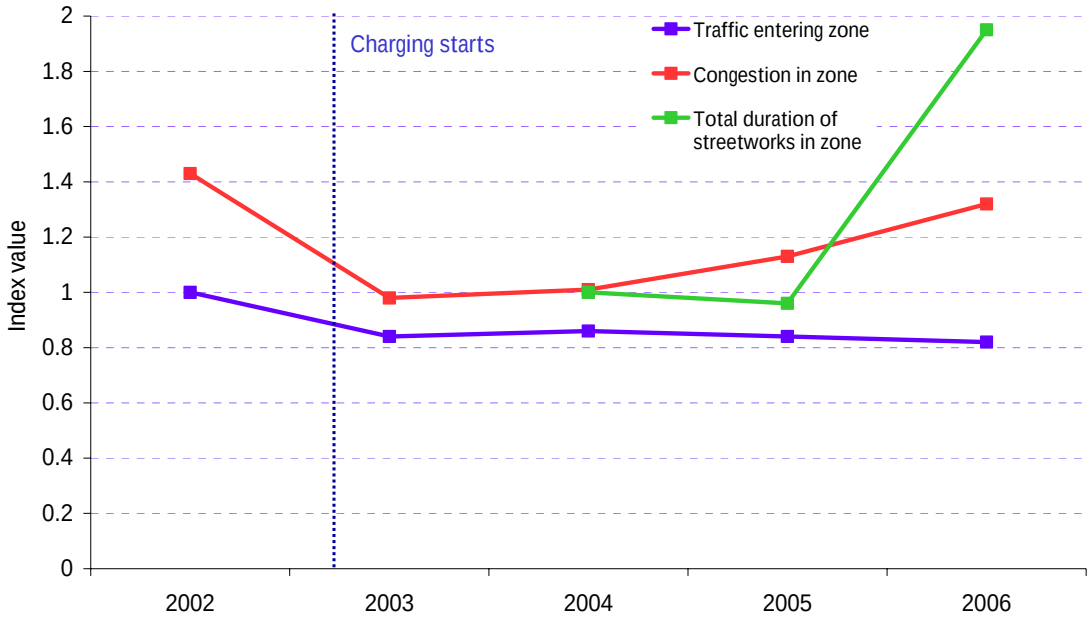


Figure 3.1 shows the updated time series of measurements to the start of 2007. During 2006, despite the continued reduction in traffic, it is apparent that there was a marked increase in congestion compared to 2005 overall. Although surveys in the first four months of 2006 suggested that delays were comparable to those that had applied during 2005, surveys for the remainder of the year suggested that

decongestion benefits were significantly reduced compared to the first two years after the introduction of the scheme.

Figure 3.2 shows that this observed recent increase in congestion correlated closely with a sharp increase in streetworks within the central London charging zone.

Figure 3.2 Indicators of traffic volumes, congestion and streetworks. Central London charging zone.



The figure shows congestion, traffic and street works in the zone, with values averaged on an annual average or total basis and indexed as follows:

- traffic (in terms of four wheeled vehicles entering the charging zone during charging hours) from 2002 (=1.0);
- congestion (in terms of excess delays, minutes per kilometre during charging hours) from 2003, reflecting conditions in the first year after the introduction of charging (=1.0);
- street works (in terms of total duration in hours for these works within the charging zone) from 2004 – the first year for which comprehensive data are available (=1.0).

Looking at this figure:

- The effect of charging on reducing the amount of traffic entering the charging zone is clear. Immediate and continuing reductions of approximately 20 percent are shown.
- The trend in congestion shows the immediate impacts of charging between 2002 and 2003 (note that for statistical reasons index values are not directly comparable with the percentage change figures quoted elsewhere in this report), together with the trend towards increasing congestion in 2005 and 2006.

- The trend for street works (by utilities in particular) shows a very steep rise between 2005 and 2006 (over 90 percent). This reflected the need to replace ageing infrastructure, and corresponded to the sharp deterioration in congestion observed during that year.

More disaggregate analysis of these data show a remarkably close correspondence between the total duration of street works and the observed delay values for successive moving car observer surveys during 2006. There is therefore a close statistical correlation between the increased volume of streetworks and the level of congestion in 2005 and 2006.

Of all roadworks in London, those by utilities account for about one-third, works undertaken by boroughs for general maintenance and improvement account for about half, and TfL works account for about 10 percent. However, the unplanned nature of many utility streetworks can make them particularly disruptive to traffic, and the Mayor has been pressing central Government to introduce regulations that allow better co-ordination of roadworks to reduce their congestion impacts.

The overall conclusion is therefore that an increase in streetworks significantly increased congestion within the charging zone in 2006.

Returning to Figure 3.1, interpretation is complicated by the increase in streetworks in 2006 and to a lesser extent in 2005, and the post-charging time series is too short to establish a long-term trend with confidence. However, from the early post-charging measurements in 2003 to the early part of 2006, the data suggests there was an 'average' increase in congestion of up to 0.1 minutes per kilometre. In the later half of 2006 however, the increase was a further 0.5 minutes per kilometre – a 'step change' in observed congestion levels.

Given the factors set out above, and in particular the marked impact on congestion of streetworks in the second half of 2006, a direct comparison of 2006 congestion levels with the pre-charging baseline is potentially misleading. However, carrying through this comparison gives an average 8 percent reduction in congestion in the 2006 calendar year compared to the 2002 pre-charging baseline, although it should be noted that the intensity of congestion varied considerably throughout 2006.

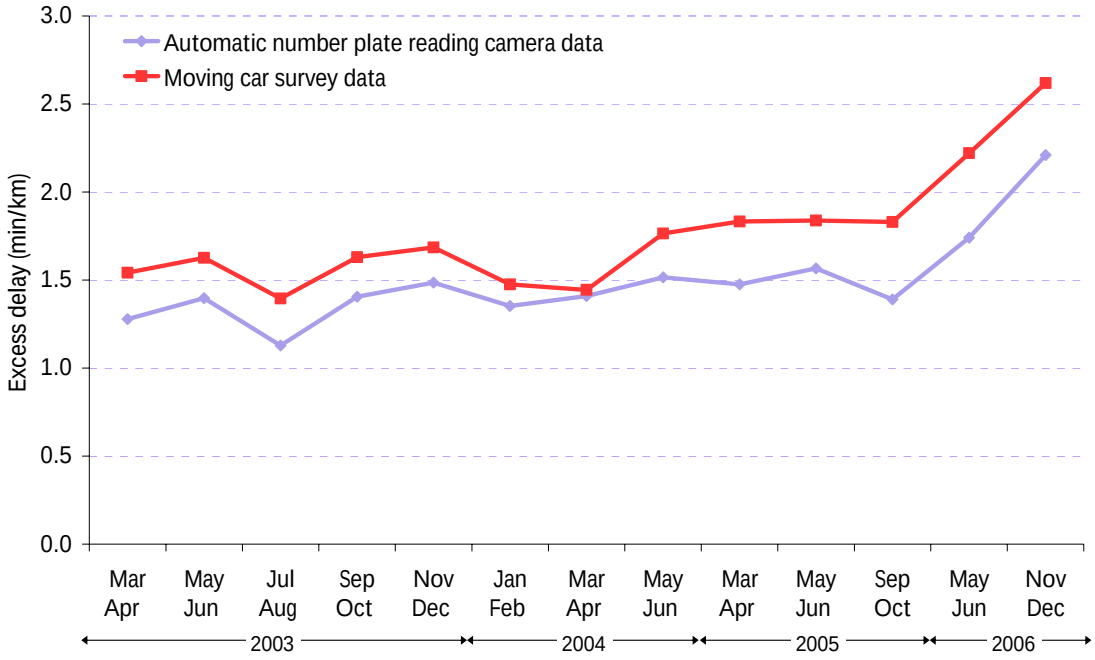
Figure 3.1 also includes a value for the January/February 2007 survey. Whilst this indicates a significantly lower absolute level of congestion than any of the four immediately preceding surveys, the most appropriate comparison is with the surveys at the same date in previous years. In this context, the early 2007 value is seen to be relatively high.

As previously described, data from automatic number plate reading cameras located in and around the charging zone can also be used to derive a second, independent measure of congestion. This works by matching observations of individual vehicles moving between pairs of cameras, where both time and distance are known. This method of measuring congestion has different characteristics to the moving car observer surveys, resulting in different absolute values for average travel times and delays. Automatic number plate reading data tends to indicate slightly lower absolute delays, perhaps reflecting the predominant location of camera sites on the major road

network. It is nevertheless quite clear from Figure 3.3 that these data are indicating a comparable picture in terms of the trend in congestion since the introduction of charging.

The reader should note that the camera measurements used in Figure 3.3 are discontinuous, with periodic camera-based measurements paired with equivalent bi-monthly moving car observer surveys.

Figure 3.3 Congestion in the central London charging zone during charging hours (07.00-18.30). Automatic number plate reading cameras and moving car observer surveys compared.



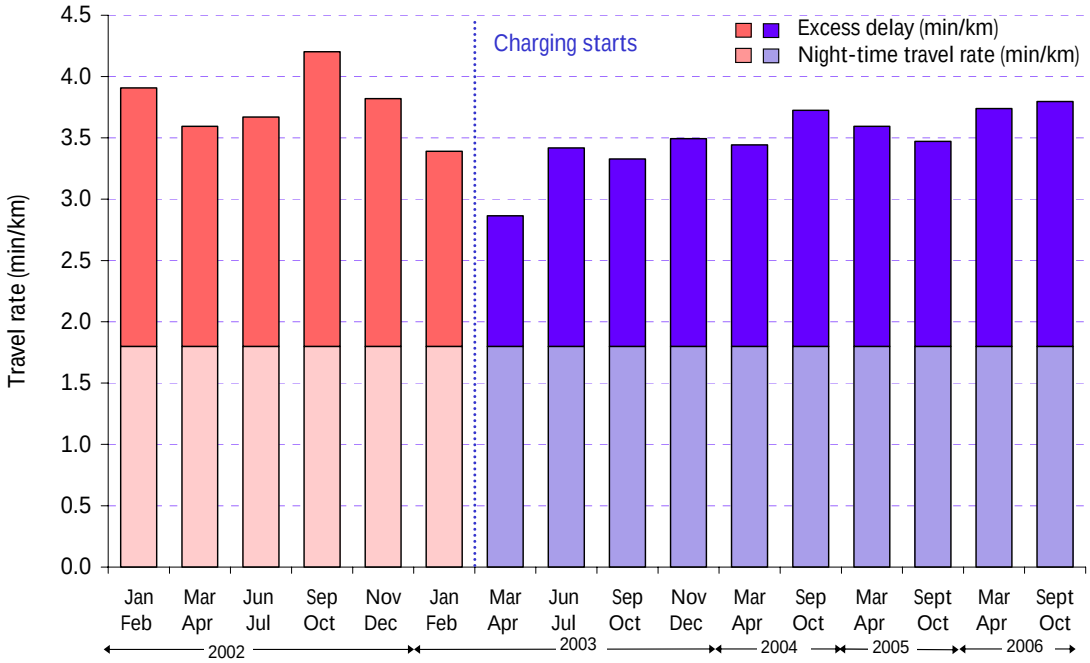
Note that the time-series for this graphic is not continuous. Camera observations have been taken at specific times of the year and paired with appropriate measurements from corresponding moving car observer surveys.

3.5 Congestion on the Inner Ring Road

The Inner Ring Road forms the boundary of the central London congestion charging zone. No charge applies to vehicles using this route. Concerns were raised before the introduction of charging that traffic diverting on to the Inner Ring Road to avoid paying the charge could lead to increased congestion on this important primary distributor road. In the event, improved traffic management arrangements combined with broadly unchanged traffic volumes on this route meant that TfL in fact recorded reductions in congestion of up to 20 percent compared with pre-charging conditions in 2002. Surveys for 2005 reported in TfL's *Fourth Annual Impacts Monitoring Report* suggested that useful gains of up to 10 percent were still being experienced.

Congestion on the Inner Ring Road has been measured by dedicated moving car observer surveys, which have been carried out at intervals since 2002. Ten surveys have now been completed since the start of charging, and these can be compared with the six surveys that were carried out before charging began (Figure 3.4).

Figure 3.4 Congestion on the Inner Ring Road during charging hours (07.00-18.30). Moving car observer surveys.



Delays for the two surveys undertaken in 2006 were 1.9 and 2.0 minutes per kilometre, compared with the pre-charging reference value of 1.9 minutes per kilometre. TfL's assessment would be that in 2006, which as noted above was affected by an increase in streetworks, conditions on the Inner Ring Road were closely comparable to those that applied before the introduction of charging. It is noteworthy that vehicle-kilometres driven on this route in 2006 were also closely comparable to pre-charging conditions (see Table 2.6), but this has also been the case for much of the period following the introduction of charging.

Conditions on the Inner Ring Road in 2002 before the introduction of the central London scheme were particularly affected by major infrastructure schemes such as Vauxhall Cross and the 'Shoreditch Triangle' scheme. Discounting both 2002 and the first survey following the introduction of congestion charging, there is also some evidence of slightly increasing congestion on the Inner Ring Road. However, the available data for 2006 do not yet allow any trends to be explored further.

3.6 Congestion on radial routes approaching the central London charging zone

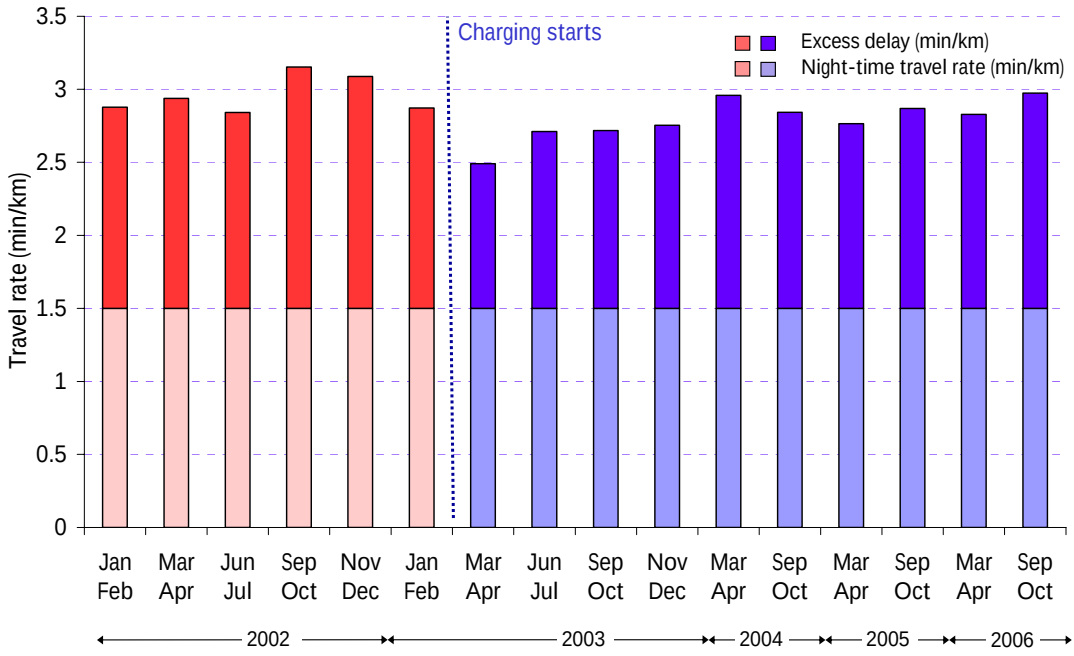
Congestion on main radial routes approaching or leaving the charging zone has been surveyed as part of the intensified moving car observer survey arrangements for the Inner Ring Road. These surveys cover a representative selection of main radial routes up to a distance of three to five kilometres from the charging zone. They are intended to measure any effects arising from changes to traffic moving to and from the charging zone (Figure 3.5).

For the purpose of this report, the measured night-time travel rate for main roads in inner London of 1.5 minutes per kilometre is used to represent uncongested conditions, giving a representative value for congestion (ie excess delay) before charging, during charging hours, of 1.5 minutes per kilometre.

The 2003 post-charging surveys saw decreases in congestion on these roads averaging 0.3 minutes per kilometre (reductions of up to 20 percent), with typical delays during charging hours averaging 1.2 minutes per kilometre. Surveys undertaken during 2004 and 2005 produced more mixed results, but all returned values below the pre-charging representative value of 1.5 minutes per kilometre, indicating continuing small gains on these routes.

Two surveys were undertaken during 2006. These continue to indicate some small gains over pre-charging conditions, with average delays of 1.4 minutes per kilometre. Again however, discounting 2002 and the first survey after the introduction of charging, both of which may have been atypical, there is some suggestion of a trend towards slightly increasing congestion here.

Figure 3.5 Congestion on main radial routes approaching the central London charging zone during charging hours (07.00-18.30). Moving car observer surveys.



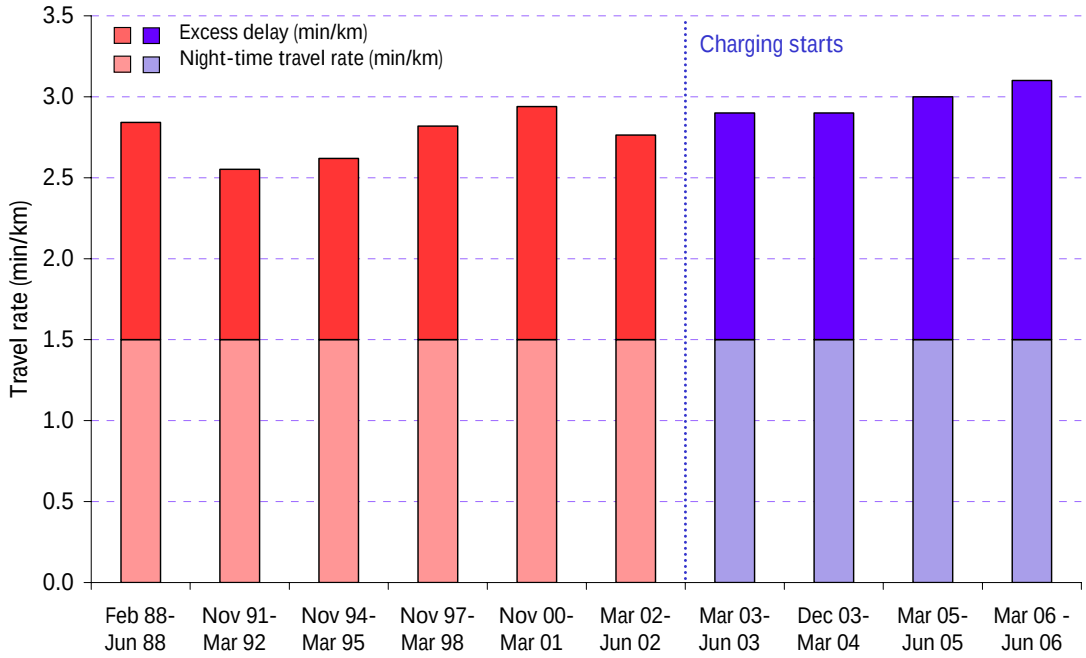
3.7 Congestion on main roads in inner London

Inner London in this context covers the network of main roads outside the Inner Ring Road and its immediate environs, but within the North and South Circular Roads. TfL expected some reductions in congestion in inner London outside the congestion charging zone. These would arise from reduced overall traffic volumes, reflecting lower volumes of travel to and from the zone.

Surveys of night-time travel rates returned a value of 1.5 minutes per kilometre, representing notional free-flow speeds of around 40 kilometres per hour. TfL estimated representative pre-charging delays to be around 1.3 minutes per kilometre.

Surveys have been undertaken every year since the introduction of charging, and all have indicated levels of congestion that are higher than the pre-charging reference value (Figure 3.6). The latest survey for 2006 continues this trend, with indicated delays of 1.6 minutes per kilometre – some 0.3 minutes per kilometre or 23 percent higher than the pre-charging reference value. Once again, there is the suggestion of an 'average' increase in congestion of around 0.1 minutes per kilometre per year, occurring alongside stable or declining traffic levels.

Figure 3.6 Congestion on main roads in inner London 1988 to 2006. Charging hours equivalent. Moving car observer surveys.



TfL's assessment would be that this survey is now also tending to reflect a wider trend across central and inner London towards increased congestion, although the picture is confused by the different 'seasons' during which historic surveys have been carried out. Again, this apparent trend appears to be unrelated to changes in traffic levels and to any effects of congestion charging. It most probably therefore reflects changes to effective road network capacity.

3.8 Congestion on main roads in outer London

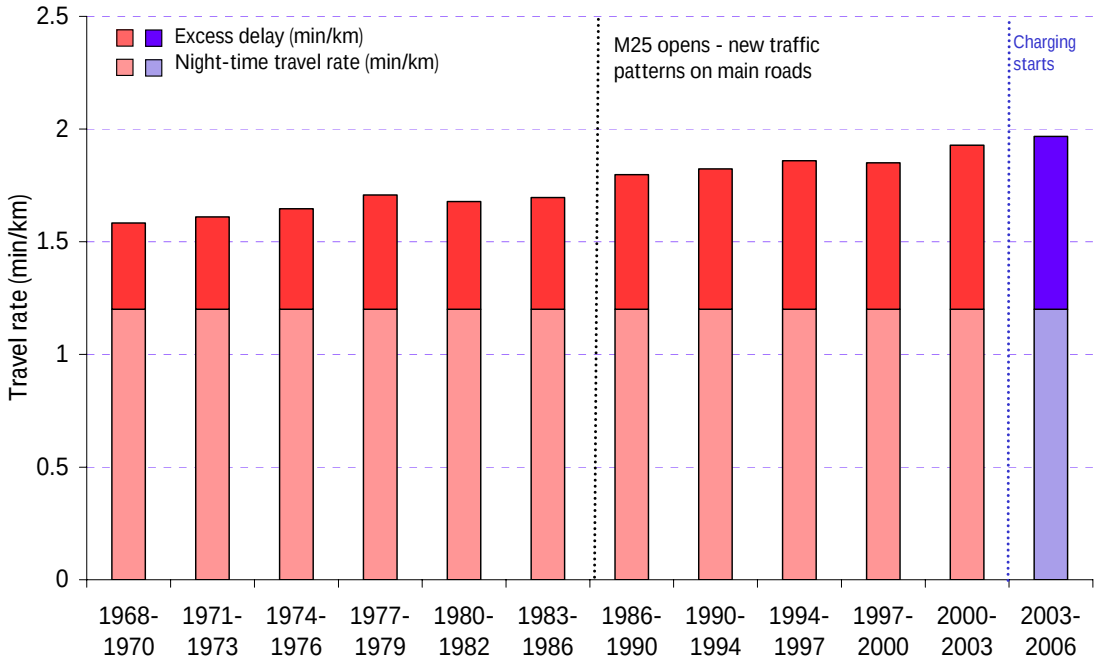
Although not part of the congestion charging monitoring work, TfL continues to undertake periodic moving car speed surveys on the network of major roads in outer London – between the North and South Circular Roads and the Greater London boundary. The available historic time-series for these measurements is shown in Figure 3.7, as they are relevant to an understanding of recent congestion trends in and

around the congestion charging zone. The surveys have been undertaken on a three to four year cycle.

The most recent (2001) night-time survey of this network returned a representative value for travel rates under uncongested conditions of 1.2 minutes per kilometre, equivalent to an average speed of just over 50 kilometres per hour.

In terms of excess travel rate, the pattern is one of consistent progressive increases. Congestion has increased by about 50 percent since the early 1970s but this is from a much lower base, reflecting lower intensities of congestion overall. Congestion trends in outer London over recent decades have nevertheless shown a similar pattern to those in central and inner London. Here the 'average' absolute increase in congestion in recent years has been somewhat smaller – around 0.03 minutes per kilometre per year.

Figure 3.7 Congestion on main roads in outer London. Charging hours equivalent. Moving car observer surveys.



3.9 Relationship of congestion to traffic volumes

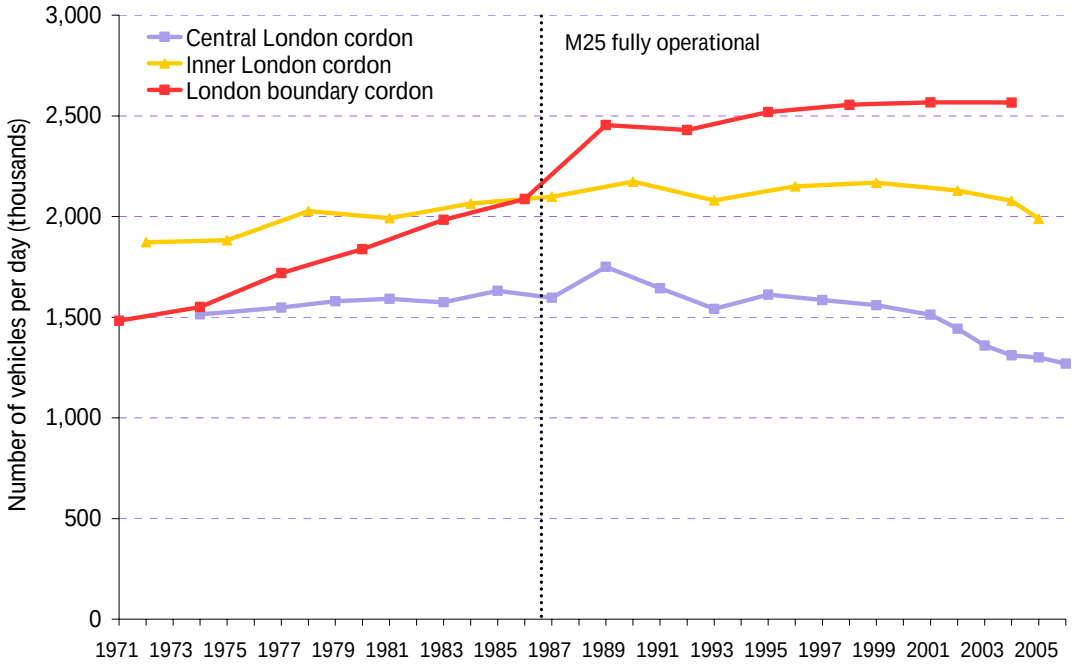
If the effective capacity of the road network remained stable, then trends in travel rates and hence congestion would be expected to directly reflect changes in traffic levels.

TfL's *Fourth Annual Impacts Monitoring Report* reviewed long-run traffic trend data and observed that increases in congestion, at least in central and inner London, were generally occurring in the context of long-term 'background' declines to traffic volumes. Figure 3.8 updates this analysis to include new traffic flow data for 2005 and 2006.

The overall trend for traffic levels during working weekdays shows a continuing trend of small year-on-year reductions to traffic entering and leaving central London and inner London. The trend for traffic crossing the outer London cordon during the 1980s reflected changes related to the opening of the M25.

Data for recent years shows that traffic growth here has now virtually levelled off. However, Figure 3.8 shows that the rate of decrease in average speeds in outer London has been relatively consistent for the past three decades, despite the much larger variation in traffic levels during the 1980s, significant enhancements to capacity at this time, and the comparative stability of both in more recent years.

Figure 3.8 Long term traffic trends across three strategic cordons in London.



3.10 Summary of recent trends

- Congestion data for 2006 for central and inner London shows an increase in congestion of a significantly greater magnitude than the gradual 'background' trend recognised in TfL's *Fourth Annual Impacts Monitoring Report*. This probably reflects a particularly high number of roadworks in the latter half of 2006, particularly in central London.
- Comprehensive traffic counts in and around the charging zone (see Section 2 of this report) suggest that this intensification of congestion was not directly related to traffic volumes, which are themselves continuing an established 'background' trend of small year-on-year declines.
- Taken alone, the 2006 surveys for the charging zone show a sharp deterioration in network conditions against previous years, such that average congestion across the year as a whole was 8 percent lower than the pre-charging reference value. This compares to an average 22 percent reduction for 2005 and a 30 percent reduction for the first two years following the introduction of charging.

- These observations for the congestion charging zone are supported by independent trend data derived from congestion charging automatic number plate reading cameras.
- Surveys of congestion on the Inner Ring Road and main radial routes around the charging zone are showing some signs of mirroring the wider trend towards increasing congestion, although conditions here remain comparable to, or marginally better than those in 2002 before the introduction of charging.
- Latest results for major roads in inner London show that delays to road users here are now about 10 percent higher than typical values before 2003, despite falling traffic volumes. Conditions here may also have been influenced by decreasing effective network capacity due to permanent and short-term interventions, although TfL have not yet examined the available data for this area in detail.
- Data for congestion on main roads in outer London post-dating the opening of the M25 mirrors the trends seen in inner and central London, though the available data points for this cover 3 years and therefore are only of value in assessing long term trends.

Furthermore, as described elsewhere in this report:

- Reliability of bus services in central London remains significantly improved over conditions before 2003. However, data for the average speeds of buses in and around central London, described in Section 4 of this report, also shows a consistent trend towards lower average speeds. Although bus speeds are in part influenced by a different set of factors to general traffic, the prevailing trend is similar to that for traffic more generally.
- Baseline congestion data has been compiled for assessing the impacts of congestion charging in the western extension zone, and this is discussed further in Section 10 of this report.

3.11 Interpretation

TfL's *Fourth Annual Impacts Monitoring Report* explored these recent trends in congestion. It was noted that the causes of these trends were likely to be complex and multi-faceted, such that it would not be feasible to arrive at a definitive understanding in the medium-term. Substantial further research would be required, and TfL was putting in place several initiatives towards this end.

In summary, TfL's *Fourth Annual Impacts Monitoring Report* concluded that:

- A trend towards slow, 'background' increases to congestion is a long-term and widespread phenomenon that can be traced back two decades or more.
- It was not, at least in recent years, directly related to changing traffic volumes on the road network.
- It therefore appeared to be primarily a manifestation of reduced effective capacity on the road network, ie the achievable vehicle throughput of the network.
- Conditions in the central London congestion charging zone in 2006 appear to have reflected an additional set of factors, causing conditions to deteriorate much more sharply, unlike the gradual long-term trend. A key factor in 2006 that is

correlated with the observed congestion measurements over this period is increased streetworks, as discussed above. Whilst many of these works are essential, improved coordination would help reduce their traffic impacts.

- The balance of road network management by highway authorities over recent years has seen increasing interventions designed to bring about a better balance between all users of the road network. These have included, but were not limited to: widespread use of traffic control and road safety measures; measures to assist pedestrians and cyclists at junctions; bus priority measures and increased bus activity and patronage. All of these contribute to achieving the wider goals of the Mayor's Transport Strategy, although TfL is only directly responsible for implementing a fraction of these interventions.
- Most of these interventions have also had beneficial impacts, either directly to selected users of the road network or more generally. Beneficial trends such as the dramatic reductions in reported road traffic accidents in London are at least in part a result of some of these measures, and are explored elsewhere in this report.

Many of these interventions would probably have occurred – to a lesser or greater extent – irrespective of the introduction of congestion charging, and indeed the major interventions in central London, such as part pedestrianisation of Trafalgar Square, preceded charging (albeit they were planned with the impacts of charging in terms of reducing traffic in mind).

Furthermore, the traffic reductions brought about by congestion charging have meant that the impacts on congestion of roadworks and in particular the sharp increase in streetworks in 2006, has been much reduced compared to a non-charging scenario.

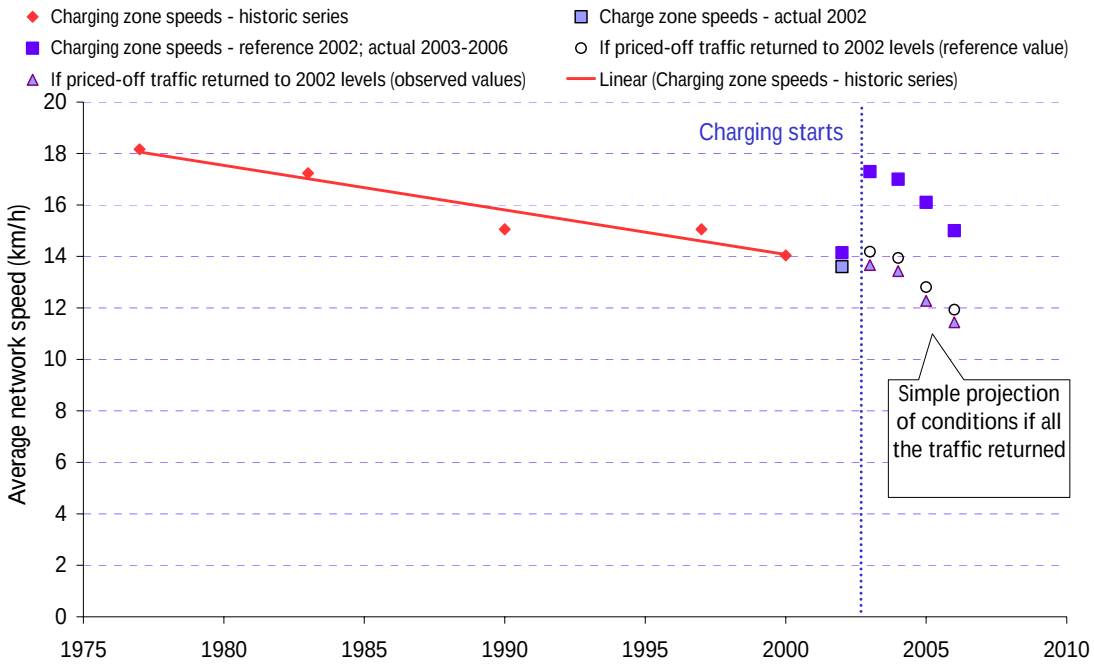
Figure 3.9 compares observed conditions in the central zone (in terms of average network speeds) over recent years with a simple projection of what conditions might have been like had charging not been introduced in 2003. The figure also shows the long-term historic trend towards increased congestion in central London. It is seen that:

- The trend towards increased congestion or reduced average network speeds is a long-term feature of the central London road network. Average network speeds during 'charging hours' in 2002 were about 14 kilometres per hour.
- The introduction of congestion charging in 2003 substantially increased speeds and reduced congestion almost overnight, bringing average network speeds during charging hours back to levels last seen in the early 1980s, at approximately 17 kilometres per hour.
- Since 2003, average observed charging hours speeds have progressively fallen back, to about 16 kilometres per hour in 2005 and 15 kilometres per hour in 2006. Given the impacts of streetworks in 2006, this latter figure should not necessarily be regarded as typical of the long term trend.
- Assuming that similar road network conditions prevailed but that charging had not been introduced, the graphic shows that network speeds in the years after charging would be substantially below those observed, with projected average speeds in 2006 perhaps being as low as11.5 kilometres per hour. This would be

equivalent to a congestion level of over 3 minutes per kilometre, compared with average observed delays of 2.1 minutes per kilometre.

- However, this simple projection may be something of an over-estimate because it does not take into account the possible wider implications of reduced network capacity for traffic levels. Nevertheless, it does suggest that in 2006, users of the road network in the charging zone were probably experiencing effective reductions in congestion comparable to those originally reported by TfL after the introduction of the scheme, with relative savings of around 0.7 minutes per kilometre against equivalent conditions in 2006 in the absence of charging.
- Analysis of recent trends for congestion in inner London reveals a broadly similar picture.

Figure 3.9 Long-term trend in traffic speeds and congestion in the central London charging zone. Charging hours equivalent. Moving car observer surveys.



3.12 Analysis

TfL has continued to investigate these trends under three broad headings:

- nature of increased congestion;
- relationship to known interventions;
- a network capacity inventory framework.

Nature of increased congestion

Congestion varies continuously, both spatially and temporally. Concentration of the trend towards increased congestion in one area, or one particular time period, may provide insight into the causes. The disaggregate data from moving car observer surveys allow some examination of these possibilities, but they are limited in this regard in two related ways:

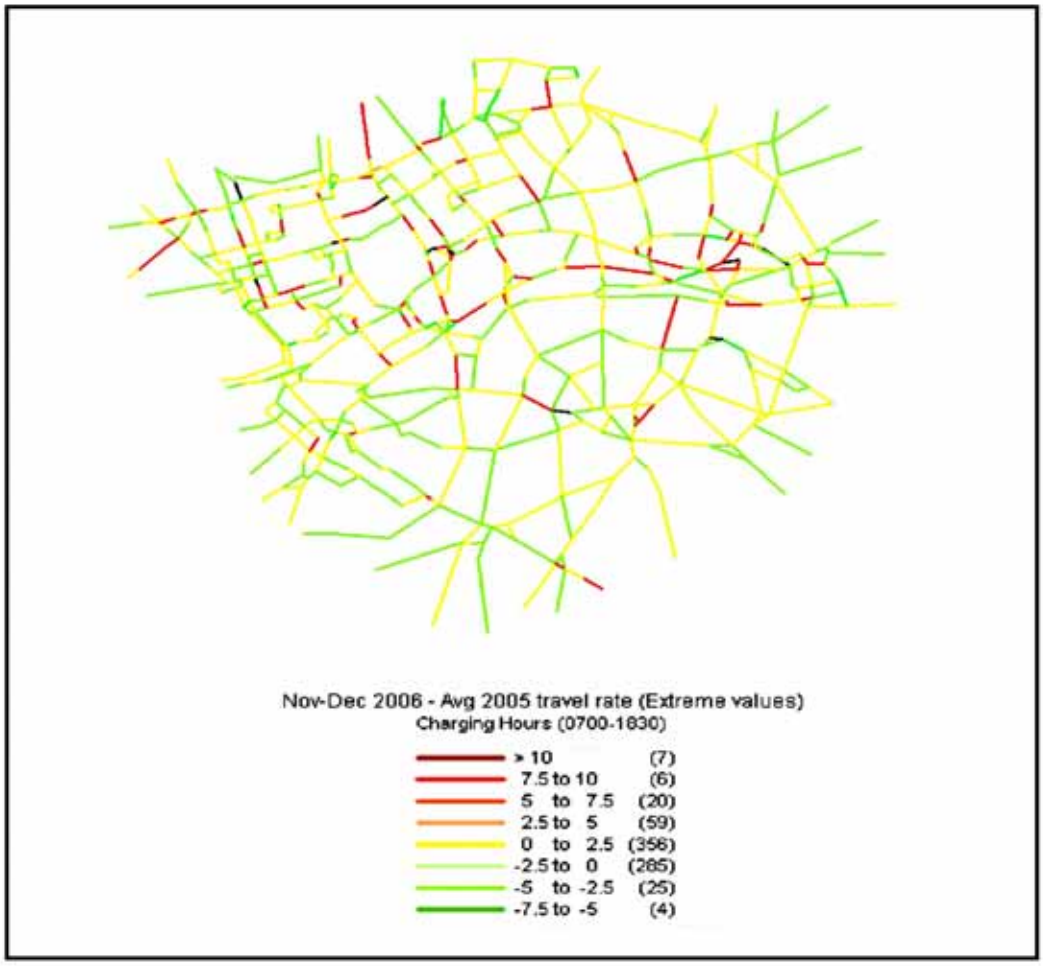
- The surveys are optimised to give a medium-run view of average speeds across the network of interest. Therefore, observations on each link would be subject to considerable 'natural' variability reflecting normal minute-by-minute changes in prevailing traffic conditions, as well as normal statistical sampling error.
- A possible solution to this is to aggregate data from several surveys to give a potentially more robust estimate. However, the tendency here is then for the differences in repeated measurements for the same link to cancel each other out. This is an intended effect at the network wide level. In trying to identify specific locations or time periods with disproportionate change it can however disguise the variations in which we are interested, particularly for shorter-term incidents such as streetworks.

Nevertheless, a number of exploratory analyses are possible. Highly-averaged comparisons between different surveys and repeated, more disaggregate, comparisons between sequential surveys, tend to suggest the following:

- At the more aggregate level, the tendency towards increased delays is widespread and general across the network, rather than being concentrated in particular 'hot-spots'.
- Having said this, disaggregate comparisons suggest that each individual survey is characterised by (often small) parts of the network that show much higher delay values than in comparable surveys at other times.
- Between successive surveys, these 'hot spots' tend to 're-locate' around the network, partly giving rise to the more general effect seen in the more aggregate comparisons.
- It is possible, over successive surveys, to begin to identify areas of the charging zone where these effects are relatively more pronounced, but these localised effects are not very distinct.

Figure 3.10 presents an example of this type of analysis. It shows a comparison of average results from all six moving car observer surveys for 2005 against the individual survey for November/December 2006. The data are for charging hours, and represent an aggregation of 24 individual runs for the 2005 average, and four individual runs for the November/December 2006 average. Individual links are colour coded according to the difference (in minutes per kilometre) between the two sets of average total travel rates (as opposed to delays). The delay value for November/December 2006 indicated the highest level of congestion seen since the introduction of charging, and the figure therefore shows how conditions differed across the network during this relatively extreme period compared to average conditions for the whole of 2005.

Figure 3.10 Excess travel rate for November/December 2006 moving car observer survey compared with average delays for 2005 (all surveys). Difference in congested travel rate.



The following key observations are made:

- Links with positive values (increased congestion) are much more widespread than those with negative values.
- However, the majority of these links with positive values have only small increases on the average value for 2005. Furthermore, as maximum vehicle speed (ie the minimum achievable travel rate) is relatively constrained in comparison with maximum possible delay (ie the maximum observed travel rate), the scope for 'improvement' in any particular comparison is limited, and the ranges used for the graphic would tend to visually over-state the magnitude of the deterioration.
- Bearing in mind the tendency of interventions at particular points to cause delays on surrounding links in the local network, this tends to substantiate the observation that increased congestion is a fairly general effect across the whole network, rather than being exclusive to specific 'hot spots'.
- Extreme positive values (increases in congested travel rate of greater than 5 minutes per kilometre on a link by link basis) are observed in several locations. The incidence of these extreme positive values is an expected feature of these

comparisons, as they partly reflect normal variability between surveys, where certain links are affected by significant road works for example. It is however notable that those in the graphic correspond to areas of known works-related disruption at the time of the November/December 2006 surveys: Tottenham Court Road, Victoria Embankment/Lower Thames Street and parts of the network in the City of London.

Relationship to known interventions

The *Fourth Annual Impacts Monitoring Report* identified four key groups of interventions on the road network that would be expected to have reduced effective capacity for general traffic. Subsequent research by TfL, further to the Network Capacity Inventory initiative outlined below, has broken these down into twenty or so more specific types of intervention that are known to have been widespread in central and inner London in recent years. These can loosely be classified as:

- permanent (eg public realm schemes or carriageway re-modelling such as bus lanes);
- long term (eg new traffic signals or substantial alterations to signal timings);
- short term (eg the more significant streetworks, including utility works);
- transient (eg short term road works or accidents and incidents);
- traffic-related (mainly changes to the composition of traffic including more taxis, articulated buses and more activity by two-wheeled vehicles).

It is likely that:

- All of these interventions would contribute to some degree of reduced effective network capacity for general traffic, although some interventions would be more significant than others, and it is not immediately possible to quantify either the extent of all of the different types of intervention or their relative contribution to the observed congestion effect.
- Research by TfL is suggesting that the incremental effect of successive interventions is a compounding one, in that each individual intervention interacts with subsequent ones, such that the impact of later interventions is larger due to reduced resilience resulting from earlier interventions.

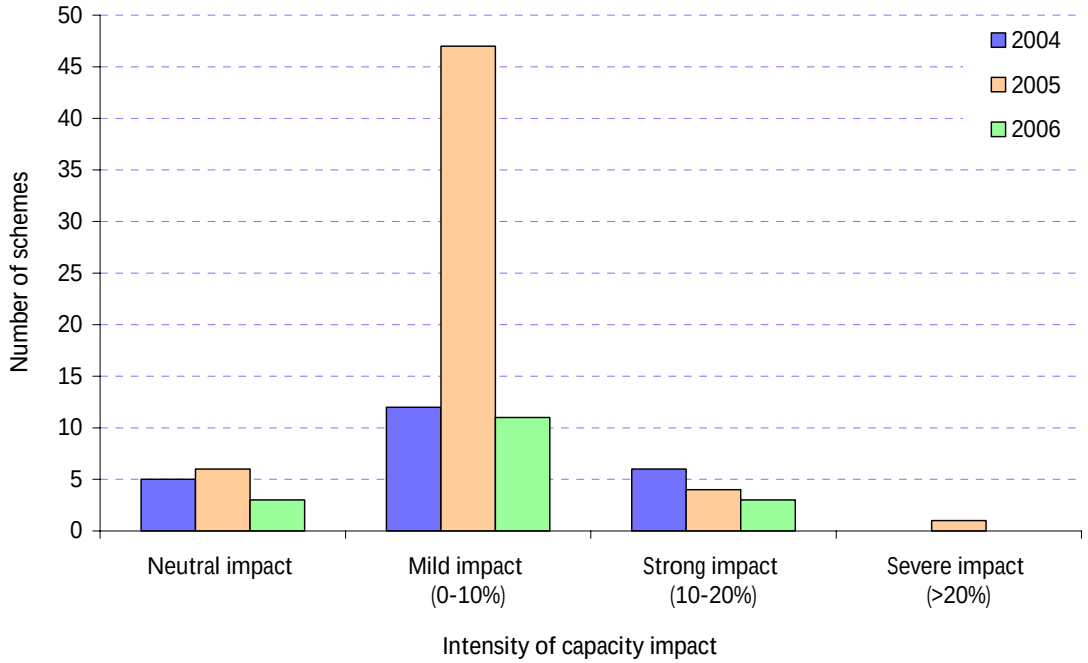
Recent research by TfL has focused on a sub-set of these interventions, and looked at trends since the introduction of congestion charging. The important category of increased streetworks and their relationship to recent congestion trends has already been discussed above. A further category of intervention that has been studied is changes to traffic signals.

Figure 3.11 shows the number of changes to traffic signals in the central zone by year for the period 2004 to 2006. They are grouped according to the severity of the projected impact on local junction capacity for general road traffic. Note that this is not wholly equivalent to effective network capacity, but may for this purpose be taken as a good proxy as it is junctions that largely control the effective capacity of an urban road network. The grouping is on the following basis:

- 'neutral' impact: schemes with a marginal positive, negligible or marginal negative impact on local network capacity;
- 'mild' impact: schemes with a projected reduction in the range 0 to 10 percent for local network capacity;
- 'strong' impact: schemes with a projected reduction in the range 10 to 20 percent for local network capacity;
- 'severe' impact: schemes with a projected reduction in local network capacity of greater than 20 percent.

There were approximately 100 schemes during the period under review. This compares to around 600 schemes conducted across the whole of Greater London in 2006. Schemes apply to junctions, rather than individual signals, and the configuration of signalised junctions varies. Since there are about 540 signals in the charging zone, this activity probably represents changes to about half the junctions within the zone. These changes are of a magnitude that could account for a significant proportion of the overall reduction in road network capacity implied by the congestion measurements in the central London charging zone since 2004.

Figure 3.11 Traffic signal schemes in the central London charging zone, 2004–2006, grouped by impact on local network capacity.



It is clear from the figure that:

- The overwhelming balance of these interventions is towards those that would measurably reduce effective capacity of the road network for general traffic, thereby increasing congestion or traffic delays. Few, if any, schemes have an objective to increase local network capacity, but this is not unexpected given the wider constraints of the central London road network, and the need to achieve a better balance between all users of the road network, including pedestrians.

- The level of activity in 2005 was considerably greater than in both 2004 and 2006. This does not immediately correspond to the sharp increases to congestion observed in late 2006, but may have acted as a 'precursor' by reducing the capacity of the network to cater for subsequent interventions such as the sharp increase in streetworks in the latter part of 2006.
- 'All red' installations are not explicitly shown on the graphic, but there have been seven of these in the central London charging zone over the period covered by the figure. These would fall into the 'strong' or 'severe' impact categories.

A road network capacity inventory

The work described above represents the start of a longer-term research programme that will enable TfL to better understand the nature and causes of the recent trends in traffic and congestion. This will allow TfL to respond more effectively to the 'Network Management Duty' under the Traffic Management Act 2004, which requires TfL to expedite the movement of all traffic, including pedestrians. This work is focused around a proposed network capacity inventory, and has three main elements:

- assembling data describing each of the various categories of intervention, and translation to a common basis which quantifies the resulting reduction in effective network capacity;
- develop a simulation tool that will allow both 'back-casting' and experimentation to establish proportionate cause and effect;
- facilitate better management, co-ordination and policy development by allowing simulation of possible future network activity scenarios.

A pilot project is currently underway in south-east London, and this is expected to lead to a larger-scale exercise, to be undertaken in the western extension itself, together with appropriate 'control' areas, later in 2007.

3.13 Summary of key points

The year 2006 saw a sharp increase in streetworks that correlates with a significant reduction in decongestion achieved within the central London congestion charging zone.

This is in addition to a gradual longer-term trend of increasing congestion across London, reflecting a longer-term phenomenon going back two decades or more.

Research undertaken by TfL suggests that this more gradual 'background' trend reflects the collective impact of a wide range of interventions on the road network. These have included both schemes that would have a long-term capacity reduction effect for general traffic, for example public realm schemes and bus priorities such as bus lanes, and interventions having a shorter term or temporary impact, such as road and street works. These longer-term interventions are generally to achieve benefits for particular groups of road users in safety and amenity. However, the balance of evidence for the charging zone suggests that the main cause of reduced capacity and increased congestion in the zone in the latter half of 2006 is the increase in streetworks.

In view of these factors, comparison of conditions in 2006 against a static baseline from 2002 is increasingly inappropriate. More relevant is a comparison of conditions in 2006 against what might have been the case in the absence of congestion charging, assuming that other aspects of road network management had continued unchanged. Despite the increased prevailing level of congestion, this suggests that drivers in the charging zone during 2006 were probably experiencing comparable absolute levels of congestion reduction to that observed when the scheme was first introduced in 2003, of up to 0.7 minutes per kilometre.

4. Central zone: public transport, accidents and air quality

4.1 Introduction

This section looks at some important secondary indicators of the impact of congestion charging in the original central London congestion charging zone.

Public transport – particularly the bus network – acted as a key facilitator of the central London scheme, by providing a viable alternative for displaced car occupants. In turn, the traffic and mode shift changes brought about by congestion charging had implications for the operation of the public transport networks. This took place against the backdrop of substantial improvements to the bus network, reflecting wider initiatives in the Mayor's Transport Strategy.

The traffic reductions described elsewhere also had implications for road traffic accidents and vehicle emissions in and around the charging zone. In the case of accidents, the new traffic patterns were expected to lead to fewer casualties in the charging zone, alongside a host of other TfL and borough accident reduction schemes that have collectively led to substantial year-on-year reductions in reported casualties across London.

For vehicle emissions, post-charging traffic patterns with fewer vehicles moving with less delay fed through to reductions in emissions of Oxides of Nitrogen, particulate matter and Carbon Dioxide. However, owing to the complexity of the processes involved, these were not necessarily expected to be measurable as reduced pollutant concentrations at air quality monitoring sites.

4.2 Key findings from previous reports

- Passengers entering the central charging zone by bus increased by 37 percent during charging hours in the first year of the operation of the scheme. Up to one half of that growth was estimated to have reflected displaced car travellers transferring to the bus network, and the remainder a 'background' trend reflecting wider improvements to bus services.
- Bus service reliability improved on routes in and around the charging zone following the introduction of the scheme. Excess waiting time – a measure of the unreliability of the service – fell by 30 percent in the first year and by a further 18 percent in the second year after the introduction of charging. Although congestion charging related traffic changes would have contributed substantially to this in central London, the general trend was mirrored throughout the entire London bus network and in part reflected new bus operator contractual regimes.
- There was a similar improvement in the indicator of bus kilometres not operated because of traffic congestion on routes affected by the charging zone. This fell by 20 percent in the first year after charging, and was maintained at this level during the second. However in the third year it increased by 13 percent. This latter change was a general trend reflected across the wider bus network that may have been linked to wider congestion trends, as discussed in Section 3 of this report.

- Contrary to TfL's expectations, the number of passengers exiting Underground stations in and around the central charging zone dropped during the first year of charging, reflecting external factors unconnected with charging such as the Chancery Lane derailment. Over more recent years, the prevailing trend has been towards increasing patronage, with the London bombings of July 2005 having little apparent long-term effect on aggregate patronage.
- The overall number of passengers using National Rail to travel to or from the charging zone was stable over the period spanning the introduction of the scheme.
- Recent years had seen significant year-on-year reductions to reported personal injury road traffic accidents both within the central London zone and across London as a whole, reflecting wider TfL and borough road safety initiatives. This background trend was further enhanced by an estimated 'excess reduction' of between 40 and 70 fewer accidents per year within the charging zone and on the Inner Ring Road.
- Independent statistical treatment of the accumulating time-series of road traffic accident data confirmed that TfL's earlier conclusions regarding the impact of congestion charging on road traffic accidents were reasonable.
- There was no evidence of disproportionate or detrimental changes to the number of reported casualties involving two-wheeled vehicles in or around the charging zone, despite increases to the numbers of these vehicles. The was also no evidence of disproportionate or detrimental accident trends on the Inner Ring Road.
- By reducing the volume of traffic circulating within the charging zone and improving the efficiency with which it circulates, it was estimated that congestion charging had been directly responsible for reductions of 8 percent in Oxides of Nitrogen (NO_x), 7 percent in fine particulate matter (PM_{10}) and 16 percent for Carbon Dioxide (CO_2). These figures related to an annual average 24 hour day for all emissions from road traffic only.
- Trends in actual measured air quality (as opposed to emissions) across London continued to reflect the diversity and dominance of external factors in determining pollutant concentrations and, as such, did not allow the identification of a clear 'congestion charging effect'. Although this measurement outcome was not unexpected, the removal of a proportion of road traffic emissions both contributes to wider initiatives to improve air quality, and to comparatively improved air quality over the long-term.
- Sample surveys of ambient noise in and around the congestion charging zone showed a mixed picture that was more reflective of local and measurement issues than indicating any consistent congestion charging effect.

4.3 Key findings for 2006

- Although there was no direct measure of the number of passengers entering the charging zone by bus in 2006, the number of bus passengers entering a wider definition of central London in the weekday morning peak was 116,000, which was closely comparable with 2005.

- As in previous years, the availability of bus services in and around the charging zone continued to satisfactorily accommodate patronage.
- Reliability of bus services in and around the charging zone has seen some deterioration, with excess waiting time increasing by 2 percent from 2005, although it still remains substantially better than pre-charging levels.
- The percentage of scheduled bus kilometres lost in the central zone due to traffic congestion increased by 28 percent compared with the previous year, to stand at 2.3 percent of scheduled kilometres. This is a substantial increase and is possibly linked to the wider congestion trends discussed in Section 3 of this report.
- The number of passengers using the Underground to travel to and from central London in 2006 increased in relation to 2005, reflecting wider travel and network trends and continuing the recovery from the recent lows of 2003/2004, to stand 1 percent above the pre-charging level of 2002.
- The number of reported personal injury road accidents continued to decrease in 2005/2006 across Greater London, reflecting recent year-on-year trends and ongoing road safety initiatives.
- Trends in reported accidents within the central charging zone during 2005/2006 showed a greater proportionate decline in accidents compared with other areas in London. However, for the first time since the introduction of charging there was evidence of increased numbers of collisions involving pedal cyclists, which may in part reflect greater numbers of these vehicles.
- In the absence of 'step' traffic changes, such as those that accompanied the introduction of congestion charging in 2003, the dominant influence on emissions of key air pollutants over recent years has been vehicle technology improvements. Between 2003 following the introduction of congestion charging and 2006, these changes were estimated to have reduced emissions of NO_x by 17 percent, PM_{10} by 24 percent and CO_2 by 3 percent.
- Trends in measured ambient air quality during 2006 have largely reflected previous years. There is some evidence of a differential reduction in the concentrations of PM_{10} at the roadside in the charging zone compared with other parts of London, but the causes of this are not yet clear. Concentrations of NO_2 have been stable or have increased, particularly adjacent to major roads, reflecting increased emissions of primary NO_2 from diesel fuelled vehicles. The latter is part of a wider national trend and is currently the subject of an active research programme.

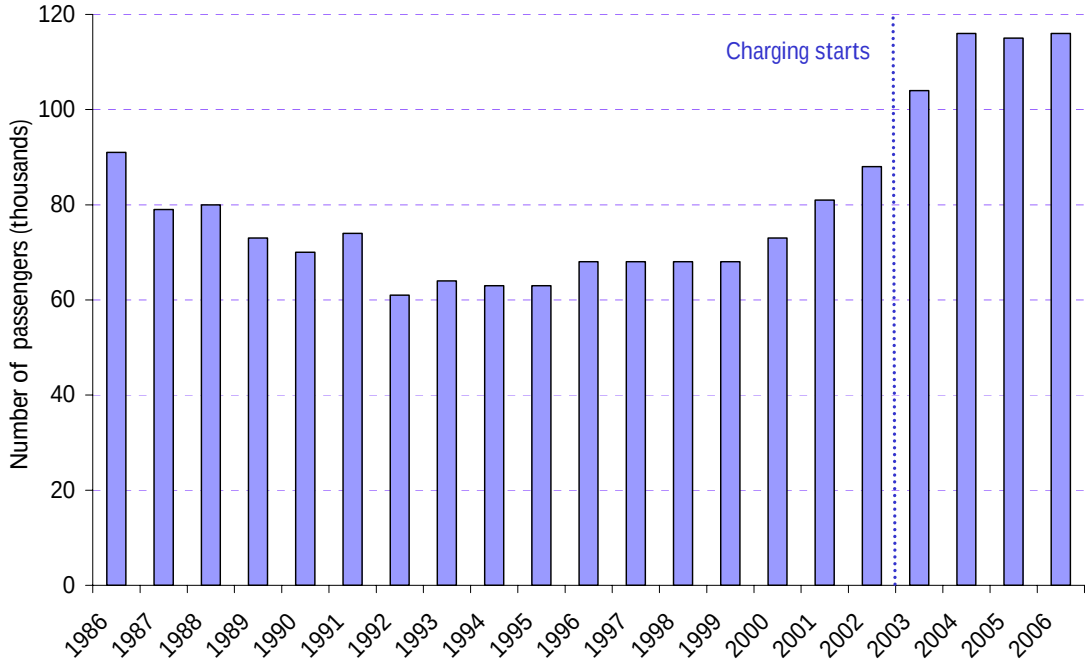
4.4 Buses

Bus patronage

Bus passenger numbers entering the central charging zone are no longer measured directly. In Autumn 2006, the regular survey of bus passengers entering the central London area (a larger area than the central congestion charging zone) was undertaken as part of TfL's Central Area Peak Count. Although the data does not relate directly to the congestion charging zone it provides an indication of bus passenger trends in the area.

Figure 4.1 shows these counts over the last twenty years. The increase in passengers entering central London by bus over more recent years and in particular following the introduction of charging in 2003 is clear. Bus passenger numbers increased by 18 percent and 12 percent respectively during the first and second years after charging. Passenger numbers have since settled at around 116,000 in the weekday morning peak period. The increase in the charge in July 2005 had only a limited impact on the number of cars entering the central zone – too small to have a detectable impact on bus patronage.

Figure 4.1 Bus passengers entering central London, 07.00 to 10.00, Autumn counts, 1986 to 2006. TfL Central Area Peak Count.



A number of factors have affected bus passenger numbers in central London as well as the introduction of congestion charging. Bus fares have been restructured over the last few years. The large-scale move towards off-bus tickets and in particular Oyster pay-as-you-go has led to a real decrease in the average fare that is paid per individual trip. Free travel for specific population groups and concessions are also being extended. From 1 September 2006 free bus travel was introduced for young people aged 16 and 17 in full-time education.

Bus speeds

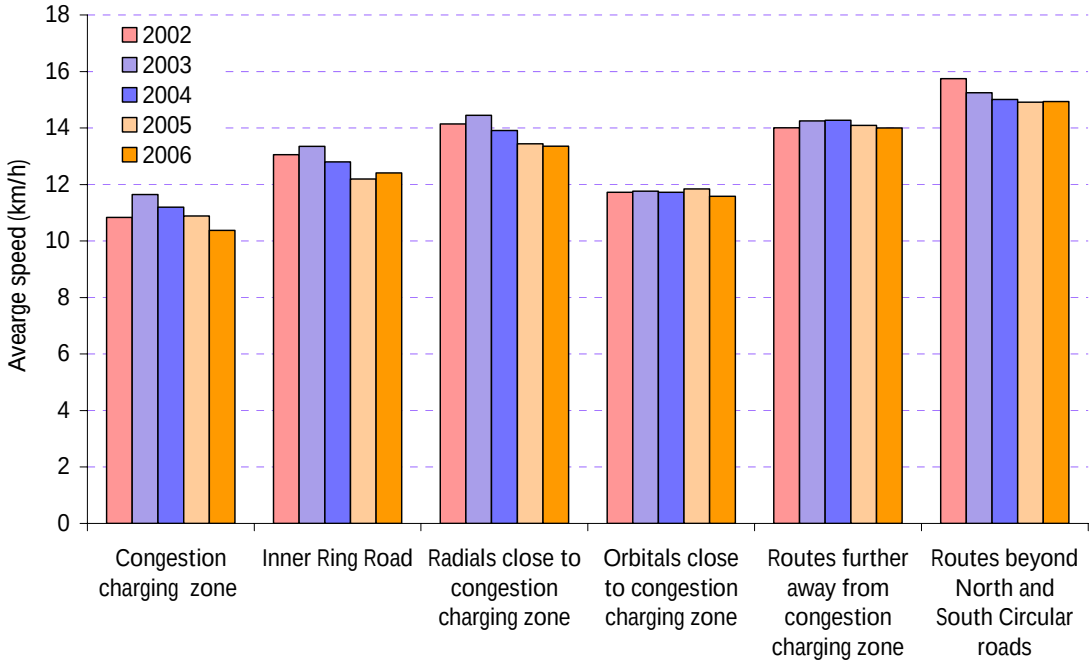
Figure 4.2 shows trends in average bus journey speeds across London from 2002 to 2006. These speeds include the time spent at bus stops and in traffic queues. In the first year following the introduction of charging, bus speeds increased in central London with a particularly marked improvement in the congestion charging zone. Buses operate to a schedule and, furthermore, progress along a route is influenced by passenger boarding/alighting and bus priority infrastructure. Therefore, bus speeds will not bear a direct relationship to more general traffic conditions. Nevertheless, trends in bus speeds would be expected to broadly reflect trends in general traffic, taking these other factors into account.

The figure shows that, between 2002 before the introduction of charging and 2003, bus speeds increased by 7 percent inside the congestion charging zone and by 2 percent on the Inner Ring Road and on radial routes close to the congestion charging zone. Bus speeds for routes beyond the North and South Circular Road, which were not likely to be affected by charging, decreased by 3 percent.

Since 2003 however, bus speeds in all areas have decreased consistently and in the past year alone there has been a 5 percent decrease in bus speeds in the original central London charging zone. Bus speeds on routes on the Inner Ring Road showed a slight increase in the last year of 2 percent. Bus speeds on routes in all other areas in central London showed a decrease in the order of 1 to 2 percent, while routes beyond the North and South Circular road showed no change in average bus speeds.

The overall reduction in bus speeds since 2003 has been 11 percent within the central zone, 7 percent on the Inner Ring Road and 8 percent on radial routes close to the central London charging zone. Areas further away from central London have showed a decrease of the order of 2 percent over this period.

Figure 4.2 Average bus speeds – selected sections of road.



This apparently consistent and widespread trend for buses to become slower therefore also reflects the trends for general traffic explored in Section 3. Whilst there may have been specific reasons for this that are not associated with general traffic, for example increases in bus patronage (see Figure 4.1), there have also been offsetting factors related to payment methods and a general increase in the provision of bus priorities (eg bus lanes, bus priority at traffic signals). TfL is exploring this trend as part of the wider work on understanding the influences on the capacity of the road network.

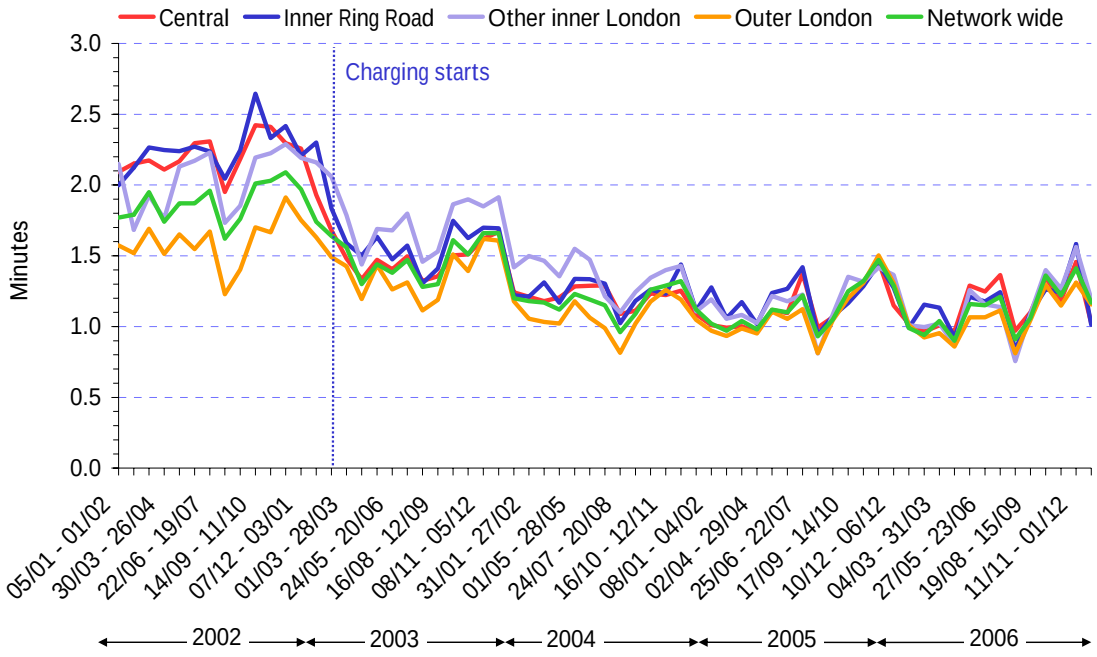
Bus service reliability

Reliability of bus services in central London also improved following the introduction of congestion charging. This reflected a variety of factors, which included: increased investment in robust schedules, enhanced route supervision and the introduction of Quality Incentive Contracts, as well as the introduction of congestion charging itself.

One measure of bus service reliability is 'excess waiting time', reflecting the additional waiting time at bus stops experienced by passengers caused by service irregularity or missing buses. In the first year after charging, excess waiting time decreased in and around the charging zone by around 30 percent, compared with reductions of 20 percent network wide. In the second year after charging, further improvements of 18 percent were made while in the third year there was a smaller scale improvement of 4 percent in the congestion charging zone. After the initial 'step' change in central London, directly reflecting the impact of charging, trends over the following two years in the charging zone followed the pattern of network wide averages.

In the most recent year, bus service reliability has seen a slight deterioration in the central charging zone, with excess waiting time having increased by 2 percent from the previous year. During the same period, the network wide average excess waiting time remained closely comparable to the previous year. Figure 4.3 shows the measured excess waiting time for different parts of the London bus network as well as the network wide average. It illustrates the improvement in bus service reliability in central London over recent years.

Figure 4.3 Excess waiting time – high frequency routes (weekday charging hours).



Further to the improvement in excess waiting time since the introduction of charging in central London, there are also improvements directly linked to improved traffic

conditions. This is reported in terms of 'bus kilometres not operated' compared to those scheduled. During the first year after the introduction of charging, bus routes in and around the charging zone saw the biggest improvement in this indicator, with lost kilometres reduced by 60 percent. In the following years the picture was fairly stable across the network until last year when the trend towards improvement was reversed and some of the earlier gains lost.

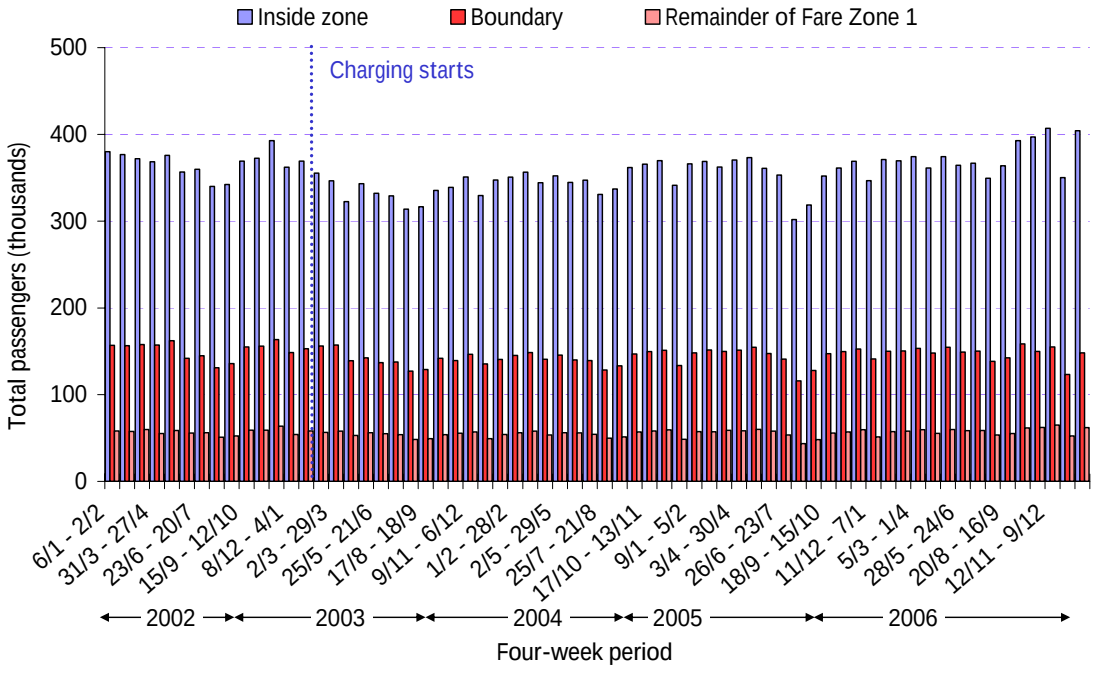
The same picture is apparent in the most recent period and is most evident in the central zone, where kilometres lost have increased by around 28 percent relative to the previous year. This represented 1.8 percent of scheduled bus kilometres in 2005, and 2.3 percent in 2006. However, bus services in central London are still performing better compared to before congestion charging was introduced.

4.5 Underground

Underground patronage

Previous annual impacts monitoring reports have described how Underground patronage decreased in and around the central London charging zone during the first year of charging. This was contrary to TfL's expectation of a small net increase of up to one percent, and was largely the result of prolonged closure of the Central line following the Chancery Lane derailment as well as wider economic factors during 2003. In more recent years passenger numbers have increased, and have now reached and slightly exceeded pre-charging levels. Figure 4.4 updates the trend in Underground patronage in and around the charging zone (with Underground Fare Zone 1 divided into three sectors), based on estimates derived from passenger exits through automatic ticket gates at stations.

Figure 4.4 Passengers exiting Underground stations in and around the central London charging zone and within the rest of Fare Zone 1. Weekday morning peak period (07.00 to 10.00).



The trend in passenger numbers exiting stations inside the charging zone is similar to those for passengers at stations on the charging zone boundary and the remainder of Fare Zone 1. Following the reduction in passengers during the first 12 four-week monitoring periods after the introduction of charging, numbers increased by between 2 and 5 percent in 2004 and by a further 1 percent in 2005. In Figure 4.4 the impact of the disruption caused by the July bombings on passengers on the Underground during the morning peak period is also evident, although largely transitory.

On average, around 523,000 passengers exited stations in and around the central charging zone during the morning peak period in 2006. This compares to 516,000 passengers prior to the introduction of charging in 2002 and to 498,000 passengers in the previous 12 four-week reporting periods in 2005.

Patronage during charging hours at stations in and around the charging zone follows a very similar trend. After a slight decrease of 2 percent in the 12 four-week monitoring periods in 2005, passenger numbers in 2006 have increased by 5 percent, reaching 1,286,000. These compare with 1,226,000 passengers in the equivalent periods of 2005, and represent, a net 1 percent increase from the number of passengers in and around the charging zone prior to the introduction of charging.

4.6 Accidents involving personal injury

Recent years have seen consistent and substantial declines in the number of reported personal injury road traffic accidents across London, with an 'excess' trend within the congestion charging zone, equivalent to between 40 and 70 additional collisions 'saved' per year, notionally attributable to the traffic changes brought about by congestion charging. This general trend has continued to be evident during 2005/2006.

Table 4.1 provides an update on the number of reported personal injury accidents in the charging zone, on the Inner Ring Road and for other parts of London and now includes three comparable 12 month reporting periods since the introduction of congestion charging in 2003.

The number of collisions in the charging zone during charging hours was 11 percent lower in 2005/2006 than the previous 12 month period. The reduction in the Inner Ring Road and rest of London for the same period was 6 percent, a somewhat slower rate of decrease compared to recent years.

Across the whole week, including non-charging hours, there has been a 13 percent reduction in the number of collisions in the charging zone, whilst the reduction on the Inner Ring Road has been slightly lower, at 11 percent. The equivalent reduction across the rest of London has also been lower, at 7 percent.

Although most areas of London show ongoing reductions in the number of reported accidents, the rate of reduction differs across the different parts of London, with the charging zone showing a comparatively high rate, as in previous years.

Table 4.1 Total reported personal injury road traffic accidents by area. 2001 to 2006.

		Charging Zone	Inner Ring Road	Rest of London	Total
2001	Weekdays 07.00-19.00	1,644	528	18,410	20,582
(Feb '01-Jan '02)	Weekdays 00.00-07.00;19.00-24.00	464	207	6,269	6,940
	Weekends all day	490	196	7,979	8,665
	Total	2,598	931	32,658	36,187
2002	Weekdays 07.00-19.00	1,418	450	16,964	18,832
(Feb '02-Jan '03)	Weekdays 00.00-07.00;19.00-24.00	439	174	6,078	6,691
	Weekends all day	439	204	7,588	8,231
	Total	2,296	828	30,630	33,754
2003	Weekdays 07.00-19.00	1,270	428	16,226	17,924
(Mar '03-Feb '04)	Weekdays 00.00-07.00;19.00-24.00	403	185	5,277	5,865
	Weekends all day	430	189	7,037	7,656
	Total	2,103	802	28,540	31,445
2004	Weekdays 07.00-19.00	1,131	374	14,695	16,200
(Mar '04-Feb '05)	Weekdays 00.00-07.00;19.00-24.00	389	172	4,927	5,488
	Weekends all day	346	167	6,202	6,715
	Total	1,866	713	25,824	28,403
2005	Weekdays 07.00-19.00	1,001	352	13,782	15,135
(Mar '05-Feb '06)	Weekdays 00.00-07.00;19.00-24.00	321	133	4,539	4,993
	Weekends all day	307	147	5,683	6,137
	Total	1,629	632	24,004	26,265

4.7 Pedestrian and non-pedestrian involvement in accidents

Accidents can be divided into two categories: those with a pedestrian involvement and those involving only vehicle occupants and riders. Table 4.2 updates the information previously reported, which indicated that there had been no significant change in the proportion of reported collisions affecting pedestrians compared to vehicle occupants or riders in the charging zone during charging hours.

Table 4.2 Accidents involving personal injury, 07.00 to 19.00, 2001 to 2006.

	Charging zone		Inner Ring Road		Rest of London	
	Pedestrian	Non-pedestrian	Pedestrian	Non-pedestrian	Pedestrian	Non-pedestrian
2001 Feb 2001 - Jan 2002	532 (32%)	1,112 (68%)	111 (21%)	417 (79%)	4,045 (22%)	14,365 (78%)
2002 Feb 2002 - Jan 2003	443 (31%)	975 (69%)	99 (22%)	351 (78%)	3,803 (22%)	13,161 (78%)
2003 Mar 2003 - Feb 2004	420 (33%)	850 (67%)	79 (18%)	349 (82%)	3,521 (22%)	12,705 (78%)
2004 Mar 2004 - Feb 2005	383 (34%)	748 (66%)	76 (20%)	298 (80%)	3,180 (22%)	11,515 (78%)
2005 Mar 2005 - Feb 2006	350 (35%)	651 (65%)	75 (21%)	277 (79%)	3,105 (23%)	10,677 (77%)

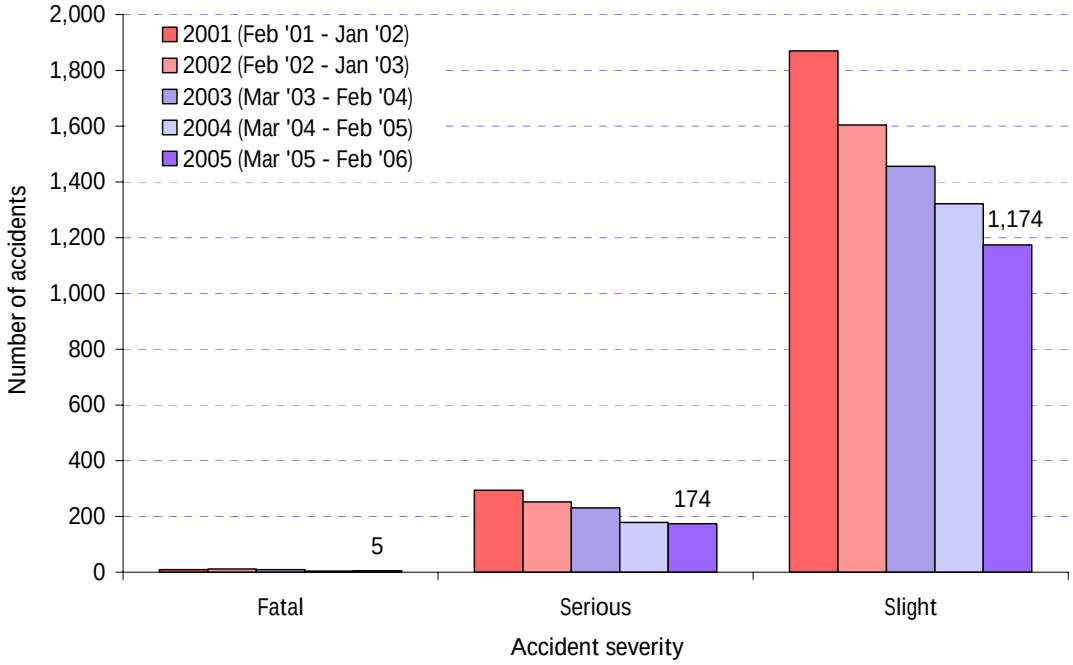
The 2005 and 2006 data supports the previously reported tendency towards a slight increase in the proportion of collisions affecting pedestrians in the charging zone, compared with vehicle occupants or riders. Such a proportionate change, albeit within a reduced overall total, is not apparent in the aggregate data for the rest of London.

4.8 Severity of accidents

Road traffic casualties are categorised into three severity classes, reflecting the degree of personal injury sustained.

Figure 4.5 shows the severity of the injuries resulting from reported collisions in the charging zone and on the Inner Ring Road during charging hours. There is a reduction in the number of reported injuries across the 'serious' and 'slight' categories, reflecting the general trend of accident reduction. In the third year after charging the number of fatalities increased to five compared with the previous year (four), although such change cannot be regarded as statistically significant, and the total number of fatalities remains substantially below pre-charging levels. Serious injuries have reduced by 3 percent and injuries classified as slight, which make up the majority of injuries, have reduced by over 10 percent.

Figure 4.5 Reported personal injury road traffic accidents within the central London charging zone and on the Inner Ring Road combined by severity class. 07.00 to 19.00, 2001 to 2006.



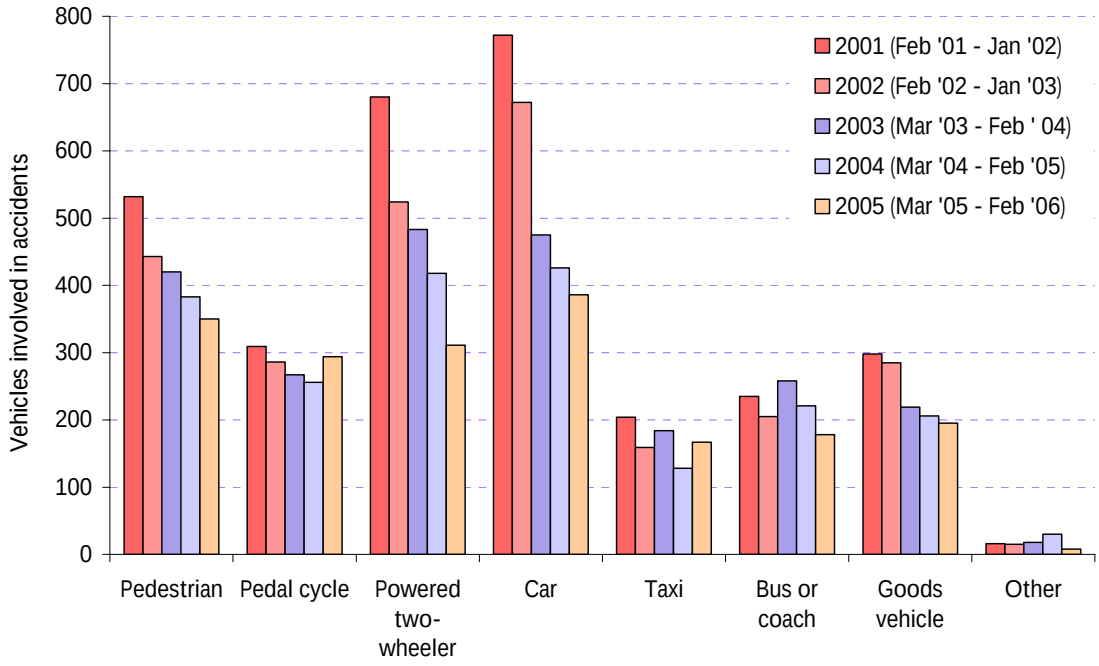
4.9 Vehicle involvement in accidents

Figure 4.6 illustrates trends in the vehicles involved in collisions within the charging zone. The continuing downward trend continues to be evident for most types of vehicles, again reflecting the general trend of reduced accidents.

Comparing data for 2005/2006 with the previous year, the largest percentage reduction was for the number of powered two-wheelers involved in collisions, at 26 percent, followed by buses or coaches, down by 19 percent. Accidents involving cars fell by 9 percent and those involving goods vehicles by 5 percent. The involvement of taxis showed an increase of around 30 percent following the previous year's

reduction, but the total number of collisions involving taxis remains lower than the first year after charging despite increases in taxi volumes of over 10 percent. Finally, the number of pedal cycles involved in collisions increased by 15 percent against the previous year; these now being roughly equivalent in number to pre-charging levels. This could be partly a reflection of the increased number of cyclists in the zone during charging hours, although the accident rate per cycle kilometre remains substantially below pre-charging levels.

Figure 4.6 Accident involvement by vehicle type within the central London charging zone. 07.00 to 19.00, 2001 to 2006.



Comparable patterns are also seen across the rest of London, although on the Inner Ring Road cars, taxis and goods vehicles have seen smaller proportionate reductions, whilst all other modes have had a greater proportionate reduction in the number of vehicles involved in reported collisions.

4.10 Vehicle emissions

The beneficial impacts of congestion charging in reducing emissions to air have been set out in previous annual impacts monitoring reports. The introduction of the scheme in 2003 fed through to step-change reductions in emissions of Oxides of Nitrogen (NO_x), particulate matter (PM_{10}) and Carbon Dioxide (CO_2) from road transport in and around the charging zone. These arose from less traffic moving to, from and within the charging zone, and the fact that the remaining traffic was moving around more efficiently.

These reductions occurred against the wider backdrop of beneficial technology changes to the vehicle fleet, much of it driven by European legislation (the 'Euro Standards'), which produces year-on-year reductions to the volumes of pollutants emitted. Moving forward from 2003, the year-on-year reductions from fleet changes

have continued and, all other things being equal, will become the predominant influence on road traffic emissions in central London. The effects from congestion charging would still be present, as an 'excess' reduction over what would otherwise be expected, but would not feature as a step change for subsequent years.

Table 4.3 is reproduced from the *Fourth Annual Impacts Monitoring Report*, with a line added summarising changes between 2003 and 2006 that are attributable to ongoing improvements in the emissions performance of the vehicle fleet since the introduction of congestion charging.

Table 4.3 Principal changes to emissions of NO_X, PM_{10} and CO_2. Percentage change, 2003 compared with 2002. Also showing 'background' fleet change 2003-2006.

	Charging zone			Inner Ring Road		
Change	NO_x	PM_{10}	CO_2	NO_x	PM_{10}	CO_2
Flow change - motorcycles	-	0.4	0.2	0.2	2.4	1.0
Flow change - taxis	2.3	3.8	2.4	2.0	3.6	2.1
Flow change - car	-4.5	-4.6	-11.2	-1.6	-1.8	-3.9
Flow change - bus and coach	2.9	1.0	1.2	3.2	1.1	1.4
Flow change - light goods	-0.1	-0.1	-0.1	1.7	3.2	2.3
Flow change - rigid goods	-1.6	-1.0	-0.7	1.6	1.0	0.7
Flow change - articulated heavy goods	-0.4	-0.2	-0.2	0.4	0.2	0.2
Traffic volume change	-1.4	-0.8	-8.4	7.4	9.7	3.8
Speed change	-6.5	-5.5	-7.3	-7.7	-6.9	-8.5
Traffic volume and speed change	-7.9	-6.3	-15.7	-0.2	2.8	-4.7
Vehicle stock change	-5.5	-9.2	-0.7	-6.7	-9.6	-0.7
Overall traffic emissions change 2003 versus 2002	-13.4	-15.5	-16.4	-6.9	-6.8	-5.4
Additional 'background' change from technology improvement (fleet turnover) 2003-2006	-17.3	-23.8	-3.4	-17.5	-20.9	-2.4

Note: flow and speed changes are calculated on a basis that includes the contribution of tyre and brake wear for PM_{10}. Background 'fleet' changes between 2003 and 2006 do not include this contribution.

On an annual average day basis for all road traffic emissions, it is seen that, between 2002 and 2003:

- The traffic volume and speed changes brought about by congestion charging were estimated to have led directly to reductions of about 8 percent in emissions of NO_x and about 6 percent in PM_{10} within the charging zone. These estimates were lower than those previously published owing to a change in the wider assessment methodology that recognised the large contribution to total road transport PM_{10} emissions made by tyre and brake wear, which were not taken into account in the original estimates, and which remained static between 2002 and 2003.
- On the Inner Ring Road surrounding the central London charging zone, bearing in mind the observed small increase in traffic and some changes to traffic composition, NO_x emissions were assessed as being unchanged, alongside a small net increase of about 3 percent in PM_{10} emissions.

- The influence of improved vehicle technology in the fleet was substantial, estimated reductions of 6 to 7 percent in emissions of NO_x and 9 to 10 percent in emissions of PM_{10} arising from this source between 2002 and 2003. Note that this also applied more widely across Europe.
- Total reductions from all causes between 2002 and 2003 were therefore of the order of 13 percent for NO_x and 16 percent for PM_{10} within the charging zone, and 7 percent for both NO_x and PM_{10} on the Inner Ring Road.
- Congestion charging was also estimated to have led directly to reductions of about 16 percent in CO_2 emissions from traffic within the charging zone, these more directly reflecting the overall traffic reductions and efficiency gains. The equivalent for the Inner Ring Road was a reduction of 5 percent, mainly reflecting the beneficial speed changes that were observed here in 2003.
- Between 2003 and 2004, with congestion charging in steady-state operation, year-on-year vehicle technology changes added typical gains of between 5 and 6 percent for NO_x and PM_{10}, and slightly less than 1 percent for CO_2, these also applying more widely across all traffic in London.
- Over the post-charging period 2003-2006, these vehicle fleet improvements are estimated to have reduced emissions from road traffic, both within the central London charging zone and more widely, by 17 percent for NO_x, 24 percent for PM_{10} and 3 percent for CO_2, assuming a stable traffic mix.
- Congestion increases since 2003, as discussed in Section 3, will have resulted in some reduction to these initial emission gains, although it can be argued that without congestion charging these changes would have been even greater.

4.11 Measured air quality

Previous annual impacts monitoring reports have made the point that, although congestion charging and other changes originally led to substantial reductions to emissions, these would not necessarily feed through to observable improvements to air quality. This reflects the extent and diversity of other influences on ambient air quality measurable at air quality monitoring stations, as opposed to emissions. These influences have a diluting and obscuring effect on the original emissions change, and include the following:

- Congestion charging only operates for approximately one third of the hours in any one year, but covers about two-thirds of the traffic in central London. It also only directly affects less than half of the traffic present in the charging zone during charging hours.
- The proportion of total vehicle kilometres in London affected by congestion charging is small – less than 2 percent.
- Road traffic emissions from vehicle tailpipes are only one contributor to total emissions of a given pollutant. Emissions from other sources such as industrial and domestic activity also contribute to observed concentrations.
- Various chemical reactions occur in the atmosphere between a pollutant being emitted and being observed at an air quality monitor. These can be weather-dependent and can be facilitated or limited according to prevailing climate.

- The weather itself can significantly affect the build-up of pollution, irrespective of the amounts emitted. In particular, stable weather conditions such as those that predominated in the summer of 2003 can lead to elevated pollutant concentrations, as well as the import of pollution from continental Europe.
- The impact of changes to traffic emissions on observed air quality depends in part on the location of the monitoring station in relation to nearby traffic sources.
- Certain statutory National Air Quality Strategy objectives, notably the PM_{10} exceedence day objective, are very sensitive to small changes in concentrations, given the proximity of prevailing concentrations to the objective value.
- Despite the general trend towards cleaner vehicles, certain countervailing trends have emerged, such as an increase in the proportion of NO_x emitted as NO_2 from diesel vehicles (primary or direct NO_2), which may slightly increase NO_2 concentrations.

Trends in ambient PM_{10}

Figure 4.7 shows running annual mean PM_{10} concentrations at congestion charging indicator sites and Figure 4.8 is an equivalent graphic for the National Air Quality Strategy 2005 PM_{10} exceedence day statistic. TfL's *First Annual Impacts Monitoring Report* gives a description of the methodology and site groupings employed. The exceedence day statistic measures the number of days in each year (as a running annual mean) that average concentration of PM_{10} was greater than 50µgm^3 (the National Air Quality Strategy Objective for 2005 is not more than 35 days).

Previous annual monitoring reports had observed that:

- Concentrations of PM_{10} at indicator sites both within the congestion charging zone and more widely across London had barely changed over the period 2002 to 2005.
- Because prevailing daily mean PM_{10} concentrations in London are close to 50µgm^3, small fluctuations in PM_{10} concentrations can result in larger fluctuations in the occurrence of daily mean concentrations above 50µgm^3.
- The introduction of congestion charging in 2003 coincided with a stable meteorological period. This led to elevated PM_{10} concentrations, yet because of this mechanism, fed through into large-scale changes in the number of days on which the National Air Quality Strategy objective concentration was exceeded.
- There was no clear evidence of a visible 'congestion charging effect' on PM_{10} concentrations, although the most recent data for the charging zone was suggesting some differential reductions compared to other parts of London.

Figure 4.7 Running annual mean PM_{10} concentrations at congestion charging indicator sites.

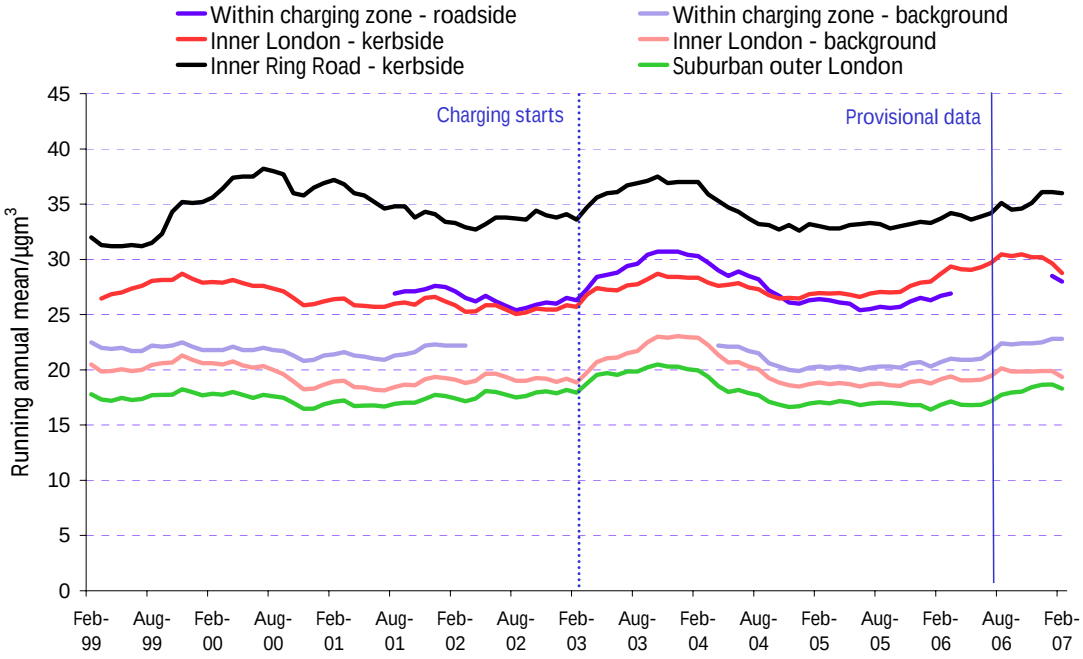
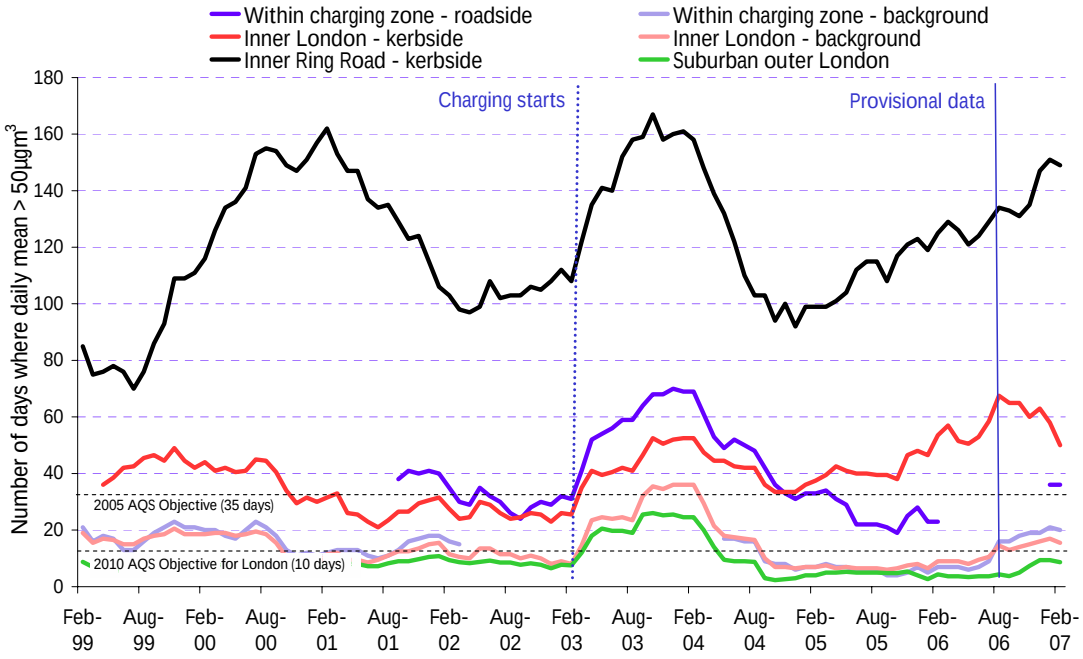


Figure 4.8 Running annual mean count of PM_{10} exceedence days at congestion charging indicator sites.



The updated charts for 2006 continue the same broad picture, with stable overall average concentrations across London, albeit trending upwards slightly during 2006, possibly reflecting weather conditions. This small upward trend has again fed through to disproportionate increases in the exceedence day indicator.

The available data for the charging zone are limited and were affected in 2006 by equipment failure. However, for the 'roadside' site it shows a continuation of the trend first observed in TfL's *Fourth Annual Impacts Monitoring Report*, with the number of days on which the National Air Quality Strategy objective was exceeded reducing, whilst increases were recorded at all other comparator sites. Again, a small relative decrease in average PM_{10} concentrations at this site has fed through to a disproportionate reduction in exceedence days, illustrating the nature of the relationship between these two indices. By contrast, the 'background' site in the charging zone appears to conform to the wider trend, if anything perhaps suggesting a greater proportionate increase in both concentrations and exceedences compared to the overall trend.

Trends in ambient NO_x/NO_2

Oxides of Nitrogen is a collective term for both Nitrogen Oxide (NO) and Nitrogen Dioxide (NO_2). The majority of emitted NO_x consists of NO which is then converted into NO_2 in the atmosphere, primarily through reaction with Ozone. NO_2 is the pollutant to which National Air Quality Strategy objectives apply, and NO the key precursor.

Figure 4.9 shows running annual mean concentrations of NO_x, and Figure 4.10 is an equivalent graphic for NO_2. The updated trends for 2006 are again very similar to previous reports, with a continuation of the pattern of small year-on-year declines to NO_x concentrations. There is some evidence, however, that the recent rate of decline has been slower than has been typical over recent years. The charging zone 'roadside site' was again affected by equipment failure during 2006 but, along with the 'background site' the available data do not suggest any clear differential trends in the charging zone compared to other comparator sites.

In terms of NO_2, TfL had previously reported how the positive effects of a general, London-wide reduction in NO_x concentrations from road traffic were being limited by other factors producing an increase in NO_2 emissions.

Tests on vehicles suggested that the phenomenon largely affected diesel-fuelled vehicles, which have become more prevalent in the UK vehicle fleet over recent years. Furthermore, there was some evidence that developments in engine technology and management systems, and emissions abatement equipment primarily directed at reducing particulate emissions were also significant factors. These were of course wider national-scale developments not directly associated with congestion charging. However, traffic conditions in and around central London would be particularly conducive to their expression.

Figure 4.9 Running annual mean NO_x concentrations at congestion charging indicator sites.

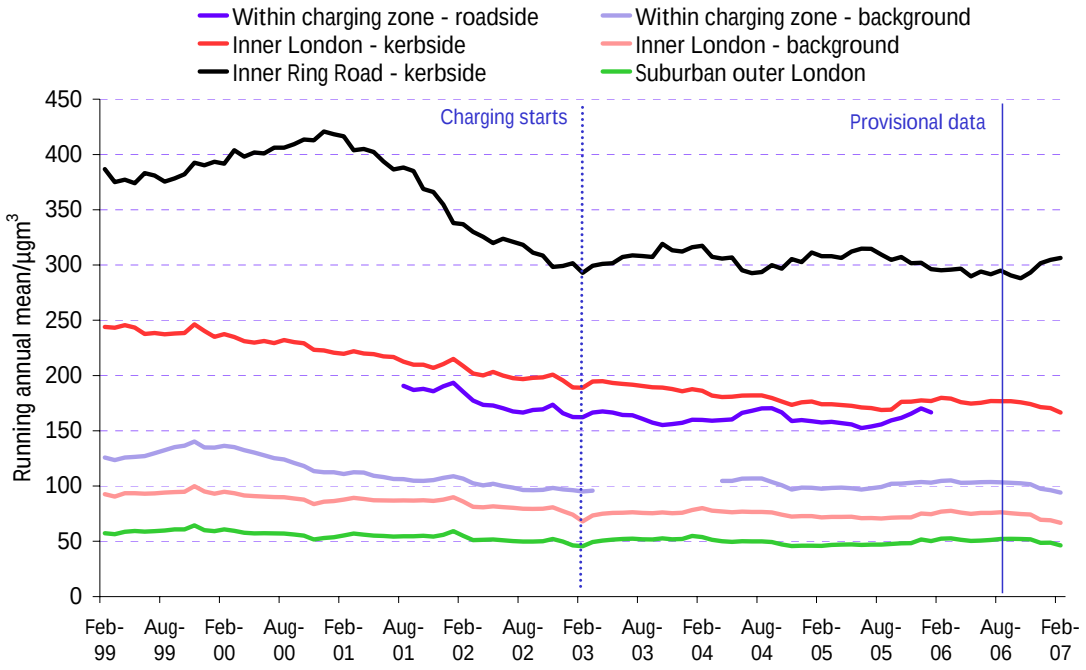


Figure 4.10 Running annual mean NO_2 concentrations at congestion charging indicator sites.

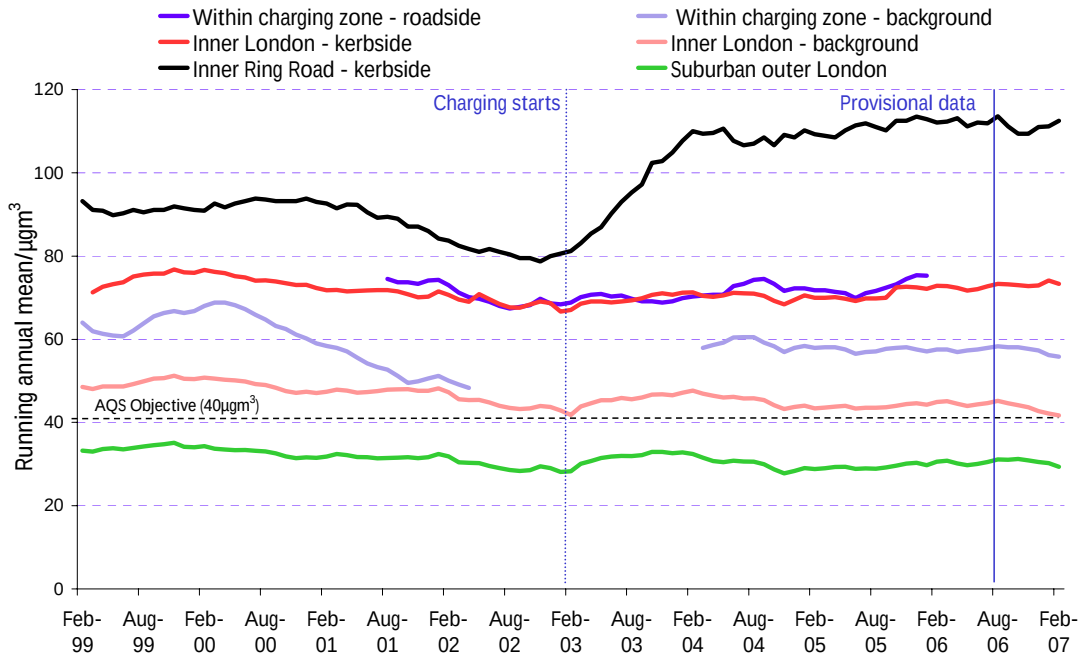


Figure 4.10 demonstrates that, over recent years, NO_2 concentrations have not responded to progressive reductions in NO_x as might be expected. Most site groupings have shown a flat trend. Other sites, exemplified by the site on the Inner Ring Road (a kerbside site located directly adjacent to the traffic stream) have seen substantial increases in NO_2 concentrations.

TfL is continuing to contribute to the wider research effort investigating these trends. It is clear from the data that they are not confined to the charging zone. It is also clear from the research so far that the causes of these trends are not directly related to congestion charging. Although these trends first became noticeable around the time that congestion charging was introduced, the primary issue is a vehicle fleet and technology one that is national or international in scope. Whilst this has implications for the ability to meet National Air Quality Strategy objectives at some sites for NO_2 in the short-term, the effect is thought to be primarily a re-distributive rather than an additive one, and continuing reductions to NO_x emissions would be expected to lead to further falls in NO_2 in the medium/long-term.

4.12 Summary of key points

Following from substantial increases in both bus service provision and patronage in and around the central London congestion charging zone between 2002 and 2003, paralleling the introduction of congestion charging, both patronage and service provision have largely stabilised during 2005 and 2006. Bus service reliability is still benefiting from the wider traffic changes brought about by charging, but there is evidence that the deterioration to general traffic conditions discussed elsewhere in this report is now negatively affecting the performance of the bus network.

Trends in Underground and National Rail travel to the central London charging zone have largely followed wider network trends, with no visible discontinuities that might be associated with charging.

Recent trends in personal injury road traffic accidents in central London continue to reflect traffic changes brought about by charging. The latest findings suggest that reductions in accidents in the charging zone are perhaps slightly greater than might otherwise have been expected, according to the wider trend of reduced accidents, but there is some evidence of possibly detrimental trends to collisions involving taxis and pedal cycles, and these will be kept under close review by TfL.

Following step-change reductions to emissions of key air pollutants upon the introduction of charging in 2003, year-on-year improvements to the emissions performance of the UK vehicle fleet are now the dominant factor reducing emissions in London. Despite substantial reductions to road traffic emissions of roundly one-quarter since 2002 however, trends in measured air pollution remain broadly static. This confirms the important role of non-charging related 'background' factors in determining overall air quality in London.

5. Central zone: business and economic impacts

5.1 Introduction

This section assesses the impact of the central London congestion charging scheme on business and economic activity in London since the introduction of the scheme in 2003.

Since 2002, Transport for London and the Greater London Authority have utilised a wide range of datasets to provide as detailed assessment of the potential macroeconomic and business impacts of congestion charging as possible. This includes the advice, insights and findings of academics, industry specialists and business decision-makers to ensure as robust an evidence base as possible. Nevertheless, the available information is relatively limited, particularly in terms of geographical resolution and timelines, with publication of key third-party data sets often lagging events by 18 months or more.

Our assessments have also taken place in the context of wider events that have effected the central London economy. Key events since the introduction of charging have included:

- the closure of the Central line, owing to the Chancery Lane derailment, and the beginning of the war in Iraq in 2003;
- the central London terrorist bombings in 2005;
- the Bank of England interest rate increases in 2006.

Furthermore, the central London economy is particularly susceptible to trends in factors such as tourism. Any assessment of the attributable impacts of congestion charging on businesses and London's economy is therefore a difficult task and cannot be done in isolation from wider economic factors.

Quantitative macroeconomic assessments of scheme impacts are limited by the quality and quantity of the available input data and the technical assumptions that need to be made. TfL have therefore used the widest possible range of evidence to build as full and comprehensive assessment as is currently possible. A separate microeconomic assessment is set out in Section 7 of this report.

The economic and business sections of previous monitoring reports have largely assessed impacts to businesses and the London economy on a year-on-year basis. Whilst this has been useful for assessing incremental change as it has become visible in the key data sets, this section aims to provide a consolidated overview of the impact of charging to business sectors for the period following the introduction of the scheme.

Based on the data currently available to TfL, it is concluded that since the introduction of the scheme, four years ago, no significant consequences of the original charge or the July 2005 Variations on business activity in aggregate have so far been identifiable. Our monitoring of the scheme indicates that since congestion charging was introduced, there have been no discernable significant effects – positive

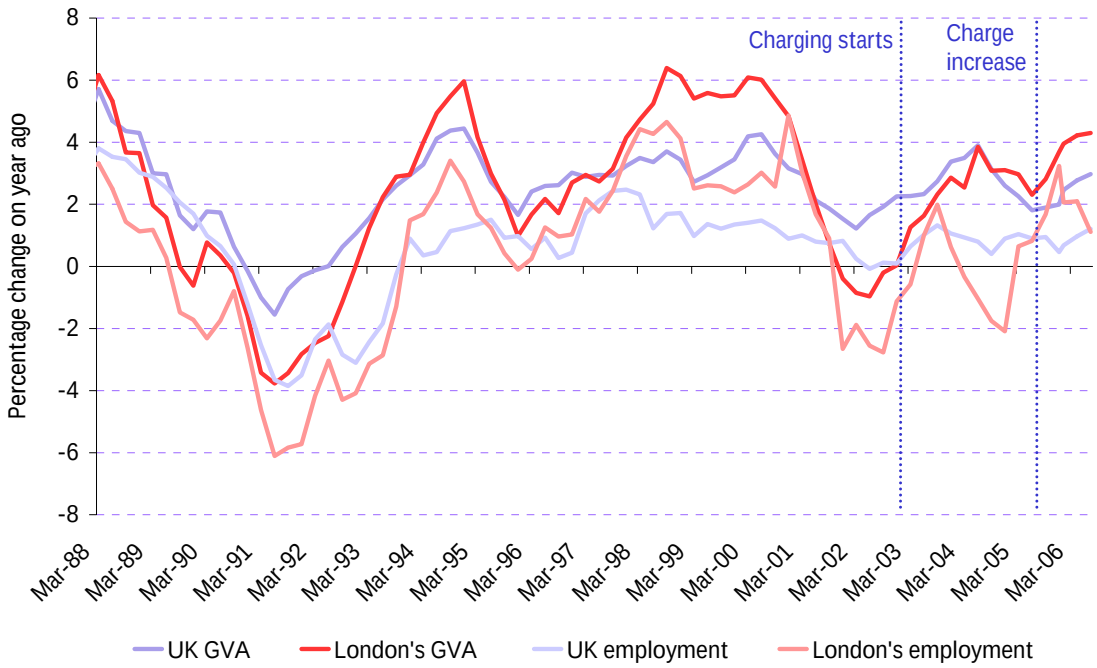
or negative – on businesses and the London economy that appear to be due to charging. The microeconomic analysis in Section 7 indicates a net positive impact from charging.

5.2 Key findings from previous reports

TfL's *Fourth Annual Impacts Monitoring Report* concluded that:

- Analysis of comparative trends in various indicators of business performance, including change in jobs, business populations and turnover, continued to show no evidence of differential effects between the charging zone and comparator locations that might be indicative of a congestion charging effect – either positive or negative – on aggregate business performance in central London with the £5 charge.
- An independent external audit of the TfL and GLA monitoring of the economic and business impacts of congestion charging concluded that TfL's assessment that the scheme has had a broadly neutral impact on the central London economy was reasonable.
- The growth of the London economy remained positive in 2005 despite the effects of the terrorist bombings in central London in July 2005 (Figure 5.1).
- Business performance in the charging zone was significantly better than in the rest of London, particularly in terms of profitability and productivity.

Figure 5.1 Output (Gross Value Added – GVA) and employment growth in Greater London and the UK.



Source: Experian.

5.3 Key findings for 2006

- The key business sectors – financial and business services, hotel and restaurants, and retail – in the central charging zone showed positive trends in the years following the introduction of congestion charging in comparison to pre-2003.
- Analysis of latest data continues to show no evidence of differential effects between the central London charging zone and comparator locations that might be indicative of a congestion charging effect.
- The hotel and restaurants sector and retail sector in the central London charging zone has registered stronger business performance since the introduction of charging, and has outperformed other areas of London.
- Analysis of commercial property rental values suggests that the property markets follow a cyclical pattern and are impacted by a combination of both local and London-wide factors. The commercial property market does not appear to have been impacted adversely by the charging scheme even though performance both before and after the introduction of charging has been mixed.

5.4 General economic trends

- Over the long-term, London's economy tends to move closely with the economy of the UK as a whole. This is unsurprising since London produces around 15-20 percent of total UK output. However, London tends to be a more volatile economy – as the peaks and troughs of the pink lines in Figure 5.1, compared to the blue lines, show.
- London's output (Gross Value Added) growth has recovered from the brief recession at the beginning of 2002 and is now growing well above the trend (and above the growth rate of the UK as a whole) at around 3 to 4 percent a year. London's employment growth has also picked up, but has remained volatile.
- Central London retail sales made a strong recovery from the brief dip that followed the London bombings in July 2005. Indeed, year-on-year retail sales growth in central London has significantly outperformed that of the UK since then. Similarly, overseas visitor numbers and their expenditure also recovered following a brief downturn at the end of 2005.
- In 2006, the London economy outperformed the UK as a whole. The rate of house price growth continued to rise in 2006, supporting consumer spending. The outlook for 2007 is slightly subdued with growth projected to be slower than in 2006, but still above trend. This reflects rising inflation and interest rates which are likely to start influencing consumer spending, as well as higher utility bills and a rising tax burden. For the UK as a whole, most commentators expect growth to remain around trend level (2.5 percent a year).

5.5 Assessing the business and economic impacts of congestion charging in central London

The economic impact of road user charging can be divided into supply side and demand side effects, alongside some redistribution of economic activity. The scale of these effects is determined by the actual cost of paying the charge and the impact on journey times brought about by the scheme.

Supply side effects

Supply side effects relate to the impact of the charge on the cost-effectiveness of businesses. On the positive side, productivity improvements and cost savings may be expected from lower travel times and better reliability for commuting and business journeys in the charging zone. On the negative side, the 'compliance costs' of paying the charge and some business costs will rise as suppliers and freight operators pass on charge payments to businesses.

Demand side effects

The demand side effect is a combination of 'income' and 'substitution' effects. The income effect primarily relates to the reduction in purchasing power from those who pay the charge. The substitution effect is the redistribution of economic activity as drivers potentially switch expenditure away from the charging zone in order to avoid paying the charge.

As discussed in previous reports, transport costs are typically only a small fraction of total business costs, and congestion charging would typically have only a very limited impact on these costs. It follows that the impact on most businesses will be small, albeit that some specific types of business may be affected to a greater extent.

Section 7 presents a quantitative cost and benefit microeconomic evaluation of the scheme with the £5 charge.

The main data sources used in this report for macroeconomic evaluations are:

- *The Annual Business Inquiry* – Official data from the Office for National Statistics that enables comparison of employment and business units at a relatively fine level of geographic and industrial disaggregation.
- *The Dun & Bradstreet database of businesses* – A commercial database containing individual records for most businesses and workplaces in the UK. The database is generated from Companies House and Thomson Directories and is subject to continuous updating through telephone contact.
- *Investment Property Databank* – A global information organisation providing objective measurement and analysis of property markets, through the supply of independent market indices and portfolio benchmarks for the property industry.
- *SPSL Retail Traffic Indicators* – A private company providing technology and analysis to measure retail traffic (footfall) to UK retail outlets and locations. Specific retail traffic indicators were established specifically for monitoring footfall within the congestion charging zone.

- *VAT Registrations data analysis* – spatial analysis, by business sector, based on 11 years of data from the VAT (Value Added Tax) registrations database of UK businesses registering, or deregistering for VAT.

The common approach of all these studies has been to compare aggregate business performance inside the central London charging zone with business performance outside the zone, both before and after the introduction of the scheme. This is measured by such variables as the number of businesses or sites, the numbers of employees, or sales and profits.

The conclusion from all the studies, updated for this report, is that it remains difficult to discern any significant impact on aggregate business performance from congestion charging with a £5 charge. Given the limitations of the data, TfL conclude that businesses in totality in the charging zone have not been measurably affected in net terms, either positively or negatively, by congestion charging in central London. This does not preclude the possibility that certain businesses in specific sectors may have been differentially impacted, although past research of particular business activities using 'case studies' failed to show a clear discernable impact from charging, as described in the *Third Annual Impacts Monitoring Report*, June 2005.

As a development on previous annual impacts monitoring reports, this year TfL focus the assessment of the macroeconomic impact of charging on the main business sectors in the charging zone, highlighting performance in key business and economic indicators in relation to comparable geographic locations. Trends have mainly been analysed pre-and post-2003 as opposed to pre-and post-charging due to the limitation of the available data, which is typically annual. The following summarises the results of the updated economic studies by business sector.

5.6 Financial and business services sector

In terms of employment, the number of business units, turnover and profits, the financial and business services sector in the central zone has performed considerably better post-2003 than prior to 2003. The performance pre-2003 was adversely affected by a general downturn in financial and stock market activity due to the 'bursting of the dot.com market bubble' and the terrorist attacks on the New York financial district in September 2001, which had a contagious effect throughout global financial markets.

Post-2003, the central London congestion charging zone has performed better than inner and Greater London in terms of VAT registrations and sales, but comparatively less well in terms of employment and the number of business units. Nevertheless performance in the charging zone has clearly been better pre-2003 than post-2003, which may in part reflect charging-related changes, but TfL's assessment would be that there is no conclusive evidence that the financial and business services sector has been affected significantly by congestion charging.

Employee jobs in the financial and business services sector

The financial and business services sector is by far the largest provider of jobs in the central zone, accounting for 50 percent of total jobs in 2005, according to the Annual

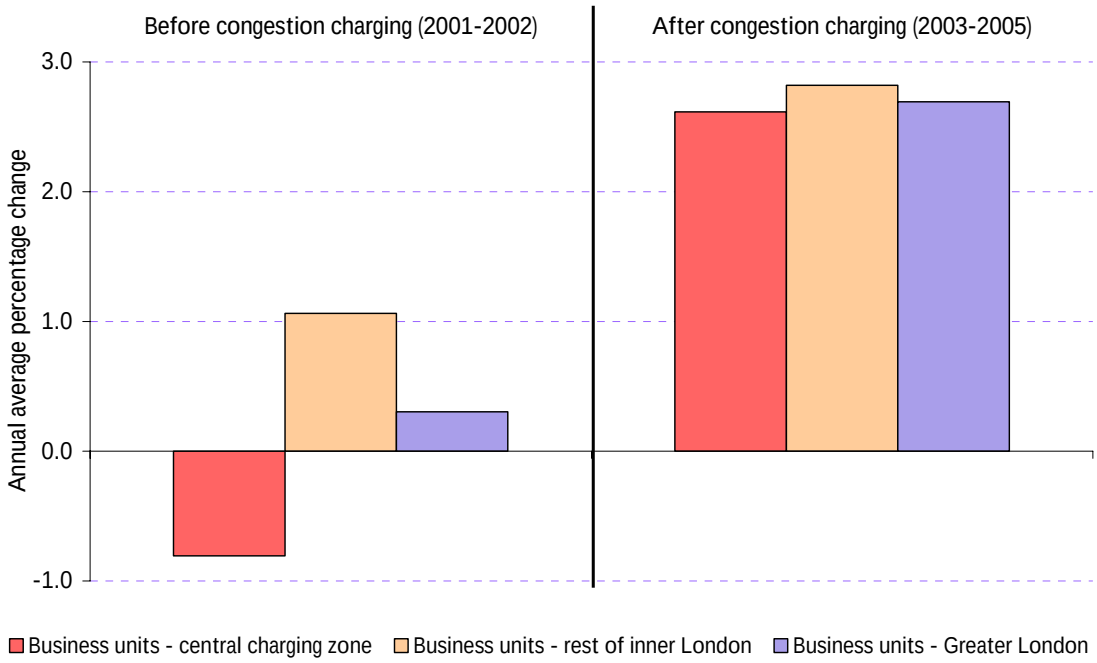
Business Inquiry, 2007. As a sector, it is incredibly diverse. For example, it comprises highly skilled financial jobs (such as derivatives trading), legal and accountancy services, and support services such as office cleaning.

Figure 5.2 shows the growth trend, both before and after 2003, in the number of financial and business services jobs in the central zone, as well as the rest of inner London and Greater London. Figure 5.3 shows the growth trend in the number of business units, for comparison.

Figure 5.2 Employee jobs in the financial and business services sector, before and after charging.

The performance of the financial and business services sector in the central zone, the rest of inner London and Greater London has been considerably stronger in the period since 2003 than in the two years prior to 2003, both in terms of numbers of employee jobs and growth in business units. Prior to 2003, employee jobs in the financial and business services sector declined by 3 percent on average over the two years. This recovered to positive growth of nearly 1 percent on average over the three years following the introduction of congestion charging. Similarly, the number of business units in the central zone declined by on average 1 percent per annum between 2001-2002 but since 2003 have recovered strongly, growing on average by 2.5 percent per annum. The improved performance since 2003 reflects the sustained pick up in activity in this sector that followed the brief recession in London in the period at the end of 2001 and beginning of 2002.

Figure 5.3 Business units in the financial and business services sector, before and after charging.

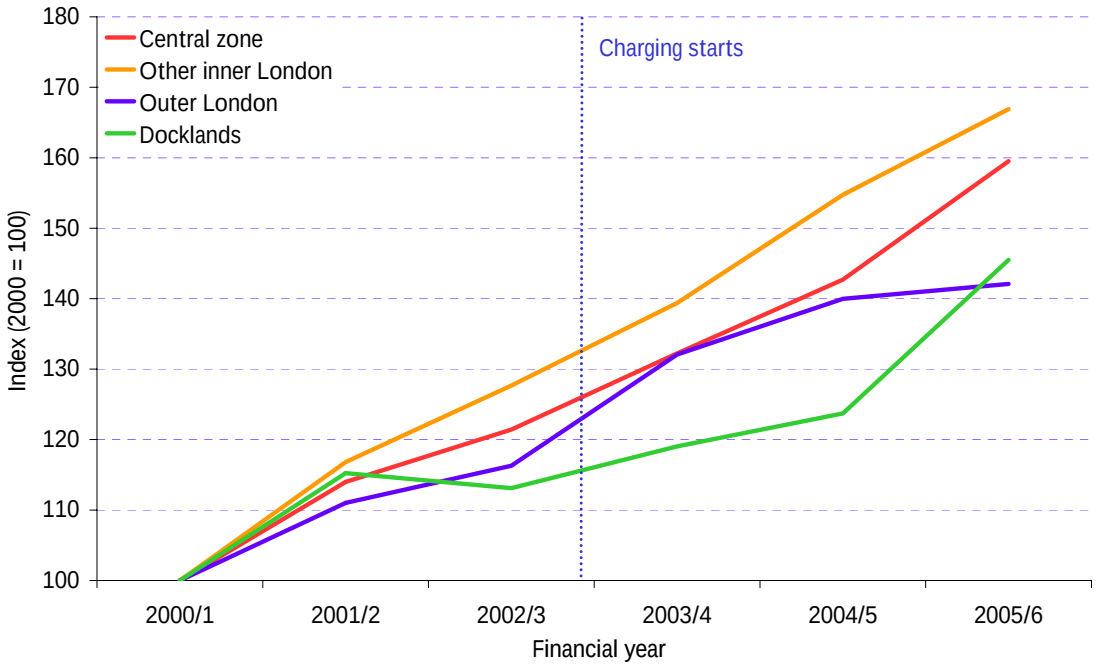


Source: Annual Business Inquiry, Office for National Statistics, January 2007.

Turnover in the financial and business services sector

In terms of turnover, the financial and business services sector has performed strongly over the last five years, increasing its turnover every year (Figure 5.4)

Figure 5.4 Dun & Bradstreet index of sales for the financial and business services sector.



Source: Dun & Bradstreet Ltd.

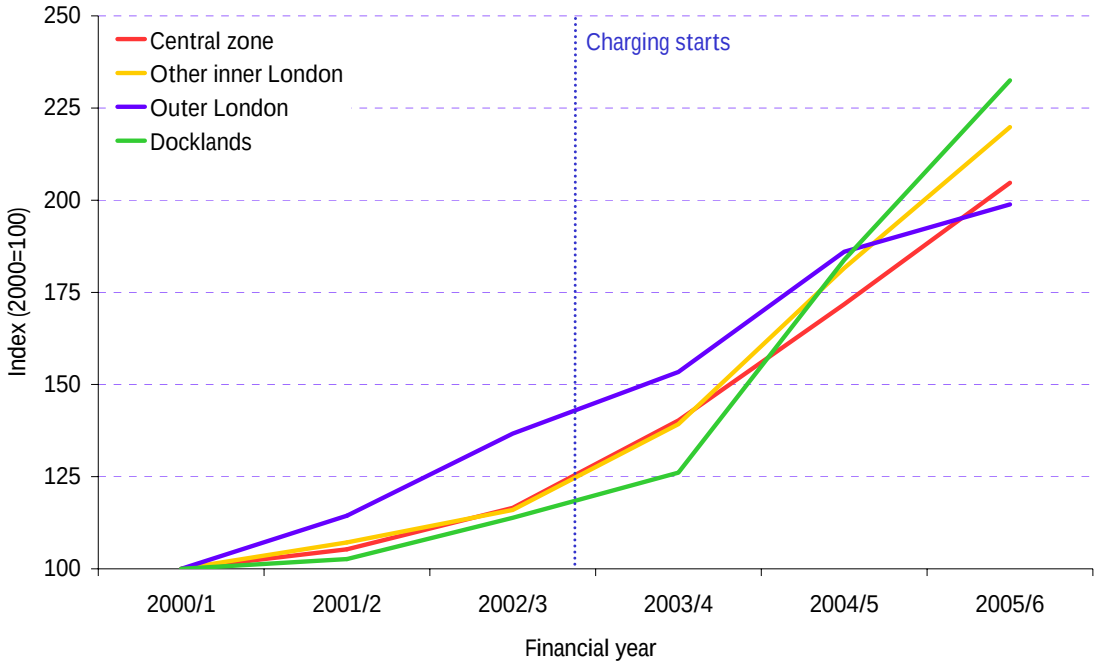
Turnover growth has been particularly strong in the central zone and in the rest of inner London, excluding the future western extension zone. Notably, the central London congestion charging zone has outperformed Docklands – with a comparable financial and business services sector profile – although Docklands sales performance picked up strongly in 2005. Businesses located in outer London have performed comparatively less well.

Profits in the financial and business services sector

The financial and business sector has generally performed in line with the average growth in profits for all businesses over the last two years.

Figure 5.5 shows the Dun & Bradstreet average index of profits for the financial and business sector, for different geographical areas pre-and post-2003. All areas have seen higher profits post-2003, with only marginal differences in growth between the various areas in London.

Figure 5.5 Dun & Bradstreet index of profits for the financial and business services sector.



Source: Dun & Bradstreet Ltd.

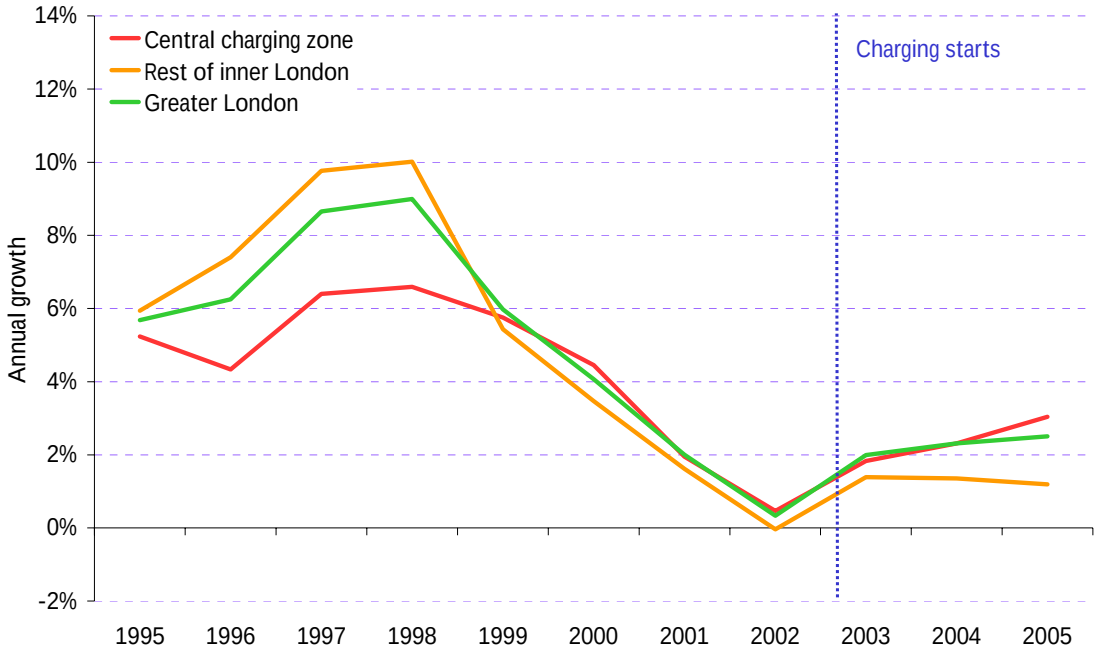
VAT registrations in the financial and business services sector

Data on VAT registrations provides a valuable gauge of new business start-ups, closures and business turnover, and are a useful indicator of the general health of business activity.

Annually, the largest number of business VAT registrations and deregistrations are in the financial and business services sector, which reflects the overwhelming dominance of this sector in the central charging zone. This sector has shown positive average annual growth in net VAT registrations both pre-and post-2003. Figure 5.6 shows that while the growth in net VAT registrations in the central London charging

zone has been lower post congestion charging, this trend is in line with lower growth rates post-2002 across London as a whole. In fact, net VAT registrations in the central London charging zone were slightly higher than the rest of inner London and Greater London as a whole.

Figure 5.6 Net change in VAT registrations for the financial services sector.

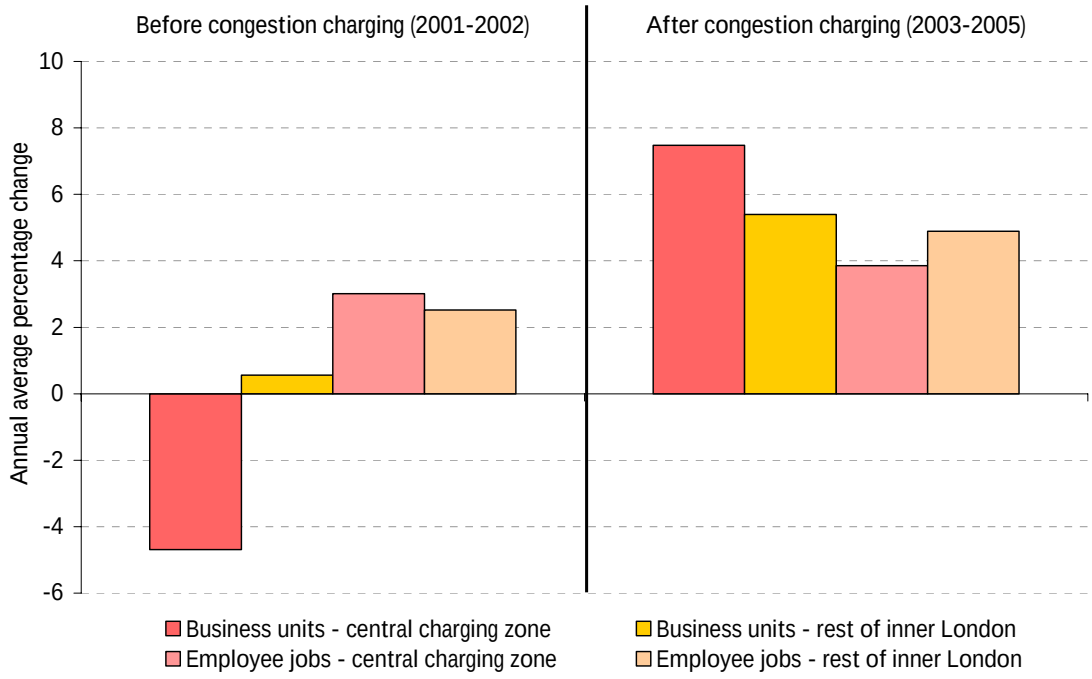


5.7 Public services: education and health sectors

Public services (defined in this analysis as the health and education sectors) are the second largest provider of jobs in the central London zone, accounting for 8 percent of jobs in 2005, according to the latest Annual Business Inquiry, 2007.

Figure 5.7 shows the growth in employment in public services in the central London zone, compared to the rest of inner London, both before and after charging. The main indicators of business performance in public services are jobs and business units. Turnover or sales provide a less relevant indicator of economic activity in the public sector. Average growth in jobs and, in particular, business units in health and education in the central London charging zone have been higher since 2003 than before, according to the Annual Business Inquiry, 2007. Post-2003, the central London charging zone has performed on par with inner London in terms of employment growth, and has considerably outperformed inner London in terms of the growth in business units. Thus, there is no discernible evidence of an aggregate congestion charging effect on these public services.

Figure 5.7 Business units in the health and education sectors, before and after charging.



Source: Annual Business Inquiry, Office for National Statistics, January 2007.

5.8 Hotels and restaurants sector

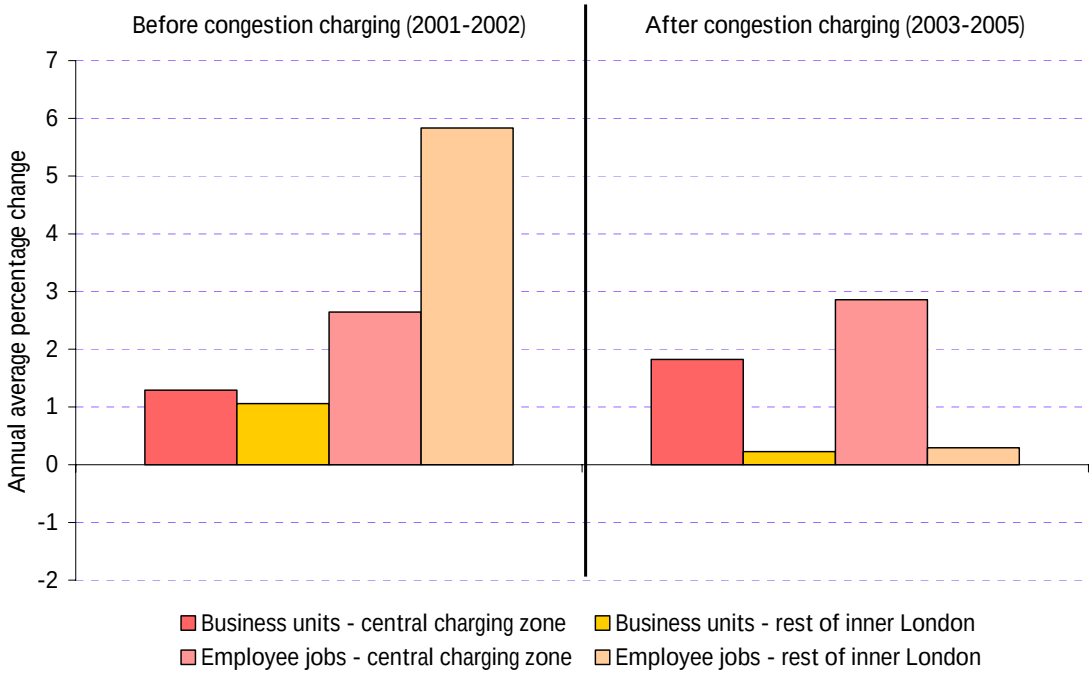
The hotels and restaurants sector is a major provider of jobs in the central London charging zone servicing both the overseas and domestic business and tourism market. Despite major terrorism incidents affecting tourism both before and after the introduction of congestion charging, growth in employment and the number of business units in the hotel and restaurants sector in the central London charging zone have been very consistent – with average growth of between 1-3 percent per annum. The central London charging zone has also generally outperformed other areas in London in terms of key performance indicators, such as profitability and turnover. Therefore, there is some evidence to suggest that the hotel and restaurants sector in the charging zone has experienced disproportionate positive growth since 2003.

Employees and business units in the hotels and restaurants sector

Closely following public services, the hotels and restaurants sector is the third largest employer in the central London congestion charging zone, accounting for almost 8 percent of total central zone employee jobs in 2005 according to the Annual Business Inquiry, 2007.

Figure 5.8 shows that the growth in employment and business units in the central London charging zone has been relatively stable pre-and post-2003 within this sector, at around 1 to 3 percent on average per annum. This performance contrasts with that of inner London over the same period, where the rate of growth in jobs and business units has declined considerably.

Figure 5.8 Business units and employee jobs in the hotels and restaurants sectors, before and after charging.

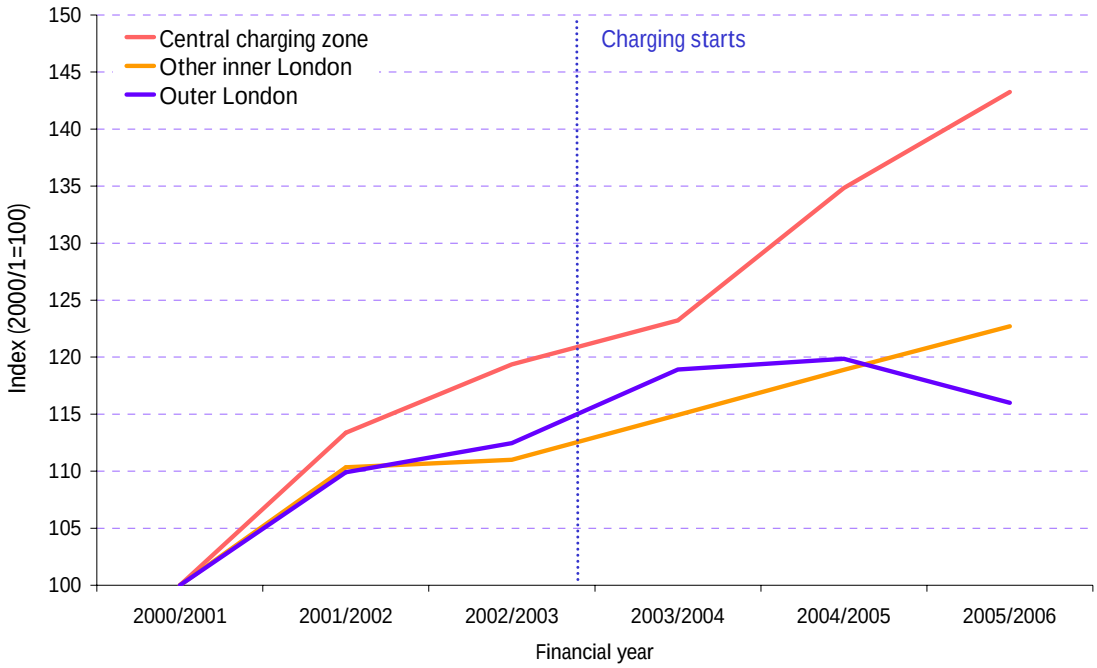


Source: Annual Business Inquiry, Office for National Statistics, January 2007.

Turnover and profitability in the hotels and restaurants sector

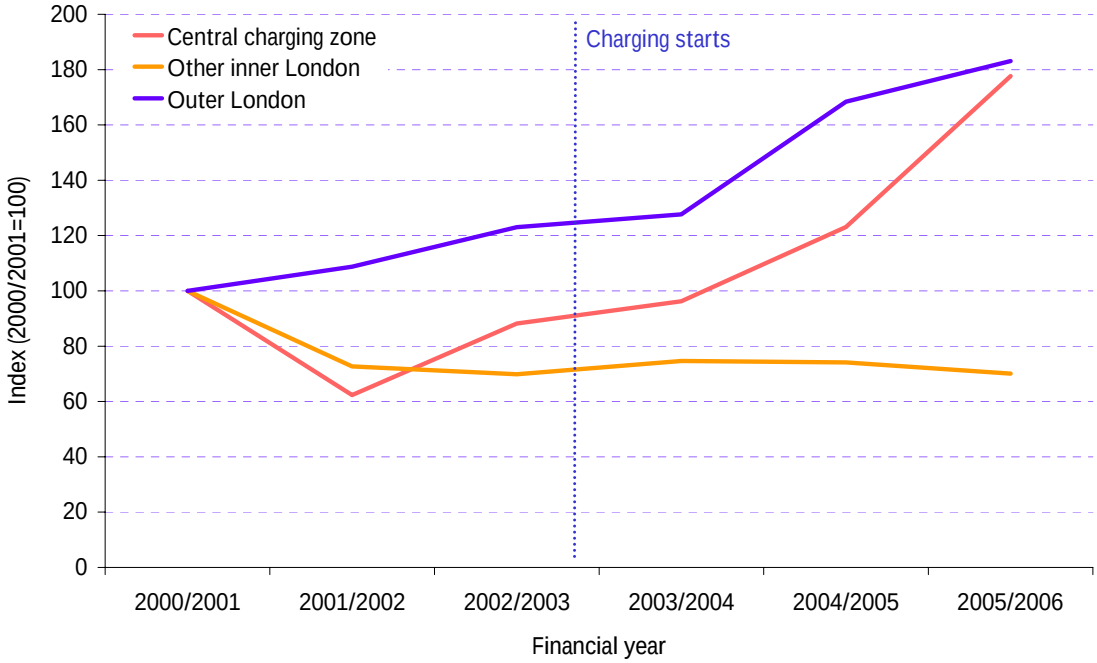
Sales growth and profitability in the hotel and restaurant sector in central London has been strong post-2003. Figure 5.9 indicates that sales growth in the central London charging zone has accelerated post-2003, rising faster than both inner and outer London. In the charging zone, profits have recovered substantially with profitability growth comparable to outer London levels in 2005/2006, despite a difficult pre-charging period in 2001-2003. In contrast, profitability in the inner London hotels and restaurants sector has declined since 2000, as shown in Figure 5.10.

Figure 5.9 Index of sales in the hotels and restaurants sector, compared to other locations in London.



Source: Dun & Bradstreet Ltd.

Figure 5.10 Index of profits in the hotels and restaurants sector, compared to other locations in London.



Source: Dun & Bradstreet Ltd.

5.9 Retail sector

Charging those who drive into the zone reduces the disposable income of those who pay the charge and encourages some drivers to avoid the charging zone. These 'income' and 'substitution' effects are likely to have the most direct effect on the retail sector. Thus, the impact on the retail sector is particularly important in assessing the impact of congestion charging.

Having said this, the retail sector itself is subject to some important external trends. These include increased weekend shopping and the increasing use of the internet for shopping and browsing – the latter possibly reducing 'window shopping' and hence shopper presence on the high street, and perhaps also sales at high street locations. Furthermore, previous annual impacts monitoring reports have shown that the proportion of shoppers who used cars to access central London has been relatively small, both before and after the introduction of charging. Therefore, the impact of any congestion charging related changes would be correspondingly small.

Growth trends in both retail employment and business units have been similar in the central London charging zone. In addition, the central London congestion charging zone has outperformed other areas in London since 2003. Retail footfall traffic in the central London charging zone has shown no noticeable effects from charging, although there appears to be greater difference between weekday and weekend trends.

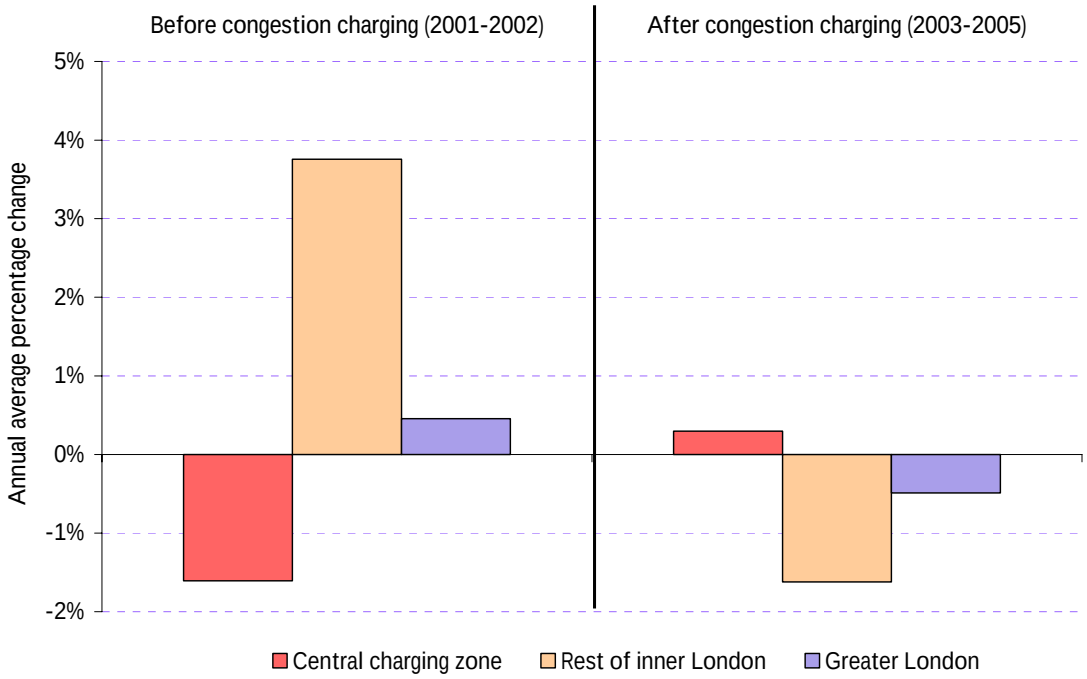
Net VAT registrations in the central London charging zone have shown slightly weaker trends post-2003 compared to elsewhere in London. However, excluding the terrorism affecting 2005, the analysis reveals that the central London congestion charging zone has in fact performed comparatively well. There is therefore no discernable effect on aggregate retail activity in central London since the start of congestion charging.

Employees and business units in the retail sector

The fourth largest employer in central London is retail, with just over 1 in 5 jobs, according to the Annual Business Inquiry, 2007.

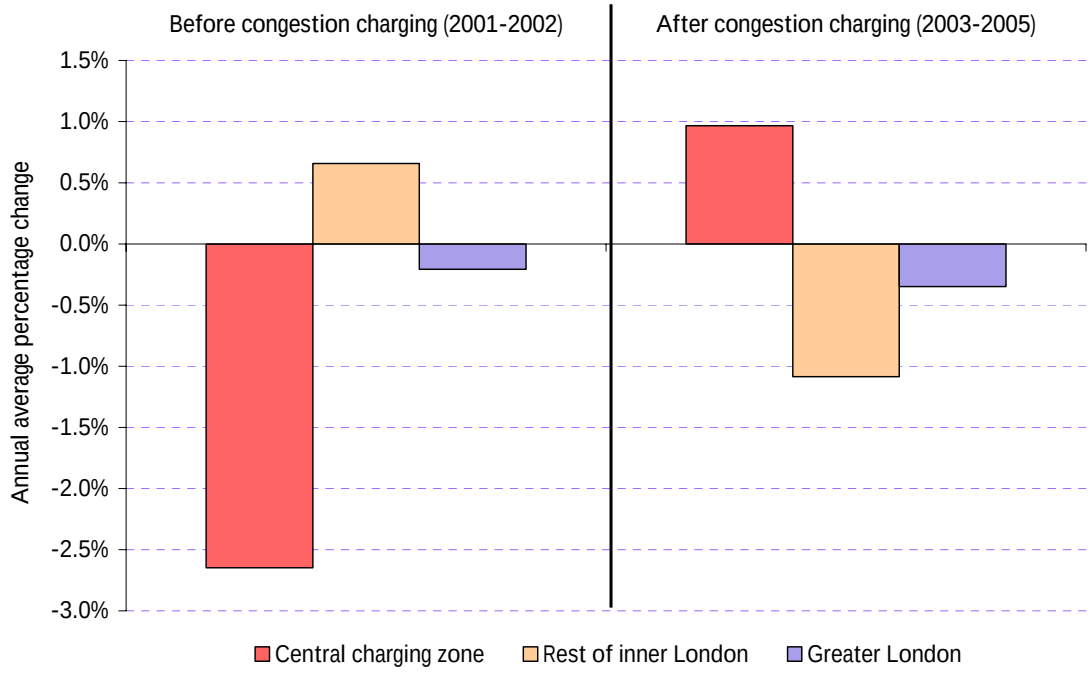
Employment in the retail sector has been volatile across London over the last five years. The central London charging zone has performed better in the period after 2003 than before 2003. Since 2003 the retail sector in the central London charging zone has outperformed both inner and Greater London, with growth in retail business units reflecting employment trends in the sector. In fact, the positive trend (3.5 percent) in the growth in business units post-2003 in the central London charging zone has been slightly greater than the 2 percent positive swing in employment (Figure 5.11). Elsewhere in London growth rates in employment and business units post-2003 have been negative, as shown in Figure 5.12

Figure 5.11 Employee jobs in the retail sector, before and after charging.



Source: Annual Business Inquiry, Office for National Statistics, January 2007.

Figure 5.12 Business units in the retail sector, before and after charging.

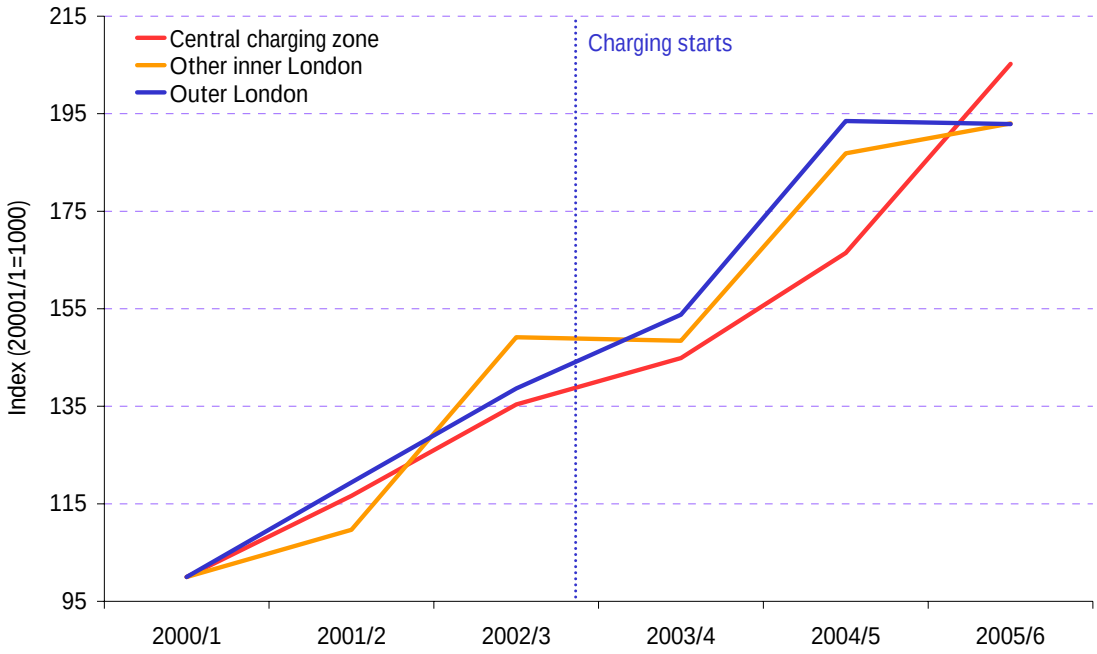


Source: Annual Business Inquiry, Office for National Statistics, January 2007.

Profits in the retail sector

Retail businesses have seen healthy profitability and steady growth across all areas of London. As Figure 5.13 shows, the central London zone retail sector has shown consistently strong profit growth during the past five years and has most recently out-performed the rest of London.

Figure 5.13 Index of profit in the retail sector.



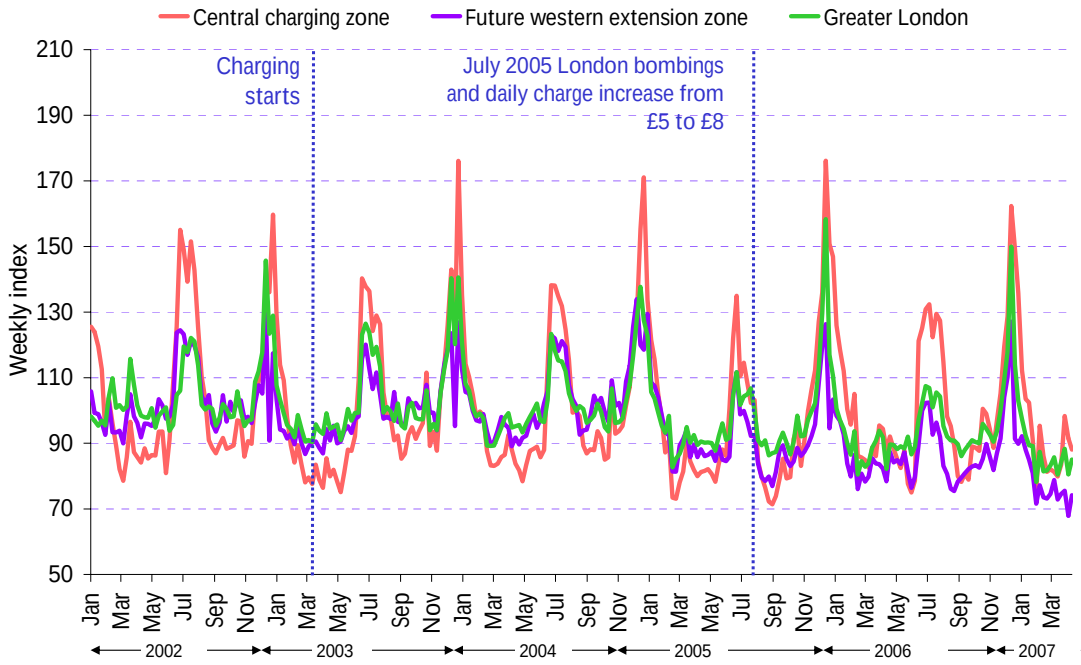
Source: Dun & Bradstreet Ltd.

Retail traffic

Retail traffic data, in comparison to other business and economic indicators presented above, is available on a weekly basis with a lag of a fortnight. This enables a more timely assessment of pre-and post-charging retail traffic (footfall) impacts than is possible with other datasets such as employment and business units. It also enables the assessment of recent scheme developments including the July 2005 Variations with the £8 charge, as shown in Figure 5.14 and 5.15.

Longer-term trends in the SPSL retail traffic index indicate that the central zone has generally outperformed the future western extension zone and Greater London as a whole. Also, there is no long-term, discernable impact following the introduction of congestion charging in February 2003, or after the July 2005 Variations. Although the retail sector in all areas within London suffered immediately following the July 2005 London bombings, retail footfall traffic indicators show swift recovery without any major lasting impact.

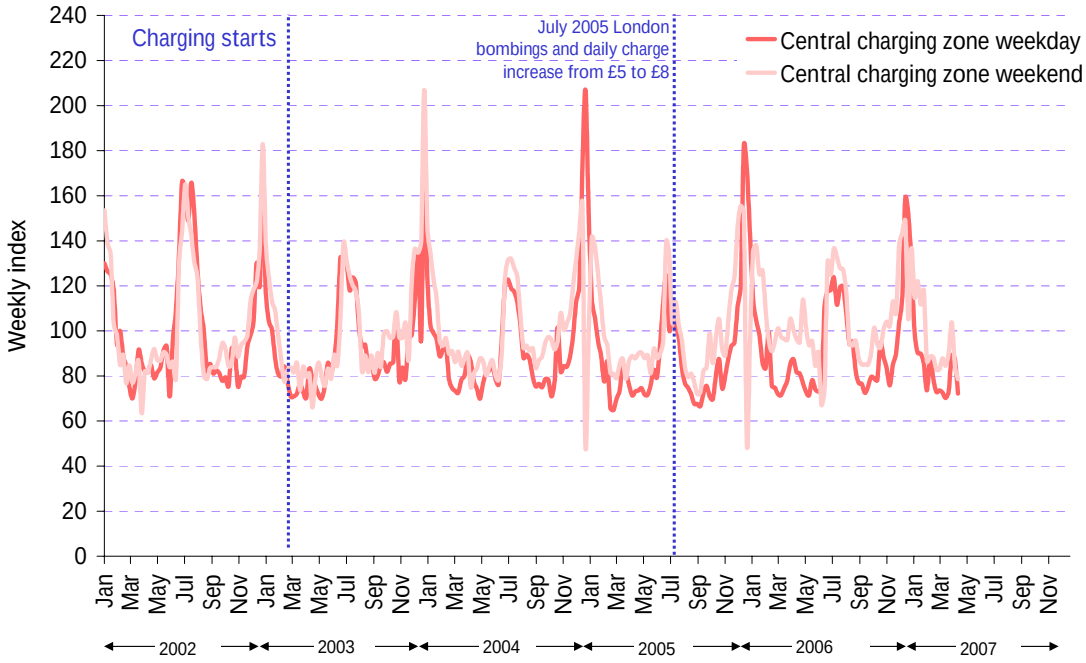
Figure 5.14 Weekly retail traffic index (footfall).



Source: SPSL Ltd.

Figure 5.15 shows the weekday and weekend split of retail footfall traffic in the central London charging zone.

Figure 5.15 Weekday and weekend split of retail traffic in the central London congestion charging zone, pre-and post-2003.



Source: SPSL Ltd.

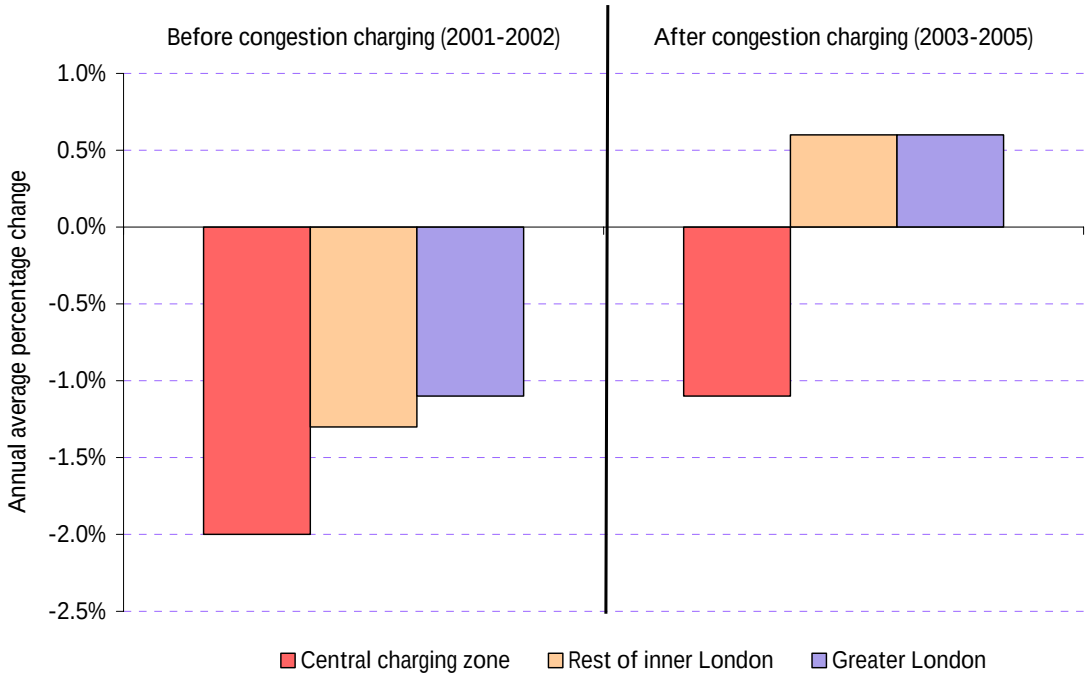
Weekday retail traffic has been relatively stable over the period since 2002, with a small upturn in 2006. The difference between weekday and weekend footfall has been increasing over the past two years. This may be due to increasing opening hours at weekends and the pick up in tourism since the end of 2004. There is no discernable impact following the introduction of congestion charging in February 2003 or after the July 2005 Variations.

VAT registrations in the retail sector

VAT registrations data currently aggregates the retail and wholesale sectors. Analysis of VAT registrations data is limited to evaluating the more immediate pre-and post-2003 periods only, due the limited availability of data following the July 2005 Variations. Collectively, the wholesale and retail sectors performed poorly in the three years prior to 2003, with the main areas in London all recording negative average annual growth of between -0.5 percent to -1.5 percent in net VAT registrations.

As Figure 5.16 shows, all areas in London have shown a pick-up in net VAT registrations since 2003, though the central London congestion charging zone is still experiencing falling numbers of registrations.

Figure 5.16 Net VAT registrations in the wholesale and retail sectors, before and after charging.

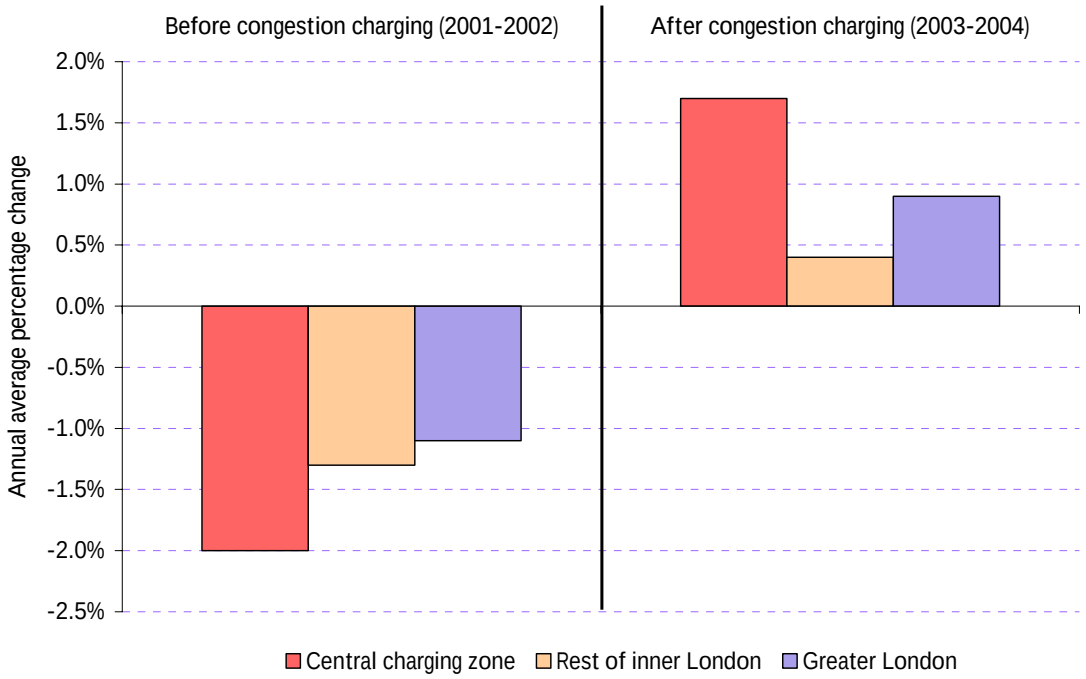


The relatively weaker net change in VAT registrations in the central London congestion charging zone was largely due to performance in 2005. In July 2005, the terrorist bombing incidents targeted central London's transport infrastructure and sharply reduced overseas visitors and consumer spending. Both factors are important business drivers for London's retail and wholesale sector. In the central London charging zone, this sector includes some of the smallest business units in the area in

terms of the number of employees and size of turnover, and these were potentially most vulnerable to sudden major economic shocks such as the July 2005 bombings.

Figure 5.17 indicates that the central London charging zone performed comparatively well post-charging when 2005 is excluded from wholesale and retail net VAT registrations calculations.

Figure 5.17 Net VAT registrations in the wholesale and retail sectors, before and after charging, excluding 2005.

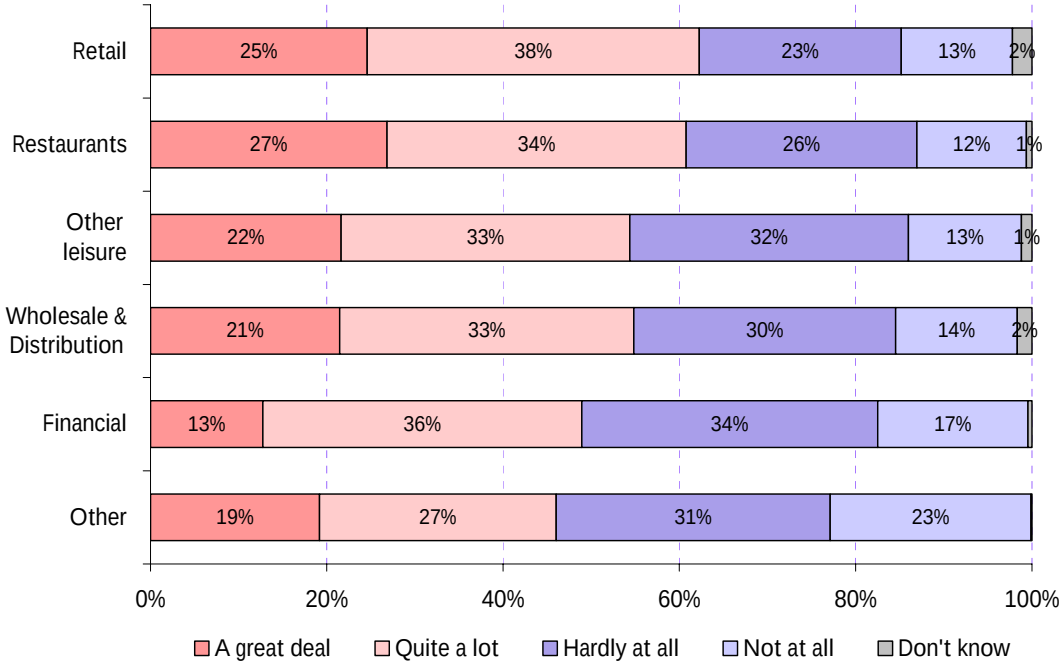


Business attitudes in the retail sector

For the last five years, TfL has conducted an annual survey of business within the central London charging zone and boundary locations to gauge business attitudes to congestion charging and its impacts on business activity. While retailers tend to be among the least supportive of the scheme, companies in retailing, more than in any other sector, agree that transport difficulties are a significant problem facing their organisation.

The most recent TfL Business Survey of Autumn 2006 suggests that nearly two-thirds of the surveyed retail sector businesses in the charging zone say that transport and travel difficulties affected their business 'a great deal' or 'quite a lot', as shown in Figure 5.18.

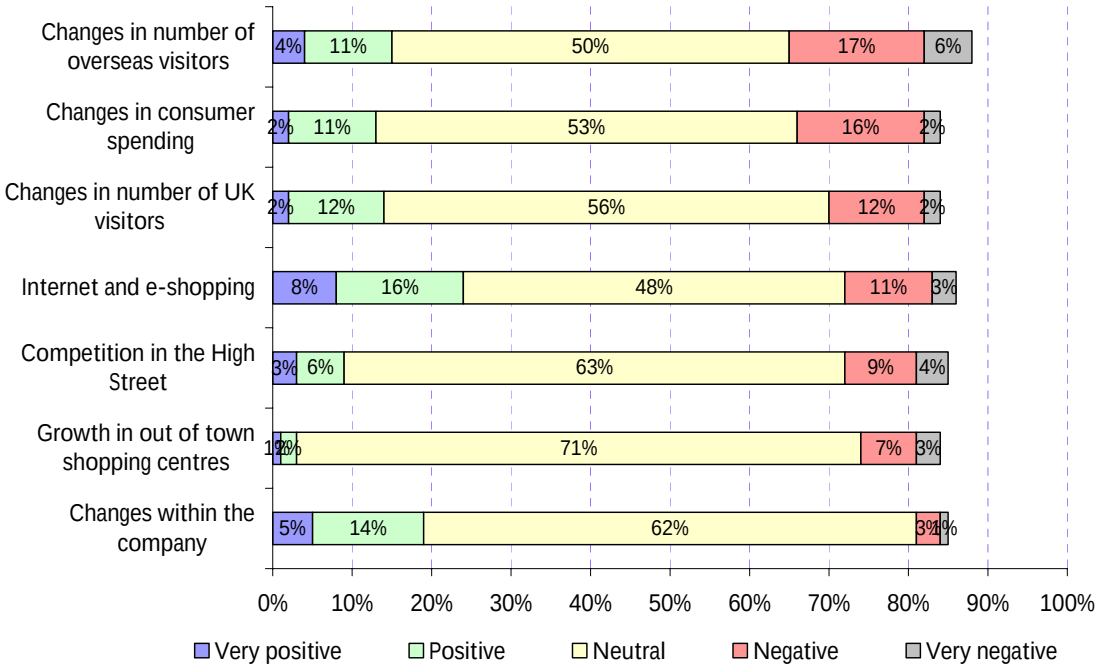
Figure 5.18 Businesses citing transport difficulties as a major problem facing the organisation, by business sector (2006).



Source: TfL Congestion Charging Business Survey: Central Zone – Wave 5.

Of the main underlying factors affecting performance in 2006, retailers in the central London charging zone identified changes in overseas visitors and consumer spending as the main negative influences on business activity (Figure 5.19).

Figure 5.19 Main factors affecting retailers in the central London congestion charging zone, 2006.



Source: TfL Congestion Charging Business Survey: Central Zone – Wave 5.

The business perspective therefore lends some support to the assertion that the relatively poor retail VAT registrations performance in the central London charging zone in financial year 2005/2006 – some three years after the start of congestion charging – was due primarily to the impact of the London bombings on overseas visitors and consumer spending.

5.10 Property markets

As with other indicators used to determine possible economic impacts of congestion charging, property prices and rental yield trends result from a complex interaction of supply and demand factors within the economic cycle, rather than merely the introduction of, or increase to, the charge. Due to the commercial nature of the congestion charging zone, our analysis of trends in property markets is focused on retail and office properties.

Analysis of commercial property rental values suggests that the property markets follow a cyclical pattern and are impacted by a combination of both local and London-wide factors. Commercial property, which dominates the property market in the central London charging zone, does not appear to have been impacted differentially compared to inner London by the charging scheme. This includes the relatively short period to September 2006, over which data is available following the rise in the charge to £8 in July 2005.

Approach

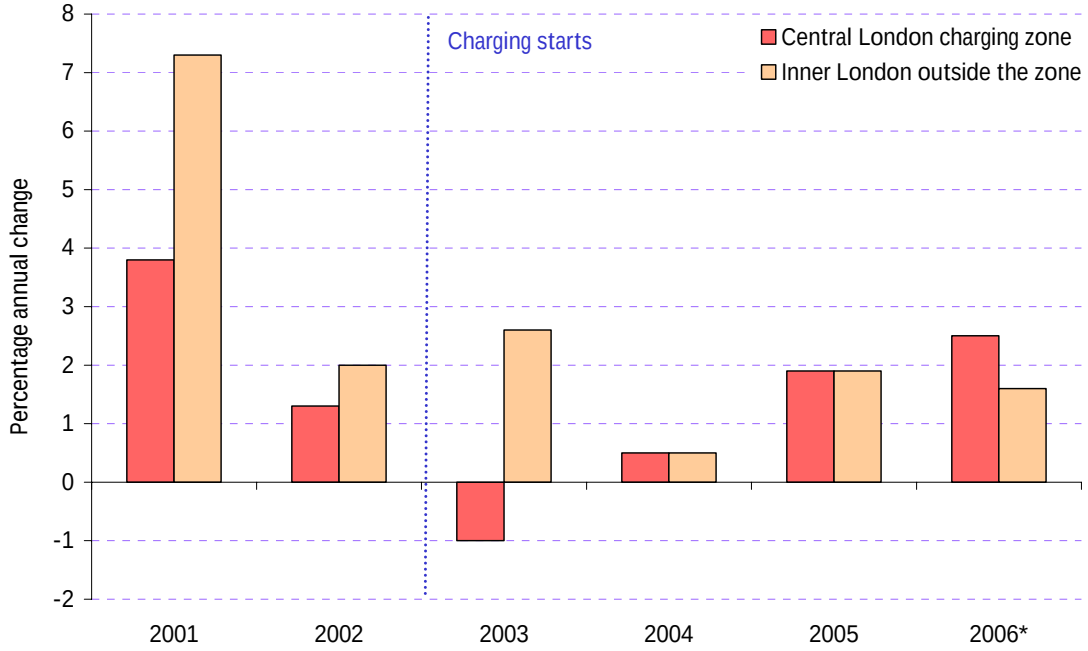
Analysis carried out by the Investment Property Databank using their quarterly databank of commercial property prices, has tracked the performance of retail and office property assets within the charging zone since 2000, using two measures:

- *rental value change* – measurement of the change in the current estimated rents of commercial properties on the open market;
- *yield impact* – measurement of the change in the value that investors place on future income streams of commercial properties.

Retail property

The central London congestion charging zone registered lower rates of growth in rental values of retail properties in comparison to inner London prior to the introduction of the charging scheme, as shown in Figure 5.20. While the poorer performance of the central London charging zone predates charging, post-2004 the rental value of retail properties in the central London charging zone has risen in line with trends in retail rental values in inner London. The positive retail property market performance reflects healthy retail performance generally.

Figure 5.20 Rental value growth of retail properties in London.



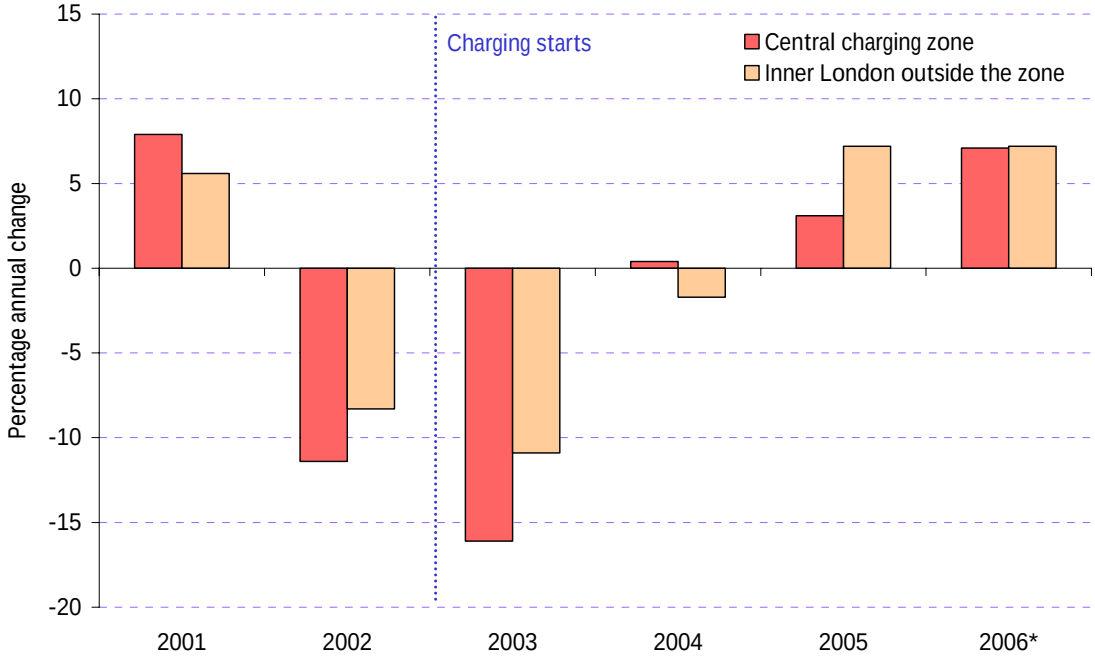
* Data for 9 months to September 2006.
Source: Investment Property Databank Ltd.

Office markets

The inner London office market is characterised by large differences in the tenant mix, type of stock and amplitude of the construction cycle. It is also affected by the cyclical pattern of office rents in the last five years, which has been influenced by such events as the start of the war in Iraq and international terrorism. In addition, the financial and business services sector and the distributive trades sector, both prominent occupiers of inner London's office space, have both experienced slowdown and growth since 2001, indicating the influence of varied trends on office rental prices.

Although growth rates differ, rental values in the London office market follow very similar trends (cyclical pattern) in both the central London charging zone and inner London. In 2001 when office rental values rose, rents in the central London charging zone outperformed inner London. However, when rental values fell in 2002, the central London charging zone performed comparatively less well. After 2003, a similar pattern has been seen with office rental values in the central London charging zone outperforming or in line with inner London rental value growth in some years, and performing comparatively less well in others, as indicated by Figure 5.21.

Figure 5.21 Rental value growth of office properties in London.



* Data for 9 months to September 2006.
Source: Investment Property Databank Ltd.

Business rates

Since 2004 the Valuation Office Agency has received over 10,000 appeals for alterations to the rateable values of commercial properties in London that cite congestion charging (among other factors). To date, the evidence presented to the Valuation Office Agency has not supported any reduction in the rateable value of properties on the grounds that the congestion charging scheme has adversely affected business activity – due to a lack of evidence.

The rateable values of commercial properties, commonly known as 'business rates' or 'non-domestic rates', are established by the Inland Revenue's Valuation Office Agency. These contribute towards the costs of local authority services.

The rateable value is based on the rental value of a commercial property at a set valuation date, called the antecedent valuation date. The most recent assessment took place in April 2003, effective from April 2005. The ratings are assessed every five years. It is then assessed by the Valuation Office Agency and used to calculate the rates payable by ratepayers.

Table 5.1 shows the outstanding commercial property appeals against rateable value evaluations for London boroughs in and around the charging zone. No new appeals citing congestion charging were received between February 2006 and February 2007, and consequently, the number of outstanding appeals has decreased significantly over this period.

Table 5.1 Outstanding appeals against the rateable value of commercial properties that cite congestion charging as a ground for appeal since 2006.

Borough	Outstanding appeals February 2006	Outstanding appeals February 2007
City of London	27	0
City of Westminster	118	44
Hackney	8	0
Islington	12	0
Tower Hamlets	0	0
TOTAL	167	51

5.11 Summary of key points

No general evidence of any clear differential impact of the central London congestion charging scheme on business activity has been found by the TfL analysis.

The dominant financial and business services sector showed positive trends in aggregate employment and business activity in the years following the start of congestion charging in comparison to the years immediately before charging in 2003. Similarly, the hotel and restaurants sector and the retail sector, both of which are important employers in the central London congestion charging zone, registered stronger business performance following the introduction of charging, and have outperformed other areas of London.

Analysis of commercial property rental values is complicated by economic cyclical patterns and by a combination of both local and London wide factors. Notwithstanding this, commercial property values do not appear to have been impacted differentially by the charging scheme based on mixed performance both before and after the introduction of charging.

The business and economic impacts monitoring of the July 2005 Variations to the scheme is currently limited due to long lags in the availability of published economic and business data. Retail traffic (footfall) data, which is one business dataset that is available to early 2007, shows no significant adverse impact that may be attributed the scheme variations in 2005.

6. Central zone: scheme operation, enforcement and revenues

6.1 Introduction

This section looks at developments to the operation and enforcement of the central London congestion charging scheme during 2006. It also reviews revenues and expenditure associated with the scheme. Developments related to the introduction of the western extension are summarised in Section 14.

The operation of the central London congestion charging scheme continued to improve throughout 2006, with the introduction of further service enhancements that have resulted in a better chargepayer experience, reflected in increased chargepayer satisfaction and increased compliance with the scheme.

Key developments during 2006

- Overall satisfaction with the quality of service provided by congestion charging reached a new high of 79 percent in 2006.
- A number of changes were introduced to the operation of the scheme during 2006, including significant improvements to the processing of residents' discounts and the launch of 'Pay Next Day', allowing chargepayers to pay the charge the day after they travelled within the charging zone.
- Total valid charge payments decreased slowly for much of 2006, reflecting the charge increase in July 2005 and the ongoing general 'background' decline to traffic referred to elsewhere in this report. However, numbers of charges paid increased towards the end of the year, probably reflecting the extension of residents' discount status to western extension zone residents from October 2006.
- Capita, the main service provider for the scheme, generally performed well and met all of its key milestones in the delivery of additional and new services required for customer improvements and preparation for the launch and operation of the Western Extension.
- The internet remains the most used channel for charge payments, accounting for 33 percent of transactions.
- Compliance with the scheme continued to improve, with the level of Penalty Charge Notices issued in 2006 about 17 percent down on 2005.
- Representations and appeals against Penalty Charge Notices continued to reduce, with 14 percent of the Penalty Charge Notices now being subject to a representation and 1 percent subject to appeal.
- Of the cases which reach the Parking and Traffic Adjudicators, TfL congestion charging has a higher level of success in winning appeals than any local Authority, with 84 percent of appeals heard being found in TfL's favour.
- Penalty payment rates remain consistent, with over 72 percent paid – the vast majority at the discounted amount.

- Significant improvements have been made to the congestion charging website to provide simple guidance and advice to vehicle keepers who receive Penalty Charge Notices.

Scheme operation

6.2 Service developments and contractor performance

Developments to the operation of the scheme during 2006 have built upon the enhancements to the service delivered in 2003, 2004 and 2005 as described in previous annual impacts monitoring reports. The result has been additional improvements to the 'chargepayer experience', increased compliance with the scheme and a further reduction in the issuing of Penalty Charge Notices that chargepayers believe are unfair.

Key developments for the scheme in 2006 were:

Residents and discounts

- The residents' discount renewal process has been greatly simplified so that each year registered residents now simply have to confirm their details rather than submit a new application. This has resulted in 95 percent of resident affirmation applications being approved and a 30 percent reduction in rejected discount renewals.
- Enhancements in the application process now allow qualifying residents to pre-register on the web or through the call centre. Completed application forms are then generated and sent to the applicant along with a letter clearly stating the proof of details that need to be returned. The applicant simply has to sign the form and return it with the required proofs. These amendments have contributed to a 50 percent reduction in rejected new discount applications.
- Improvements have also been made to the actual processing of residents discounts. A specialist team has been established to help residents who are having difficulty in setting up their discount. This includes outbound calling to new residents who have incorrectly completed the application form to ensure speedier resolution of the problem.
- TfL has aligned the dates for residents' charges with the period for which they are eligible for the residents' discounts. Residents are now no longer able to buy valid charges beyond the period for which they are eligible for a discount. This has reduced the level of confusion at discount expiry and hence decreased the number of Penalty Charge Notices issued to residents.
- A new 100 percent discount from the congestion charge, for three-wheeled vehicles that are less than 1 metre wide and 2 metres long, was successfully introduced in September 2006.

Payments

- The Pay Next Day scheme was introduced on 19 June 2006. Chargepayers can now, at a total charge of £10, pay up to midnight on the charging day following

their journey in the congestion charging zone. Previously, chargepayers had to pay in advance or on the day of travel. Pay Next Day has proven very popular and is used for over 4,000 payments per day, increasing convenience and reducing the level of Penalty Charge Notices issued by around 12 percent.

- A new call recording system was introduced that records all 'customer' calls coming into the call centre. This provides significant enhancements to training, as well as allowing faster resolution of complaints and enquiries.

Enforcement information

Additional specific enforcement-related pages have been added to the congestion charging website, www.cclondon.com, to provide detailed information regarding the entire enforcement process. These include particular advice on how to make representations, and the appeal and statutory declaration processes. By providing this information in an easy to follow format, chargepayers will have access to information that provides them with clear guidance and advice if they receive a congestion charging Penalty Charge Notice. These additional pages can be found at www.cclondon.com/Penalties-Enforcement.

Appeals

TfL successfully introduced an electronic data interface with the appeals service in November 2005, working in conjunction with the Parking and Traffic Appeals Service. This interface allows the electronic transfer of all evidence relating to appeals between Capita and the appeals service. It removes the need for paper exchange of documents, thereby reducing the likelihood of evidence going missing. TfL is still the only Authority to use such an interface and its introduction has contributed to:

- increased efficiency in submitting appeal packs and other data to Parking and Traffic Appeals from TfL;
- a significant reduction in paper and printing by TfL and Capita;
- a reduction in decisions to not contest appeals by TfL;
- a reduction in the risk of appeals packs being delayed or lost in transit.

Bailiffs

During 2006 TfL undertook a thorough review of its bailiff arrangements, contracts and bailiff monitoring programme and has made further improvements in numerous areas. These improvements include:

- The introduction of additional monitoring activities and increased frequency of monitoring with detailed monitoring reports provided to each bailiff company.
- From later in 2007, introduction of a bailiff 'Know Your Rights' leaflet to be issued with bailiff correspondence and interaction. This will provide debtors with simple information about what happens when bailiffs are engaged to discharge a debt and what a bailiff can and cannot do, as well as detailed information regarding the complaints processes.
- Formal variations to the contracts with financial penalties for: failure by the bailiff companies to issue the Know Your Rights leaflet; failure to use the correct

documentation or misleading documentation during the enforcement process; failure to provide proof of visits using Global Positioning Satellite tracker records or a suitable alternative; failure to check the references of new personnel and failure to use certificated bailiffs in the execution of congestion charging warrants.

In addition to the above, from June 2007, all four bailiff companies will be required to report on call centre answer times and availability, and to provide an additional report showing the point in the enforcement process where payment has been achieved.

Foreign vehicles

Congestion charging continues to use the services of a dedicated European debt recovery agency – Euro Parking Collections. Euro Parking Collections is now into its third full year of working on the collection of congestion charging penalties incurred by foreign registered vehicles. Where Euro Parking Collections is able to access the keeper information of foreign registered vehicles it has achieved a 38 percent collection rate, which represents a steady improvement on previous years.

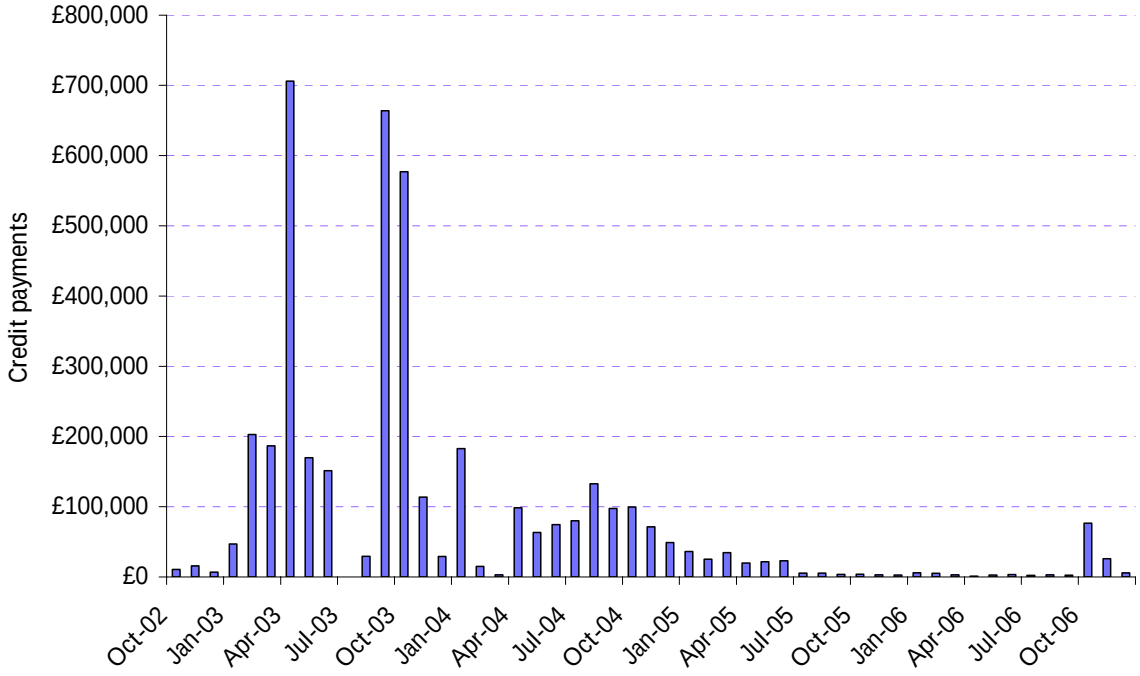
Working in partnership with TfL, Euro Parking Collections continues to widen the scope of its access to European vehicle licensing agencies and has recently gained access to the agencies of Finland and Austria, bringing the total number of countries to 16. It is hoped that access to further European countries will be achieved in the coming year with steady progress being made to access details for keepers registered in Belgium, Estonia, Hungary, Ireland, Latvia, Lithuania, Bulgaria, Czech Republic, France, Romania, Slovakia, Slovenia and the Netherlands.

6.3 Capita performance

Capita is the main service provider supporting the day to day operations of the scheme on behalf of TfL. Capita has staff in London and Coventry that manage the key functions of the service including camera maintenance, image capture, the contact centre, discount registration services and most enforcement services such as the processing of all Penalty Charge Notices, Penalty Charge Notice progression, representations and appeals.

TfL has 52 performance indicators within the Capita contract and Supplemental Agreement (see TfL's *Third Annual Impacts Monitoring Report*). There are seven 'super' key performance indicators, 32 key performance indicators and 13 quality performance indicators. Performance against these indicators has further improved in 2006, with the vast majority of indicators being met.

Figure 6.1 Capita performance – service credit payments from Capita to TfL.



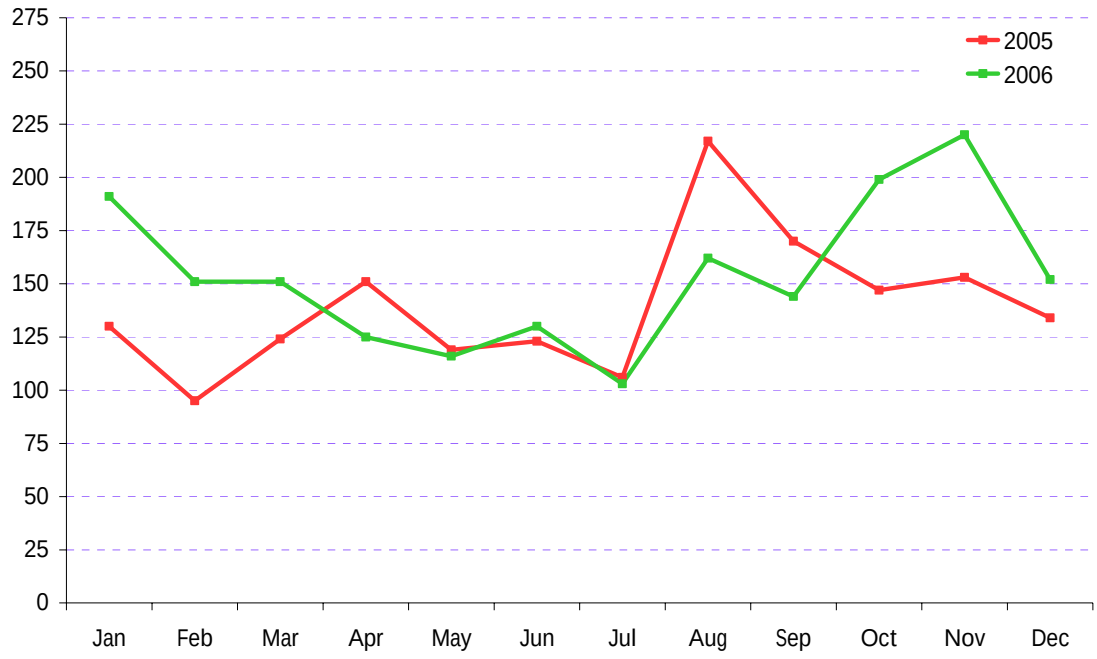
This strict performance regime, monitored by a team of TfL Policy and Monitoring Advisors based on site in Capita's main contact centre, has contributed to a significant and sustained improvement in the quality of service in key performance areas. These include reductions to Penalty Charge Notices issued as a result of an error by Capita, or the incorrect processing of representations and appeals, both of which remain within acceptable levels.

Performance from July 2005 and throughout 2006 steadily improved when compared with earlier years with the exception of some processing errors that occurred in October, as reflected in the trend of service credit payments from Capita to TfL (Figure 6.1).

NCP Services is TfL's service provider for on-street enforcement operations in respect of persistent evaders of the congestion charge. The company has continued to provide a fully satisfactory performance throughout 2006 (Figure 6.2).

Based on the successful introduction of a 'Locust' van in 2005, a second 'Locust' van which is capable of reading number plates of parked vehicles whilst travelling at the speed of general traffic was introduced in 2006. This has contributed to a more effective method of identifying and enforcing against persistent evaders of the scheme.

Figure 6.2 Number of persistent evader vehicles enforced against per month in 2005 and 2006.



Planned developments

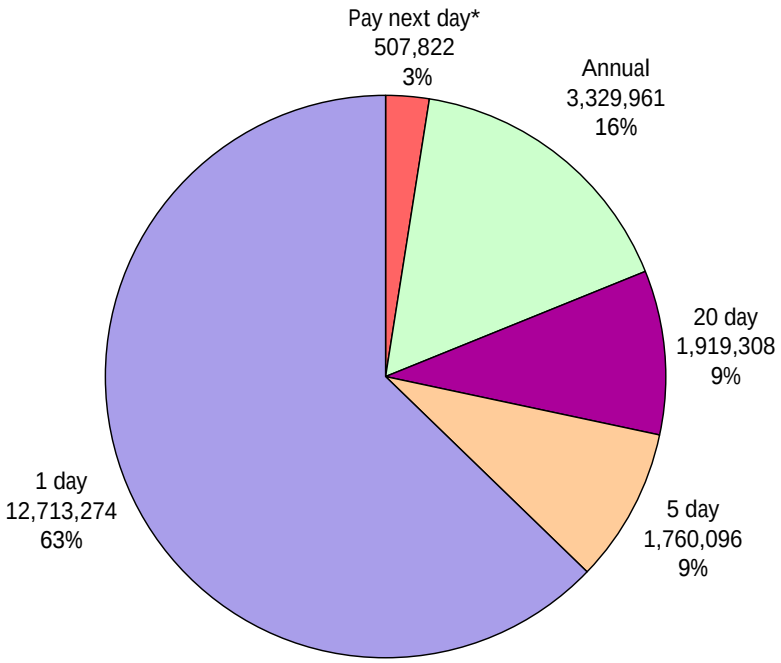
Additional developments are planned to further improve the quality of service and maintain high levels of chargepayer satisfaction in 2007. These include:

- Further improvements to the website to improve the accessibility and usability.
- The Blue Badge discount application process will be improved following the successful changes introduced to the residents' process.
- Further public information relating to how to challenge a Penalty Charge Notice and what evidence TfL requires in order to investigate a representation.
- Further consultation with the British Vehicle Rental and Leasing Association is underway to help ensure that hire companies provide the appropriate information to transfer liability to the hirer.
- Congestion charging enforcement expect to launch a system whereby members of the public intending to purchase a new vehicle, can, on provision of confirmation from the existing keeper, check with TfL to ascertain whether the vehicle has outstanding congestion charging Penalty Charge Notices.

6.4 Congestion charging payments

Figure 6.3 shows the breakdown of congestion charging payments by type. Standard daily charges were the most common payment type throughout 2006. The Pay Next Day option was only introduced in June 2006, so is not directly comparable with the percentages of other payment options.

Figure 6.3 Congestion charging payments by type, 2006.



* Pay next day introduced in June 2006.
Note: payments valid for more than 1 day (eg, annual) shown multiplied by days for which they are valid.

Figure 6.4 shows the monthly average volumes of valid charges paid since the start of 2004. The general trend is slowly downwards, reflecting the ongoing 'background' declines to traffic in and around central London described elsewhere in this report. The response to the increase in the charge to £8 in July 2005 is clearly visible in this indicator, as is an upturn in the latter months of 2006, reflecting western extension residents' discount charge payments. The percentage of 'fleet scheme' vehicles increased from 16 percent to 18 percent during 2006, reflecting a number of improvements to TfL's fleet scheme arrangements as described in previous reports.

As noted in TfL's *Fourth Annual Impacts Monitoring Report*, because potentially chargeable vehicles (cars, vans and lorries) account for under half the traffic within the charging zone during charging hours, the magnitude of changes to the total number of vehicles observed would be reduced in comparison with the equivalent congestion charge payments trend. Taking this and other relevant factors such as background decline in traffic into account, the long-run effect of the July 2005 charge increase on payments is of the order of 8 percent, corresponding to an approximate reduction in total traffic in the central zone of about 3 percent (see also Section 2 of this report).

The up-turn in charge payments in late 2006 would correspond to an increase in traffic in the original central zone from trips by newly-discounted western extension residents. Western extension residents making similar trips before October 2006 would generally have been full chargepayers. However, the extension of the discount facility will have led to additional trips over and above those routinely made by these residents beforehand. Taking these factors into account, the implied corresponding increase to traffic in the central zone from additional resident's discount trips in late 2006 would be of the order of 3 percent.

Figure 6.4 Average number of valid charges on each charging day, January 2004 to December 2006.

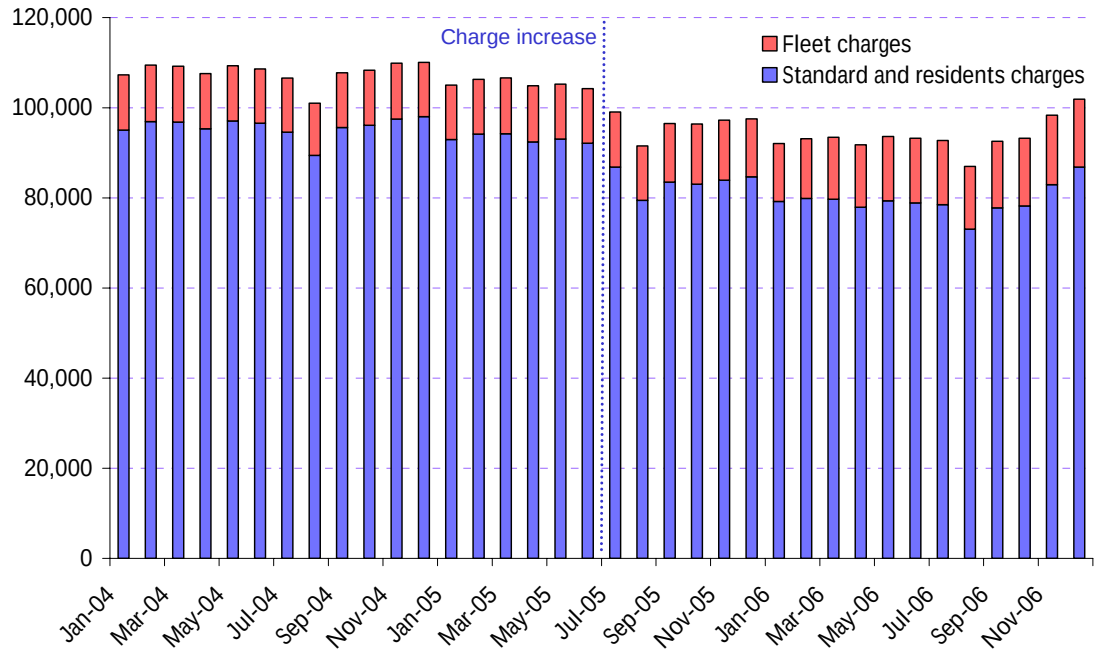


Table 6.1 illustrates the percentages of each type of payment since the start of the scheme in 2003. As can be seen, almost two-thirds of residents' charges are annual, whereas over eighty percent of standard charge payments are daily.

Table 6.1 Charges by payment type.

	Standard charges				Residents' charges		
	Daily	Weekly	Monthly	Annual	Weekly	Monthly	Annual
First year of scheme (17/02/03 - 31/12/03)	82%	9%	6%	2%	20%	24%	56%
Second year of scheme (01/01/04 - 31/12/04)	82%	9%	6%	2%	18%	22%	60%
Third year of scheme (01/01/05 - 31/12/05)	81%	9%	7%	3%	17%	18%	65%
Fourth year of scheme (01/01/06 - 31/12/06)	81%	6%	8%	4%	19%	16%	65%

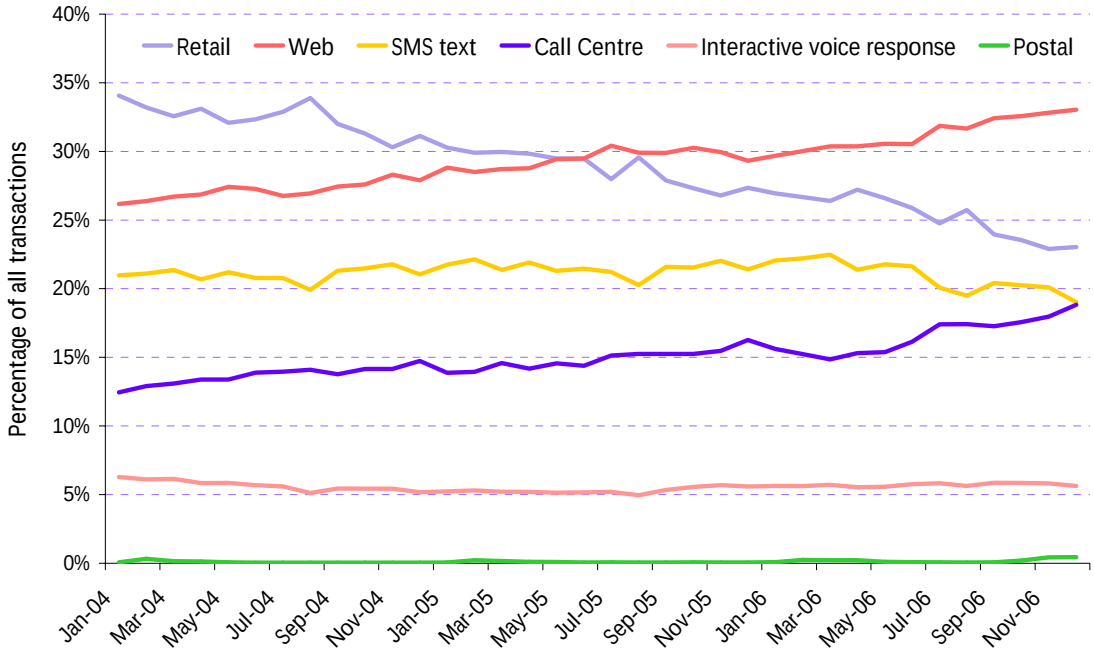
Taking all payment types into account, of the payments made for the 12 months ending December 2006, 20 percent were made in respect of vehicles registered for the 90 percent residents' discount. This was an increase from 16 percent in 2005, and primarily reflects the extension of residents' discount status to residents of the western extension zone, following registration, from late October 2006.

6.5 Payment channel split

Previous annual impacts monitoring reports have described established patterns of payment, and identified a trend towards growing use of automated payment channels.

In 2006, there has been a further increase in the usage of the web channel and a reduction in usage of the retail channel. The call centre payment channel saw growth in latter part of 2006. This was in part the result of Pay Next Day, which was introduced in June 2006 and is available through only the web and call centre channels (Figure 6.5).

Figure 6.5 Charge transactions payment by channel, January 2004 to December 2006.



6.6 Quality of service

Overall satisfaction with the operation of the scheme as measured by surveys of chargepayers is now at 79 percent, up from 77 percent twelve months ago, and at its highest level since the start of the scheme. Satisfaction with the payments process rose from 82 percent in 2005 to 85 percent in 2006, again representing a new highest level.

Improvements in the monitoring regime for payments have increased the error free payment rate to 99.8 percent. These improvements include additional quality and monitoring staff employed in the contact centre to ensure that chargepayers receive a high and consistent level of service when they contact TfL.

Call centre performance improved further in 2006, with average queuing times at only 9 seconds for the year. The volume of calls has dropped slightly from 2005 figures, averaging some 230,000 calls per month. The percentage of callers abandoning calls or unable to get through to the call centre was 0.5 percent in 2006.

In reviewing the quality of service provided by TfL, the Local Government Ombudsman in the *Local Government Ombudsman Annual Letter 2005/2006* commended congestion charging on a reduction in complaints received, and the

manner in which TfL congestion charging takes a "positive and proactive approach" when handling and settling complaints.

6.7 Public information

A series of public information campaigns were run throughout 2006, aimed at both frequent and infrequent drivers through a variety of media, including posters, press and radio.

A radio campaign, which ran on eight London radio stations from November 2005 to March 2006 to remind chargepayers of the hours of operation of the scheme, won an 'Aerial Award' in January 2006 for its 'barbershop' ad.

In March a campaign was launched to help drivers remember to pay the charge. Drivers were encouraged to visit www.cclondon.com to download a free 'desktop reminder' to run on their computer or to request a car tax disc holder. The desktop reminder allows users to select the day of the week and time of day they wish to be reminded to pay the charge, with a click-through link to www.cclondon.com to enable users to pay the charge online. As of May 2007, 13,000 potential chargepayers have downloaded the desktop reminder, and 26,000 car tax discs have been requested and issued.

The new Pay Next Day payment option was launched using radio and press in June 2006 accompanied by some direct mail to a key segment of registered chargepayers who had driven in the charging zone during the last 12 months and had received at least one Penalty Charge Notice.

July saw the launch of a new campaign targeting all Londoners as well as drivers, explaining the benefits of the scheme and how the net revenue generated was being used. Key messages focused on *'Less congestion', 'More people using public transport'*, '*72km of new cycle lanes'*, and *'350 more buses to catch'*. The messages ran on roadside posters, in the London-wide local press and ethnic minority press, as well as in the Londoner and the Metro.

Press advertisements in the Metro newspaper in December 2006 reminded Londoners that the charge was not in operation over the Christmas period.

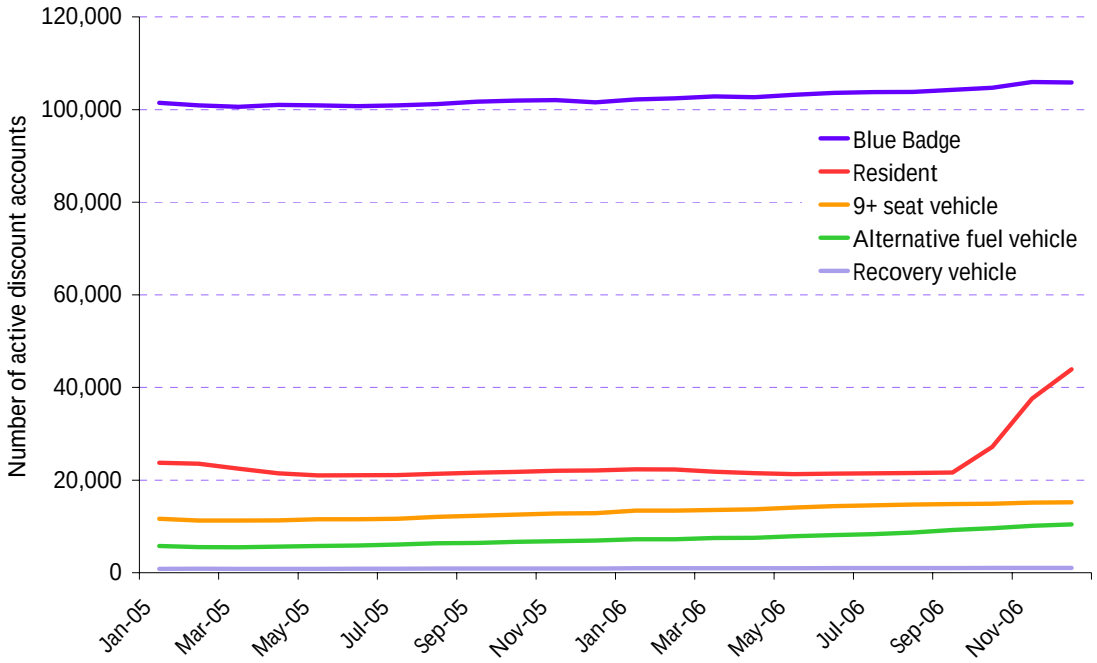
New leaflets have been developed specifically targeting newly registered residents and Blue Badge holders. The leaflets aim to help these people understand how their discount works and provide tips to help them avoid receiving any unnecessary Penalty Charge Notices.

6.8 Registrations and discounts

As expected, applications for resident discounts rose sharply from October 2006 as residents in the western extension zone took the opportunity to pre-register for the extended scheme (Figure 6.6). This conferred discounted status for trips to, from or in the original central zone (see also Section 6.4) from date of registration, leading to some increases in circulating traffic in the central London zone. Note that a proportion of these 'newly discounted' residents' trips would have been made

previously as fully-chargeable trips. However, others would have been 'new' trips, contributing to a small overall increase in traffic in the central zone.

Figure 6.6 Active discount accounts by type, January 2005 to December 2006.



Scheme enforcement

6.9 Enforcement process

There are no tollbooths or barriers around the congestion charging zone and no paper tickets or licences. Instead, drivers or vehicle operators pay to register their vehicle registration number on a database for journeys within the charging zone during charging hours for single or multiple charging days. Receipts (or receipt numbers) are available and on occasion are vital for proving payment of the charge for the correct vehicle on the date of travel.

Cameras at every entry and exit point, and on various routes within the zone, capture images of vehicles within the charging zone during the hours of operation (07.00 to 18.30 throughout 2006). The hours of operation in both parts of the extended charging zone changed to 07.00 to 18.00 following the introduction of the western extension in February 2007. Vehicle images are continually fed through to a central processing centre where automated number plate recognition systems interpret the characters on the number plate of every vehicle detected.

Once a registration number has been interpreted, a complex process of confidence measurement of the images takes place. At the end of the charging day, only the best, highest quality interpretation of each individual detected vehicle is used for checking against the database of paid, exempt, 100 percent discounted or fleet vehicle registrations. Once a match against the database is made, the vehicle details and the images are automatically removed from the database. Images of all vehicles

where there is no matching record on the database are then sent through to the next stage of the process.

Since the introduction of Pay Next Day in June 2006, the process for issuing Penalty Charge Notices has been extended by 24 hours. By 02.00 on the second working day following the end of the charging day on which the vehicle was detected, all the vehicle registration numbers for those vehicles where no match was made are sent to the Driver and Vehicle Licensing Agency using a web enabled interface developed in partnership by TfL and the Agency. By 07.00 on the same day the Agency supply TfL with the name and address of the registered keeper and vehicle details including the make, model and colour of the vehicle.

The final stage of the process before the issue of any Penalty Charge Notice involves a visual check of all the images of vehicles identified as potential contraventions of the requirements of the scheme. Trained staff check that the camera systems have correctly interpreted the number plate. If there is any doubt, the image is rejected for re-interpretation or deletion.

Failure to pay the congestion charge or to register correctly for a discount results in a Penalty Charge Notice of £100 being issued to the registered keeper of the vehicle as supplied by the Driver Vehicle and Licensing Agency. This amount is reduced to £50 for prompt payment within 14 days. Failure to pay the Penalty Charge Notice within 28 days results in the issue of Charge Certificate and the amount due being increased to £150.

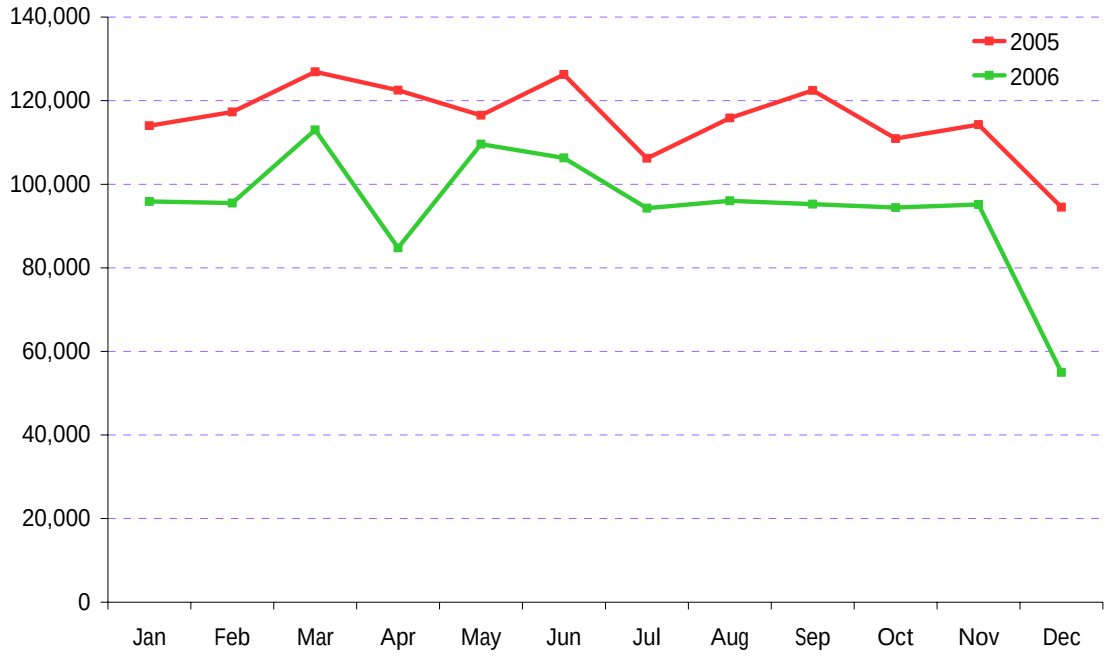
Should a chargepayer wish to challenge a Penalty Charge Notice, they are legally required to make a written representation to TfL. From the moment that a written representation is received by TfL, all enforcement action is put on hold until the matter is investigated. Should TfL reject the representation, the chargepayer is able to make an appeal against TfL to the independent Parking and Traffic Appeals Authority.

6.10 Penalty Charge Notices issued

The number of Penalty Charge Notices issued continued to reduce throughout 2006 (Figure 6.7). This continuing reduction can be attributed to greater chargepayer understanding of the operation of the scheme and implications of not paying, the introduction of Pay Next Day, reduced service provider and chargepayer errors, fewer chargeable vehicles driving in the zone and improved quality of service by Capita.

The impact of Pay Next Day, which was introduced in June 2006, has been to reduce Penalty Charge Notices from 15 percent at the point of introduction to 12 percent towards the end of the year. Overall, 17 percent fewer Penalty Charge Notices were issued in 2006 compared to 2005.

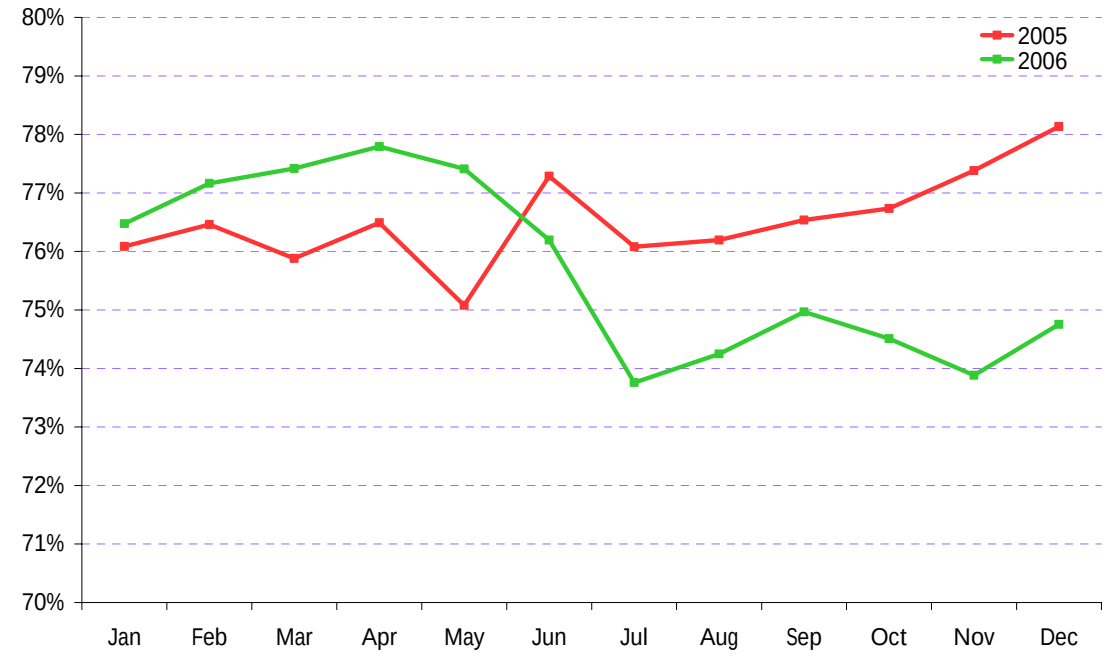
Figure 6.7 Penalty Charge Notices issued, 2005 and 2006.



6.11 Penalty Charge Notices paid

Throughout 2006 the proportion of Penalty Charge Notices paid has remained consistently above 74 percent of all Penalty Charge Notices issued. Figure 6.8 is based on the 'contravention date' and therefore Penalty Charge Notices recovered in the last few months of 2006 will increase over time to an anticipated average over the year of above 74 percent.

Figure 6.8 Proportion of Penalty Charge Notices that were paid, 2005 and 2006.



This recovery rate for Penalty Charge Notices compares favourably with that achieved by Local Authorities for similar civil traffic offences such as parking offences. The remaining 26 percent of Penalty Charge Notices are cancelled as a result of an accepted representation, or in the event that the debt can not be recovered as when the keeper of the vehicle cannot be traced, is bankrupt or deceased.

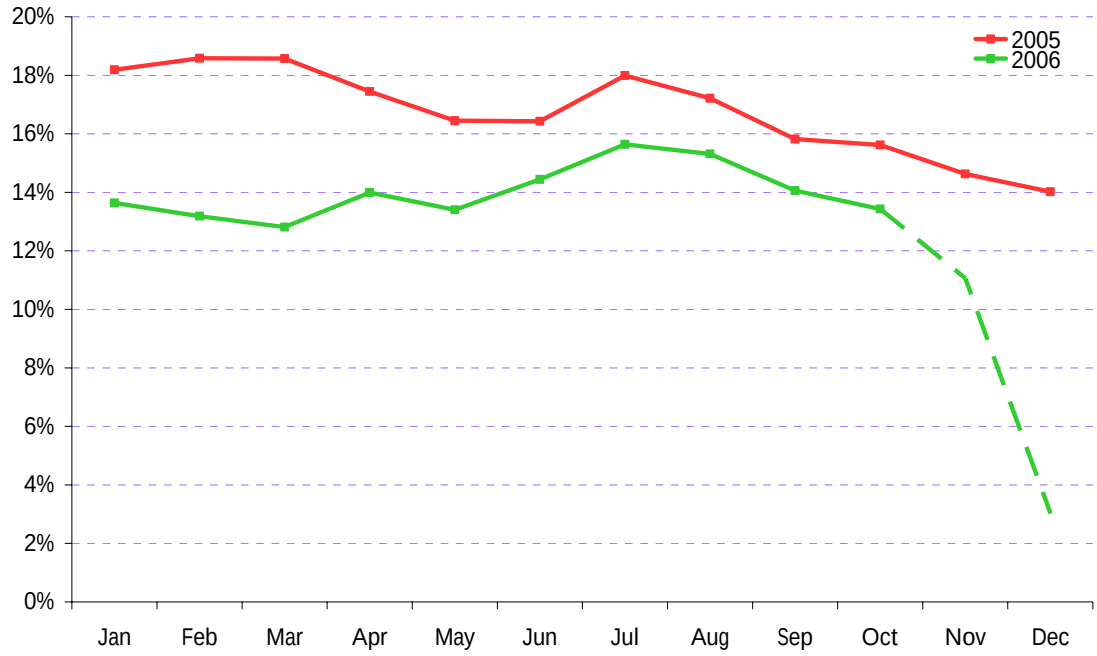
6.12 Representations made against Penalty Charge Notices

Every recipient of a Penalty Charge Notice has the right to challenge its issue through a written representation to TfL. A representation must be made within 28 days of the date of receipt of the Penalty Charge Notice, by or with the written permission of the registered keeper of the vehicle.

The percentage of representations made against Penalty Charge Notices with a contravention date in 2005 was consistently below 15 percent.

Figure 6.9 is based on contravention date with almost all representations received within 5 to 7 months of the date of contravention. Data up to September 2006 are considered unlikely to change, with small further increases expected for October through to December. An overall figure of 15 percent is expected for 2006. This percentage has fallen from a high of 64 percent in 2003 to 21 percent in 2004 and is consistent with an overall figure of 15 percent in 2005. This continues to reflect the improvements to, and increased understanding of, the scheme.

Figure 6.9 Representations received as a percentage of Penalty Charge Notices issued, 2005 and 2006.



The main reasons for representations being accepted or rejected in 2006 are:

Representations accepted

- *Sold vehicle before the date of offence* – TfL accesses live data of the registered keeper as held by the Driver and Vehicle Licensing Agency and, as a result, Penalty Charge Notices can be issued to the old keeper whilst the Driver and Vehicle Licensing Agency record is updated.
- *Vehicle registration number payment error by chargepayer* – TfL applies its discretion and normally accepts representations where chargepayers can prove that they made an innocent mistake in providing their vehicle registration mark when paying for the charge.
- *Hire company transfer of liability* – TfL will transfer liability for the penalty if a hire company provides evidence to support claims that the penalty was incurred by a chargepayer whilst the vehicle was on hire.

Representations rejected

- *No charge/insufficient evidence* – TfL will only normally accept a representation if sufficient evidence is provided and will not normally accept a representation for chargepayers who simply forget to pay.
- *Unplanned entry in zone* – TfL will not normally accept representations from those who claim they did not intend to travel into the zone, did not see the numerous signs, road markings etc.
- *Insufficient evidence of hire* – representations are often rejected when the hire company is unable to provide sufficient evidence in the form required by the Regulations that govern the transfer of liability from hire company to hirer.

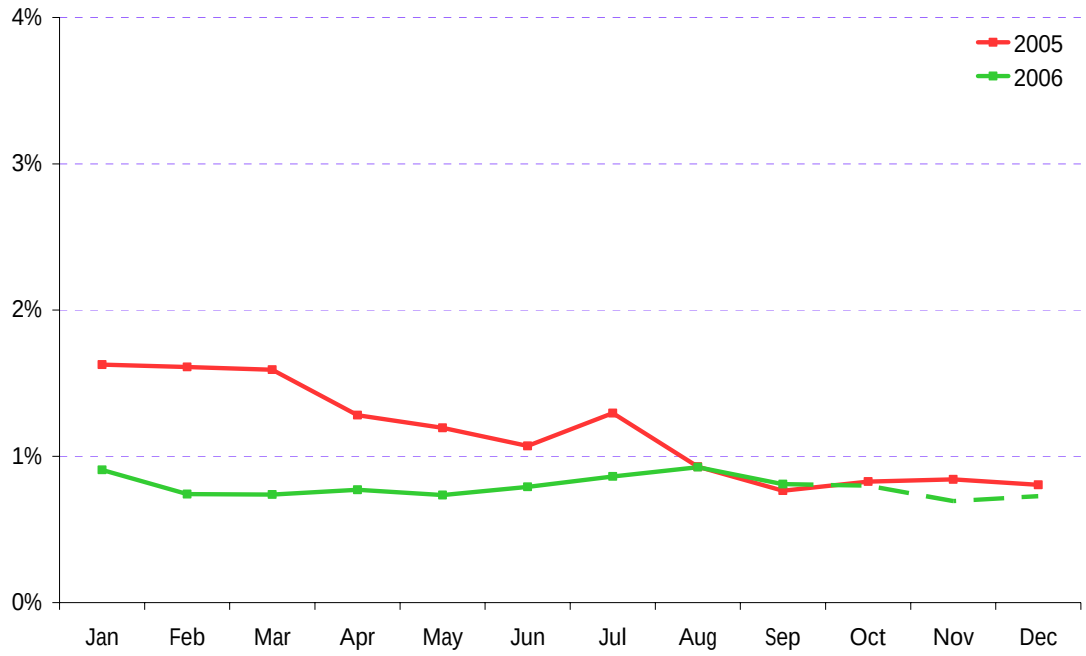
6.13 Appeals

The keeper of any vehicle that was the subject of a representation that TfL considered but rejected may appeal against this decision to the Parking and Traffic Appeals Service. All appeals are considered by independent adjudicators.

The volume of appeals received consistently reduced throughout 2003, 2004 and 2005 and a further reduction has been seen during 2006. In 2006, just over 1 percent of Penalty Charge Notices issued resulted in an appeal and an average of 84 percent of appeals were determined in favour of TfL. This is the highest success rate for traffic enforcement penalties heard by adjudicators of any Authority.

Figure 6.10 is based on contravention date with almost all appeals received within 5-8 months of the date of contravention. Figures up to August 2006 are not expected to change. Minor increases are expected for the period September to December. The annual average appeal rate for 2006 is expected to be 1.5 percent.

Figure 6.10 Appeals received as a percentage of Penalty Charge Notices issued, 2005 and 2006.



6.14 Debt collection and persistent evasion

Where a Penalty Charge Notice remains unpaid and there is no outstanding representation or appeal, the debt is registered at County Court and a warrant passed to bailiffs for recovery of the debt. The registration process does not result in a County Court Judgement or contribute to credit history or credit ratings. The use of these measures to recover unpaid penalties is a last resort that TfL would rather not have to use but which is necessary to ensure that those who fail to pay the initial charge or penalties arising from non-compliance are pursued where possible.

As at December 2006 some 741,016 warrants have been issued to bailiffs since the start of the scheme. The number issued in 2006 was 169,839. TfL have four contracted bailiff companies who, through the warrant, have the power to seize goods to the value of the debt outstanding plus a defined set of additional fees incurred in the recovery of the debt. Since the start of congestion charging in February 2003 an average of 15 percent of warrants issued have resulted in payment.

During 2006 TfL undertook a thorough review of its existing bailiff arrangement, contracts and bailiff monitoring programme and have made further improvements in numerous areas (see Section 6.2).

In addition to bailiff recovery, TfL also carries out on-street enforcement using its powers to clamp and remove vehicles that are persistent evaders of the congestion charge. A persistent Penalty Charge Notice evader is defined as a vehicle that has three or more outstanding Penalty Charge Notices with no pending representation or appeal. The on-street enforcement service is also effective in the enforcement against vehicles that are not registered with the Driver Vehicle and Licensing Agency.

TfL's ability to effectively identify and enforce against persistent evaders improved in 2006 through the introduction of the 'Locust' van. The total number of vehicles clamped and removed during 2006 was 1,844.

6.15 Scheme costs and revenues

Since the *Fourth Annual Impacts Monitoring Report* there have been two significant developments that have affected the income and operational costs of the scheme:

- In June 2006, following feedback from chargepayers, the facility to pay the charge on the following day was added to the scheme. An additional charge of £2, making a total of £10, is now payable in these circumstances. This has given rise to some increased charge income and a reduction in Penalty Charge Notices issued.
- The second and in the longer-term more significant change has been the introduction of the Western Extension from 19 February 2007, with the associated change in scheme operational hours.

The combined effect of these changes, coupled with background trends, had little impact on net scheme revenues in 2006/2007. The extended scheme operates as a single enlarged zone, and it not possible to attribute income specifically to either the original central zone or the western extension. The figures below relate to the financial year 2006/2007 and therefore include an element of contribution from the western extension, both in terms of discounted residents' payments from October 2006 and charges from 19 February 2007. In a full financial year, the indications are that additional net revenues, after allowing for costs and when compared with the original central London scheme, will be up to £40m a year.

The costs and revenues associated with the scheme are provisionally estimated for 2006/2007 below. A provisional summary is also provided for the application of the net revenues from the scheme in 2006/2007 and their allocation to transport programmes in support of the Mayor's Transport Strategy, as required by law.

The costs of operating the scheme cover the payments to TfL's contractors, principally the key service providers involved in operating and enforcing the scheme. Operating costs also include the relevant staff and other costs of TfL in supervising, administering and monitoring the scheme. In 2006/2007 these exclude the additional costs required for the introduction of the western extension as these are provided centrally and not from the scheme income.

Table 6.2 provides provisional out-turn figures for financial year 2006/2007, comparing scheme revenues with scheme operation costs.

Table 6.2 Scheme revenues and costs, financial year 2006/2007. (£million provisional).

Revenues	
Standard daily vehicle charges (£8)	125
Fleet vehicle daily charges (£7)	27
Resident vehicles (£4 per week)	6
Enforcement income	55
Total revenues	213
Total operation and administration costs	-90
Net revenues	123

Allocation of net revenues

By law the net revenues from the scheme must be spent on measures to further the Mayor's Transport Strategy. This is in accordance with an appendix to the Scheme Order approved by the Secretary of State for Transport. TfL is required to report every four years to the Secretary of State on the expenditure of scheme revenues.

Originally, the revenues from the scheme were only available to TfL for the first ten years of the operation of the scheme. However, TfL have been advised by Government that a longer period of hypothecation would apply following the introduction of the western extension in February 2007. The hypothecation period will therefore extend to 2017.

Table 6.3 provides a provisional summary of the areas of expenditure of the net revenues in financial year 2006/2007.

Table 6.3 Application of congestion charging scheme revenues, financial year 2006/2007. (£million provisional).

Bus network operations: Contributions to major enhancements of London's bus garages, stations, stops and shelters; to bus priority and real-time customer information systems; and to bus operations and support activities.	101
Roads and bridges: Contributions to investing in programmes to improve the quality of street conditions, including reconstructing and resurfacing carriageways and footways and upgrading and strengthening structures.	14
Road safety: Contributions to measures to reduce road casualties, both on Tfl roads and borough roads.	5
Walking and cycling: Contributions to a programme of improvements for pedestrians, both on TfL roads and on borough roads; includes contributions to borough local transport improvements.	3
Total	123

7. Congestion charging in central London: a retrospective

7.1 Purpose and content

Introduced on 17 February 2003, this ground-breaking traffic management scheme has operated successfully for over four years, during which time TfL accumulated a substantial body of data, expertise and understanding regarding the development, implementation, operation and impacts of congestion charging in the heart of the UK's capital city. A recent key development to the scheme has been the introduction of the western extension to the original central London congestion charging zone on 19 February 2007.

At this point in the evolution of congestion charging in London, and in view of growing national and international interest in the wider topic of road user charging, it is appropriate to offer a summary of these experiences. This section therefore takes a retrospective view of some aspects of the 'original' central London congestion charging scheme. It covers the following themes:

- How the scheme evolved – from its historical antecedents through development and implementation to the recent variations to the scheme.
- Key 'success factors' associated with TfL's implementation of the scheme.
- Informing the public – a summary of how TfL approached the crucial task of informing Londoners of the nature and forthcoming operation of the scheme.
- A summary of the key distinguishing features of the scheme in the context of road user charging schemes more generally.
- Reflections on the role of scheme impacts monitoring in the context of wider transport, economic and environmental change in central London.
- A summary of a cost benefit evaluation of the scheme.

7.2 The evolution of congestion charging in central London

This section reviews the key stages in the development of the central London scheme. Starting with a brief review of the theoretical and historical basis for the policy of road user charging, it then proceeds to identify the key institutional and legislative developments that led to the active progression of these ideas and facilitated the implementation of the central London scheme. Following the commitment by the new Mayor of London to progress a scheme in his Transport Strategy in 2001, the focus then turns to TfL's approach to implementing the scheme on behalf of the Mayor, emphasising the key factors contributing to the ultimately successful implementation and subsequent operation of the scheme. Finally, TfL's public information strategy, to communicate the details of the scheme to Londoners and drivers more generally, is described in more detail as an example of the comprehensive and multi-faceted approach taken by TfL.

Historical antecedents

There is a well-established economic rationale for charging for use of the roads. A common reference point for the development of modern ideas for road user charging is the Smeed Report of 1964, prepared on behalf of the then UK Ministry of Transport. This explored the underlying rationale with reference to traffic conditions in central London, and considered a number of practical issues surrounding the levying and collection of charges for road use. The report sought to quantify the concepts of *economic efficiency* and *externalities* in the road user charging context. It proposed the principle that journeys should be discouraged if they are 'valued at less than the cost or losses that they cause to other people' and that journeys 'should not be restrained' if they are 'valued at more than the costs they incur'.

In simple terms, the basic case is that excessive traffic congestion results in an inefficient use of the available road space, causing disbenefit to the wider community. Furthermore, congestion arises because the use of road space is not efficiently priced, and therefore charging drivers to encourage a more selective and more efficient use of available road space should lead to overall efficiency gains.

Following Smeed, the late 1960s and 1970s saw the initial exploration of several potential road charging schemes in London, mostly in combination with wider traffic, transport or urban planning studies on behalf of the Greater London Council.

The Greater London Council was abolished in 1986, but in the early 1990s the Government carried out the London Congestion Charging Research Programme, which explored several potential charging schemes for central and inner London and looked at aspects of scheme operation. It concluded that congestion charging could be both feasible and worthwhile as a traffic management tool in London, but that there would be substantial technological, public acceptability and political risks surrounding the progression of any actual scheme in the medium-term.

Although no further action was taken by the Government of the day, the technical basis provided by this study, the continuing increase to congestion on the London road network, heightened concern about the negative consequences of congestion by business and the scope for charging to raise funds for investment in transport combined to create a more favourable political and stakeholder climate for the subsequent actions by the incoming Labour administration in 1997.

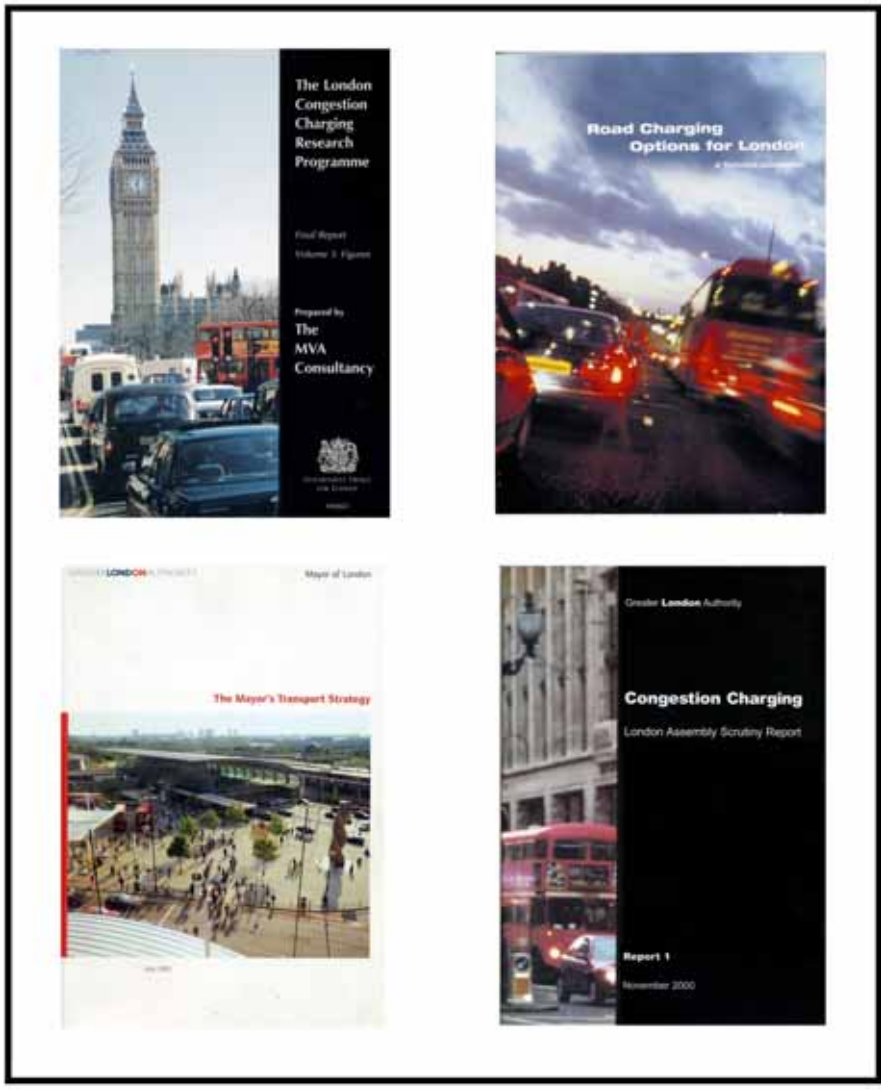
Key institutional developments

The development of the current central London scheme can be traced to the election of a Labour administration in May 1997.

- Following election, the Government published a Green Paper on establishing a directly-elected Mayor of London and Assembly. Legislation was passed enabling a London-wide referendum in May 1998. 72 percent of those participating voted in favour, and the Government subsequently published a White Paper setting out the proposed powers and responsibilities of the Mayor. This included powers to allow the implementation of road user charging schemes in Greater London, and for the revenues to be retained to be expended on transport in London.

- The Government Office for London established a working group of technical experts to explore how a future Mayor might use these proposed powers. The Group became known as ROCOL – Road Charging Options for London.
- In November the Greater London Authority (GLA) Act 1999 became law. Schedule 23 of the Act includes provision for road user charging schemes, and Schedule 24 for workplace parking levies.
- A key aspect of the Act was that decision making on such schemes was put in the hands of the Mayor, who was in a position to take a strategic overview of the needs of London and exercise effective leadership.
- In March 2000 the ROCOL working group published its report concluding that an area charging scheme in central London, with camera-based enforcement with a daily charge of £5 for cars and £15 for heavy commercial vehicles was potentially feasible, effective and publicly-acceptable.
- In May 2000, Ken Livingstone was elected Mayor of London. His manifesto included a commitment to consult on a potential road user charging scheme in central London. The Greater London Authority formally came into existence in July of that year, and the Mayor decided that the proposals of the ROCOL group provided a basis for taking forward the consultation on a potential scheme.
- The initial Mayoral consultation was taken forward in the discussion document 'Hearing London's Views', published in July 2000. Following consideration of responses, the Mayor reported to the London Assembly. His report included a number of proposed modifications to the original ROCOL proposals, including a reduction in the proposed £15 charge for heavier goods vehicles to £5, and a proposed 90 percent discount for residents of the proposed central London congestion charging zone.
- In November 2000, the Mayor began preliminary consultation on his Draft Transport Strategy. This contained more detailed information on how the proposed scheme might operate. At the same time, the London Assembly published their Scrutiny Report on the Mayor's outline proposals for the scheme. Formal public and stakeholder consultation on the Draft Transport Strategy ran from January until March 2001, with the final version of the Mayor's Transport Strategy being published in July 2001. This included a commitment to introduce a congestion charging scheme in central London, together with a description of the nature and operation of the proposed scheme.

Figure 7.1 Key studies relating to the development of congestion charging in central London.



Key legislative milestones

The legislative basis for the central London congestion charging scheme is as follows:

- The Mayor's legal authority to implement a congestion charging scheme is derived from the Greater London Authority Act, 1999, as amended, and from secondary legislation or regulations.
- The regulations covering charges and penalties, and enforcement and adjudication, came into force in July 2001. Subsequent amendments were made in January 2003; these came into force on 17 February 2003.

Key delivery milestones

Following the election of Ken Livingstone, TfL was charged with taking the development of a congestion charging scheme in central London forward.

- In January 2001, a strategic plan for the delivery of congestion charging in central London was presented to the Mayor by TfL and adopted. TfL then began to build

a delivery team, with a view to implementing the scheme in February 2003. This two-year timescale was recognised to be extremely challenging, being subject to due legislative and consultative process.

- In July 2001 TfL published for consultation the Greater London (Central Zone) Congestion Charging Order, based on the proposals outlined in the Mayor's Transport Strategy. The Scheme Order specified the details of how, where and when the congestion charging scheme would operate. Following consideration of responses, a revised Scheme Order was published in December 2001 for further consultation.
- A complete procurement for the key service provider contracts to the scheme was started with the issue of an OJEU. A Technical Design Study for the Core Services contract was conducted in Autumn 2001, and in December 2001, TfL selected Capita Business Services as the preferred bidder.
- Following confirmation of the revised Scheme Order by the Mayor in February 2002, TfL entered into formal contract with Capita Business Services as the core contractor.
- Further procurements for infrastructure such as camera equipment and telecommunications proceeded in parallel, with the resulting contracts then being novated to Capita Business Services to give a single, consolidated supplier for the key operational elements of the scheme. Separate contracts were secured for enforcement and other services.
- Approval from the Secretary of State for Transport for the use of net proceeds from the scheme was granted in March 2002.
- Applications for Judicial Review of the scheme by Westminster City Council, the Royal Borough of Kensington and the Kennington Association were rejected by the High Court in July 2002.
- Following recommendations by the Assembly Scrutiny Committee, in August 2002 TfL undertook a Readiness Review. This was to confirm that key elements of the scheme were either in place or proceeding to plan. In September 2002, TfL formally notified the Mayor that all necessary arrangements were in place and that the scheme could start as planned on 17 February 2003.
- An extensive public information campaign, to inform Londoners and visitors of the nature and details of the scheme, took place over the Autumn and Winter of 2002-2003. Key charge sales channels, enquiry services and discount registration processes also commenced ahead of the actual scheme implementation date, to ensure as smooth as possible day one operations.
- The central London congestion charging scheme was successfully introduced on schedule on 17 February 2003, with no major operational, traffic or technology difficulties.

Subsequent developments and modifications to the central London congestion charging scheme

The central London congestion charging scheme – including its associated traffic management and complementary public transport measures – is kept under continual review by TfL. Since February 2003 a number of variations have been made to the

original scheme. These have had the objective of improving aspects of the operation, payment and enforcement arrangements of the scheme. Changes to the Scheme Order are made through a procedure known as a Variation Order. Each Variation Order is subject to consultation before the Mayor considers representations received and whether or not he wishes to confirm the proposed variation, with or without modifications. Modifications have also been negotiated for the service provider contract to secure necessary changes and improvements.

- Key early variations included certain changes to the vehicles eligible for discounts from the charge, and several improvements to the chargepayer payment and registration processes, in particular to the operation of the fleet scheme for commercial vehicles. A significant variation removed the charge from those weekdays that fall between Christmas and New Year with effect from Christmas 2004/2005.
- In August 2003, TfL concluded a Supplemental Agreement with Capita Business Services – the key contractor for the scheme. This reflected TfL's early experience with the scheme, which suggested that some aspects of the service provision for the scheme were below the required standard. The Agreement provided for a phased programme of improvement in these areas, alongside financial penalties for default.
- Capita subsequently met all three agreed key delivery milestones, and has since generally continued to operate within the agreed contractual standards (see also Section 6).
- From 4 July 2005, TfL implemented variations that significantly modified the charging structure for the scheme. The basic daily charge per vehicle was increased from £5 to £8. The TfL 'fleet scheme' was also simplified and amended, with a basic charge of £7 per day, compared to the previous £5.50 charge. Furthermore, discounts of 15 percent were introduced to those purchasing monthly or annual charges, and a number of administrative charges were reduced.
- Ken Livingstone was re-elected Mayor of London in May 2004. His manifesto included a pledge to consult on a possible western extension of the central London congestion charging scheme. In August 2004 he published a revised Transport Strategy that included a proposal for a western extension.
- A detailed extension proposal for public consultation was published by TfL in May 2005. The final arrangements for a western extension were confirmed by the Mayor in September 2005.
- Since the western extension would only be in operation for a minimum of one year before the core service provider contract was subject to re-procurement, it was deemed economically advantageous to TfL, and for the operation of the scheme, to secure a Supplementary Agreement with Capita to operate the western extension up to the time that the whole extended scheme was due to be re-let.
- The western extension was implemented on schedule and without significant problems on 19 February 2007.
- Further variations during 2005 and 2006 dealt with aspects of the residents' discount application process, in particular measures to encourage residents of the

western extension zone to register for their discount ahead of the implementation date for the extension. They also introduced the 'Pay Next Day' facility, which means that a charge can be paid on the charging day following the day of travel, at an £2 supplementary charge.

7.3 Key success factors for scheme implementation

In considering the successful implementation and subsequent operation of the original scheme, a number of key factors are considered to have underpinned this achievement. These can be summarised under the following ten headings:

- Political engagement with strong leadership and clear objectives. There was continual engagement with and leadership from the Mayor, who was empowered by the legal framework of the GLA Act to take decisions on charging. The Mayor's vision for London and initial technical planning for the scheme provided a clear definition of objectives within a deliverable, if challenging, programme.
- Clear strategic project governance, timely decision making and focused communications. A clear project management structure was implemented, with regular meetings between senior TfL staff, the project managers, and the Mayor's office. Roles and responsibilities of key team members were clearly defined, with all key decisions being taken by a weekly Project Board. Early preparation of a focused business case led to early commitment to funding and resources.
- Robust and far-reaching stakeholder and public consultation. Consultation was a consistent element of the development process for the scheme, including the preliminary development of the Mayor's Transport Strategy. As well as informal and formal consultation exercises, TfL engaged with Londoners through numerous public and stakeholder meetings. Various significant changes to the proposals for the scheme were made in response to feedback received through these consultations, the results of which were published.
- Thorough research and monitoring. Sound quantitative knowledge of transport conditions and issues in central London was an essential prerequisite that enabled TfL to develop an effective and appropriate scheme. Effective transport modelling allowed the likely impacts of the scheme to be thoroughly understood in advance, and effective mitigation put in place where appropriate. Continuous, transparent and robust monitoring of the emerging traffic and wider impacts of the scheme, combined with regular publication of these findings through annual impacts monitoring and other update reports, allowed the changes brought about by the scheme to be authoritatively described, and provided an evidence base for responding to stakeholder comments and making amendments to the scheme.
- Effective procurement strategy. Although the innovative nature of the scheme meant that there was initially no precedent for a potential supplier, TfL recognised the value of appointing suppliers with a proven track record with similar large-scale service contracts at an affordable 'best value' price. Furthermore, TfL recognised the value of utilising proven 'off the shelf' solutions, customised where necessary to TfL's requirements. TfL's specifications were robust, integrated across disciplines and potential suppliers. Resulting contracts were clear about risk ownership, and contained appropriate incentives, sanctions and step-in and termination rights to encourage satisfactory performance.

- Robust contractor management. TfL acted as an intelligent and pro-active client. Clear accountabilities, project delivery plans, decision processes, lines of communication and document management were all key features of TfL's approach.
- Proactive project, programme and financial management. Facilitated through strong and clear project governance. A high-profile project planning office using a clear and simple project management methodology to ensure adherence to key delivery milestones and alignment across all parties, internal to TfL as well as external, required to deliver the scheme. Strong budgetary management ensured that costs were contained broadly within the anticipated budget.
- Effective risk management. Clear ownership of delivery risks to relevant and accountable owners, coupled with ongoing review and mitigation of current and anticipated risks and issues.
- Working closely with partners outside Core Delivery Team. Essential infrastructure, services and transport enhancements were identified and implemented in close co-operation with those primarily responsible. This included: co-ordination of streetworks with the London boroughs and the utility companies; provision of real-time traffic management infrastructure via colleagues within TfL; complementary traffic and other measures to support implementation of the scheme – working closely with the London boroughs and provision of appropriate funding; agreement and installation of signage for the scheme (Department for Transport, borough highway authorities and The Highways Agency); provision of operational support around implementation through the Police and TfL's enforcement services; provision of vehicle keeper information for enforcement purposes via the Driver and Vehicle Licensing Agency; and provision of an independent appeals route for those enforced against under the provisions of the scheme using the Parking and Traffic Appeals Service.
- Focused public information campaign and media relations. This was a crucial element in the ultimate success of the scheme and is described in more detail below, as an example of TfL's approach to the unique challenges posed by the development and implementation of the scheme.

In November 2004 the National Audit Office published its Initial Performance Assessment for Transport for London, with a specific focus on the implementation of congestion charging. The Office particularly complimented TfL on the effectiveness of the project management arrangements that had underpinned the successful implementation of the scheme.

7.4 Informing the public

The central London congestion charging scheme was a groundbreaking transport initiative. Such a traffic management scheme on such a scale had not been introduced anywhere else in the world. London's road system, the size of the zone and the number of discounts and exemptions contributed towards the complexity of the scheme and the enormity of the communications task.

Significant challenges stood in the way of ensuring that the communications campaign contributed to a successful launch for the scheme. People had no pre-

existing reference point to what was, in essence, a 'virtual system', with no visible entry and exit barriers on the ground. In addition, there was considerable scepticism about the scheme in the media, and widespread antipathy towards the scheme amongst drivers.

The public information campaign had to communicate effectively with the millions of people the scheme potentially affected, as well as letting those who would not be affected, so as to avoid unnecessary calls to the call centre. Underlying these challenges was the simple fact that if the communication campaign failed it was likely that the scheme itself would have been significantly undermined. There would be no dress rehearsal – it had to work from day one.

Challenges facing the communications task

The communications task was challenging, with no precedent for the amount of information to be disseminated, the breadth and complexity of the target audiences or the unpopularity of the message amongst the core 'behavioural change' target audience (drivers). Creating awareness of the scheme was only the beginning. The real challenge was to translate this awareness into understanding and then timely action by those affected. A continuous backdrop of hostile or misleading news coverage and speculation about the viability of the scheme meant that the 'paid for' communications had to cut through and provide the voice of authority of accurate information.

The novelty and relative complexity of the scheme posed a particular communication challenge. The types of information that needed to be disseminated included:

- Raising awareness of the start date of the scheme and other key facts, such as the geographical area affected, how the scheme would be enforced via roadside and mobile cameras, and the hours of operation.
- Explaining why the charge was being introduced.
- Informing people of the level of the charge and the various discounts and exemptions that were available.
- Describing the various methods of payment.
- Encouraging people to register early for the various discounts and the mobile phone text message payment channel.
- Explaining how and when to pay to avoid a rush to pay first thing in the morning.
- Communicating the enforcement consequences of not paying the charge.
- Alternative transport options available to those switching out of their cars

In particular, it was important to ensure that those eligible for a discount registered early to avoid a last minute rush and that those drivers who were intending to carry on driving were educated about the various payment channel options. This was to avoid a situation where people used just one payment channel, eg the call centre, or all sought to pay at the same time. Essentially, the behaviour of scheme users had to be matched with the scheme's predetermined operational specification and capacity to avoid a potential call centre 'meltdown'.

Given the design of the scheme, effective communication to close to 100 percent of Londoners was essential to ensure a successful launch. The number and diversity of the people to be reached was large. Target audiences included:

- All adults in the London area.
- Drivers residing in Greater London.
- Exemption and discount groups (22 in total).
- Fleets with over 25 vehicles (eligible for TfL's initial 'fleet scheme').
- Ethnic minorities living on the boundaries and within the charging zone.
- Overseas visitors.
- Central London businesses.

Planning for the introduction of congestion charging

It was clear from the outset that these challenges needed to be met to ensure that the introduction of the scheme was a success. For the period from 2002 until after scheme implementation, the only way the charge could be communicated effectively was through a single, integrated campaign.

The communications strategy involved helping Londoners 'self-identify' by explaining what was going to happen, when and where, and by encouraging a combination of 'inaction' by those knowing they were not affected, and 'preparatory action' by those knowing they would be affected, to encourage them to act in a timely way eg registering early or making other plans well in advance.

During this time the public had to go through a steep learning curve. This was managed through the gradual unfurling of messages and the use of a broad range of communication channels. Key messages about the scheme were delivered in bite-sized pieces.

The need to present information in this way led to the design of a three-phase structure: pre-Christmas 2002; post-Christmas 2003 and post-the launch of the scheme in February 2003, for the first six weeks following implementation. This facilitated a rolling briefing that gave people time to digest and act on the information provided at the various phases.

The creative approach involved putting the scheme itself at the heart of the creative idea with messages delivered in a straightforward tone of voice, as a public information campaign, not a marketing or 'selling' campaign. The concept of charging on its own generated an instant, often very emotive response resulting in people asking a series of questions eg, *'how does it affect me; how will it work; what do I need to do?*' These considerations resulted in a question and answer creative idea coupled with a totally integrated 'visual language', which was created using the congestion charge "c" symbol and road background to give all elements of the campaign a consistent identity (see Figure 7.2).

A multi-media campaign involved the use of TV, press, posters, radio, online activity and ambient media. In addition, leaflets were sent to key target audience groups such

as residents and Blue Badge holders, as well as via a pan London 'door drop' to all households within London. A significant number of road shows were mounted in key locations within and outside the zone as well as at motorway service stations on key routes into London. Research was carried out throughout the campaign to assess its effectiveness, and to monitor on-going knowledge levels of how the scheme operated – enabling fine tuning of the messages where appropriate.

Figure 7.2 Typical print media and poster advertisement for the central London scheme.

Campaign success

The scale and the complexity of the congestion charging scheme meant that effective communication was a critical success factor. The results, if the communication had not been adequate, could have seriously undermined the scheme. The risk of a 'system meltdown', as millions of people rang in on implementation day to try to understand the scheme, was a 'worst-case' scenario that the communications team worked hard to avoid.

In the event, this worst-case scenario and other negative results many sceptics predicted did not materialise. The call centre was not overloaded on day one with enquiries, and the timings of payments was spread across the day with drivers avoiding a predicted early morning rush or 'late panic' to avoid paying the post 10pm surcharge. Drivers used, and continue to use, the whole range of payment channels available, not just the call centre.

Significant examples of the success include:

- People knew what to do – London was prepared. As the implementation date approached, the various audiences were fully briefed. Two weeks prior to implementation awareness of the scheme was at saturation levels – at 97 percent of Londoners.
- The campaign stimulated large scale registration for the residents and Blue Badge holder discounts, thus avoiding a last minute panic to register in the two weeks prior to the scheme being implemented.
- The campaign effectively promoted payment choices and resulted in a workable split across available payment channels.
- New payment channels were pioneered. This is one of the most notable successes of the campaign, with 44 percent of all payments made via the internet or mobile phone text message. Early research had indicated that most drivers

used the internet for information sourcing, not for transactional purposes. In addition, 97 percent of those paying the charge by mobile phone text message had never previously used it to pay for goods or services.

- Penalty charges were minimised. Fewer than 10 percent of drivers in the charging zone during the first week of operation incurred a Penalty Charge Notice.
- The call centre operation load was spread across the day. The trend of the timing of payments throughout the day was smoother than predicted.
- The multiple media channels used to deliver the information contributed to meeting people's differing information needs.

These results were secured despite negative press coverage. Monitoring of the media prior to the launch of the scheme identified that in 371 articles about congestion charging that appeared in the print media in October 2002 and 359 in November 2002, 50 percent were negative and only 18 percent positive, with 32 percent considered neutral. This issue was exacerbated by various factual errors presented in the press.

The lessons learned from the public information campaign

Overall, TfL's experience in this aspect of scheme implementation reaffirmed the power and dependability of 'paid for' communication channels to cut through, keep a clear message in front of people and lead them through the path of information delivery. Paid-for communications were vital in sustaining an extended campaign, giving people time to digest and act on information; counterbalancing a negative editorial environment and ensuring that people did not just have the necessary facts, but also acted on them in a timely way.

7.5 The main features of the central London scheme

This section briefly describes the key elements of the original central London congestion charging scheme.

The central London scheme is one of several possible models, within the broader sense of charging drivers at the point of use for the external costs that they impose upon others. The most obvious distinguishing features of the scheme are as follows:

- It is an 'Area Charging' scheme – that is, drivers are charged one single payment to drive within a defined area (the central London congestion charging zone). This fixed daily payment provides the ability to drive within the zone, irrespective of the actual distance travelled, or the number of times the vehicle crosses into or out of the zone.
- In this respect the scheme differs from possible 'cordon charging' or 'distance based' schemes, where drivers would respectively be charged, on possibly multiple occasions, for crossing a particular cordon or boundary, or in a way proportionate to the distance actually travelled, or the route selected within the zone.
- It has defined scheme operational hours, initially working weekdays between 07.00 and 18.30 (now 18.00), these being broadly aligned to target the times that

experienced the most intense congestion before the introduction of the scheme. No charges apply outside these hours. In this respect, central London has for many years now featured 'all day' congestion, with no significant uncongested period during the middle of the day, reflecting the concentrated nature of economic and other activity.

- It features a range of discounts and exemptions from the charge for various vehicle and driver categories. Only cars, vans and lorries are potentially chargeable. Buses, coaches, licensed taxis and minicabs and two-wheeled vehicles are automatically exempt from the charge. Of those vehicles that are potentially chargeable, many are eligible for discounts or exemptions, most notably vehicles used by residents of the charging zone and vehicles used by disabled people with a 'Blue Badge', but also including vehicles that support essential operations such as emergency or borough services, and vehicles with nine or more seats. In support of the Mayor's environmental policies, certain alternative-fuelled vehicles are eligible for a full discount.
- The scheme is enforced using number plate recognition cameras located at the boundary of and within the zone. These identify vehicles as having been present in the zone. These details are then compared to a database containing the identity of all vehicles for which TfL has a record of a valid payment or exemption. Only those vehicles to which neither of these apply are progressed to the enforcement stage of the operation. The remainder are permanently deleted, and all enforcement operations fully comply with appropriate Data Protection provisions.
- Those who received a Penalty Charge Notice were originally liable for an additional charge of £80, or £40 if paid promptly (now £100 and £50 respectively). Particular provisions apply to vehicles with three or more unpaid Penalty Charge Notices. These vehicles are liable to be clamped or removed.
- The central London scheme is much more than just the charge itself. It includes complementary public transport measures – most obviously additional bus services to accommodate displaced car occupants, together with a wide range of associated traffic management measures, bringing wider benefits to travel in London.
- Although considered to be a 'flagship' policy, the scheme is only one element of the Mayor's Transport Strategy. The Transport Strategy contains numerous other policies and proposals that have a greater or lesser relationship with congestion charging. In turn, the Mayor's other Strategies cross-refer to congestion charging, in line with the provision in the 1999 Greater London Authority Act that requires Mayoral Strategies to be mutually consistent. This means that congestion charging was implemented in a very much wider context of transport, environmental and other related initiatives, particularly parallel and wider improvements to the provision of public transport.
- Finally, net revenues raised from the scheme must be spent on other elements of the Mayor's Transport Strategy by law. Essentially, they are re-invested in the improvement of transport in London, and are 'hypothecated' for this purpose. Scheme revenues therefore contribute directly to the wider improvement of transport for all Londoners.

The scheme continues to develop, in particular to make the scheme easier to use, but the relatively simple structure of the initial scheme aided its communication to the public and reduced potential implementation risks.

7.6 Achievements of congestion charging in central London

The main expectations for the scheme were first set out in the Mayors' Transport Strategy, and confirmed in TfL's Report to the Mayor for the scheme. The formal, quantified expectations were simply stated:

- A reduction in traffic circulating within the zone, measured as vehicle-kilometres driven by vehicles with four or more wheels, of between 10 and 15 percent.
- A corresponding reduction in congestion, measured as a travel rate over and above that which would be experienced under uncongested conditions, of between 20 and 30 percent.

These would lead to greater efficiency for the remaining 'higher value' trips, this being in-line with the principles outlined by Smeed (1964) and set out above. In addition, there was a recognition that the scheme could lead to a range of other, less-tangible benefits. These would centre around improvements to the general environment, amenity and attractiveness of central London, and improvements to public transport – in part reflecting the reinvestment of net revenues from the scheme – for the benefit of all Londoners.

Principal achievements

The monitoring work associated with the scheme has allowed many of these impacts to be quantified and placed in context. Part 1 of this report comprehensively describes TfL's understanding of the position in the original central zone after four years of operation. In summary, key achievements have been that:

- Traffic has been reduced by about 20 percent – making central London a much more pleasant place to live, work or visit, and freeing a proportion of vacated road space for other uses, such as public realm improvement schemes and pedestrian and road safety enhancements. These have brought corresponding benefits to Londoners.
- Congestion has been substantially reduced, bringing efficiency benefits to remaining, 'higher value' trips. Although recent trends in congestion have tended to reduce these decongestion benefits relative to the pre-charging base, for example the increase in streetworks in the latter part of 2006, TfL's analysis indicates that against a 'without charging' scenario, decongestion benefits are still at a comparable level to those in the early days of congestion charging.
- Congestion charging has contributed to the increased use of public transport for travel to, from and within central London. Congestion charging has contributed to better conditions for buses in central London. These contribute to the wider Mayoral goal of encouraging the increased use of public transport for travel in London, for wider efficiency and sustainability reasons.

- Road traffic accidents have reduced. It is estimated that congestion charging directly leads to between 40 and 70 fewer personal injury road traffic accidents in the charging zone per year.
- Congestion charging contributes to wider and increasingly important efforts to reduce emissions of harmful pollutants and greenhouse gases, and therefore to a relative improvement in ambient air quality against that which would prevail in the absence of congestion charging.
- Contrary to the expectations of some commentators, the central London economy has performed particularly strongly since the introduction of congestion charging, with recent retail growth (value of retail sales) in central London at roughly twice the national growth rate (British Retail Consortium).
- The original scheme with a £5 daily charge produced net revenues of around £100m per year for reinvestment in transport in London.
- The scheme has provided a very practical illustration of the economic theory of road user charging – as set out in the Smeed report of 1964. Prior to charging traffic was moving around the central zone at a typical network speed of about 14 kilometres per hour. This equates to a travel rate of around 4.2 minutes per kilometre. Somewhat more than half of this travel rate was caused by 'congestion' – the additional delay experienced by all vehicles because of the presence of other vehicles. Moreover, the marginal vehicle was imposing on all other vehicles additional delays of about five minutes per kilometre. With an 'average' vehicle typically consuming 5 -10 kilometres within the charging zone and the 'average' value across all vehicles for losses or savings in travel time of around 40 pence per minute, this implies imposed costs from the marginal vehicle inside the charging zone of around £10-20 before charging. When charging was introduced the network travel rate reduced to about 3.5 minutes per kilometre, with each vehicle saving around 0.7 minutes per kilometre of delay. The imposed travel rate of the marginal vehicle fell to less than three minutes per kilometre, equivalent to about £6-12 for vehicle travel of 5-10 kilometres inside the zone.

7.7 The role of scheme impacts monitoring

Traffic and transport conditions in central London are continually changing, as are the background social and economic forces that determine transport demand and travel patterns, and the provision of services and capacity by the transport operators. In terms of understanding the impacts of the scheme, this created three related issues.

- First, congestion charging was introduced into this dynamic situation at a particular point in time, and the expectations for the scheme necessarily assumed – in their simplest form – a 'steady state' set of conditions against which out-turn effects could be assessed. This effectively assumes that the impacts of the scheme happen and are evaluated almost overnight. Assessment of actual out-turn effects is, however, more properly done on a longer-run basis in terms of how conditions 'would have been' in the absence of the scheme, taking into account actual 'background' developments over the review period. Consequently, it is not possible in advance of implementation of such a scheme to align

projections against what will actually happen over the scheme review period. This can only be done with the benefit of hindsight several years after the event.

- Second, prior to the introduction of the scheme, there was surprisingly little monitoring of traffic, transport and related conditions in central London. This complicated the task of assessing the impacts of the scheme against longer-term trends, because there was for years before 2002, when TfL's monitoring work for the scheme started, a lack of good data that was suitably aligned with the main geographical elements of the scheme as it was ultimately implemented.
- Third, projections of scheme impacts were based largely on established theoretical relationships between travel cost and travel demand. In simple terms, the imposition of a congestion charge would add to the 'generalised cost' of making a trip, and would feed through to a reduction in observed demand (number of trips). Whilst there is no reason to suggest that this approach would be generally invalid, the applicability of these relationships had not been tested directly in central London. Given its unique characteristics, the profile of trip makers and their responses to changes in generalised cost might well have been materially different to those observed elsewhere, and the vehicle mix and journey purpose mix to which these relationships were applied were not fully understood.

Coupled with the high priority accorded to understanding the impacts of this novel scheme, monitoring of the impacts of congestion charging was a significant project in its own right. The result was a monitoring programme of a scale that had probably never before been attempted in relation to a single traffic management scheme. This experience itself provides potentially valuable lessons for others attempting similar schemes. The following sections briefly illustrate some of the challenges presented by these three issues.

The dynamism of traffic and transport in central London

The period since the advent of the Greater London Authority has certainly been eventful in central London, although probably not more so than any comparable recent historical period. The inception of the Greater London Authority and Transport for London themselves led to a diverse and concerted set of initiatives to address long-standing problems, encapsulated in the Mayors' range of Strategies. Crucially, there was a concerted move toward encouraging public transport, whilst at the same time the scope for further growth in road traffic in central London was almost nil. Furthermore, there has been the influence of general economic trends since 2002 and a variety of disruptive incidents affecting the transport system.

All of these developments have been reflected to a greater or lesser extent in the monitoring results. In many cases, taking a four-year view, they are clearly the dominant influence on trends. Examples include: economic activity in central London; road traffic accident rates; emissions and air quality. In all three cases, longer-run or cyclical trends have produced changes of similar or greater magnitude to those immediately attributable to the scheme itself. In turn, the congestion charging attributable changes, whilst either accentuating a positive trend (emissions, accidents), reversing a negative trend (congestion) or, arguably, having a neutral impact on a cyclical trend (economy) become visible with the passage of time as relatively

modest – but nevertheless valuable – 'step' changes in a longer-run evolution of conditions in central London.

Establishing long-run trends in traffic and transport in central London

For a major capital city, there was surprisingly little monitoring of traffic conditions in central London prior to the commencement of the TfL congestion charging monitoring work in 2002. Surveys of traffic volumes focused on a counting cordon that was different to the ultimate boundary of the congestion charging zone. Prior to 2002, traffic crossing this boundary had never before been counted directly, and a completely new counting cordon precisely aligned to scheme monitoring requirements had to be put in place. There were no more than a handful of permanent automatic traffic counters in the congestion charging zone and characteristics such as seasonal and diurnal variation in traffic, origin-destination patterns and the vehicular make-up of traffic were poorly understood.
Although good projections of scheme impacts were available from established traffic models covering central London, the estimates were only loosely grounded in empirical data, and the true nature of 'normal' variability in traffic conditions in central London was not understood.

Fortunately, much of the monitoring that was undertaken at this time employed well established high-quality surveys that had been consistently applied – often for several decades – and the value of this approach should not be underestimated. Where appropriate, TfL's monitoring has continued to apply these established surveys, making adaptations where necessary that do not invalidate the developing time-series.

One consequence of this approach is that variations in traffic and transport conditions that were previously unseen have now become more apparent. This has several implications in the context of monitoring a transport scheme. Two of the more important in this context are:

- It is likely that the more frequently a quantity is measured, the more variable it will appear to be. This is, firstly, because the increased frequency of measurement allows the statistically less frequent and more extreme values to be observed and, secondly, because normal variations associated with, for example, seasonal factors can be more fully captured.
- The availability of more data of itself tends to 'beg yet more questions'. So, although the number of permanent automatic counters associated with the monitoring of the central London scheme is up to 20 times that previously available, and this of itself considerably increased the precision and robustness of the measurements quoted in this report, they have also tended to reveal spatial and temporal inconsistencies at the more local scale that are not readily explained.

There are clearly many balances to be struck in this regard, taking feasibility and costs into account. In resource terms, TfL's monitoring work for the scheme has been well supported. Even so, as this and previous reports acknowledge, there are still some important gaps in our data and understanding which cannot be fully addressed without disproportionate resources.

Response to the increase in the daily charge from £5 to £8

Overall, the traffic modelling and projection work for congestion charging schemes in London has been reasonably successful. The out-turn impacts over the first year or so of the original central London scheme were closely aligned with TfL's expectations. A comparable picture is emerging in relation to the western extension (see Section 14). In part, this reflects good empirical monitoring of the key quantities required to calibrate and validate the models. In part, it also reflects a less-tangible understanding of the road user population likely to be affected by these schemes, allowing more pragmatic assessments of the likely aggregate travel behaviour responses.

An example of where some of these issues were considered in detail was TfL's work to assess the aggregate traffic volume response to the increase to the charge from £5 to £8 in July 2005. As has been discussed elsewhere in this report, the observed aggregate traffic change associated with the charge increase was relatively small compared to the impact of the initial introduction of the charge, such that it could not immediately be detected with confidence in the available traffic volume data. The latest data for 2006 referred to in this report still do not allow TfL to discern an clear traffic impact attributable to this change. However, the trend in congestion charging payments showed a clear response over a period of two months or so.

The difficulties in identifying trends partly resulted from temporary effects associated with the central London bombings of July 2005. It also reflected the relatively limited precision of traffic counts (which are samples, subject to both systematic and random variation) against payment trends (which are absolute total values derived through an accounting system). However, reconciliation of the two indicators was a subject of wider interest to enable TfL to better understand behavioural responses to changes to the charge. In particular, TfL wished to better understand the travel response to the incremental increase in the wider 'generalised cost' of chargeable trips represented by the move from £5 to £8. Also, it was desirable to better understand the role of 'substitution' of chargeable vehicles that no longer entered the charging zone by non-chargeable vehicles, such as taxis adapting to an adjusted travel environment. This tendency had been noted from the traffic volume counts described in Section 3 of this report.

Analysis conducted by TfL has enabled the two trends to be better reconciled, providing a better understanding of the composition and responses of both potentially chargeable and non-chargeable vehicles circulating in the central London charging zone.

7.8 Cost-benefit assessment of the original central London scheme

The information now available to TfL about the impacts and achievements of the original central London scheme, including scheme revenues and expenditure, mean that it is possible to offer a cost-benefit evaluation of the scheme. This is published in full on the TfL website and is presented in summary form in this section.

The analysis quantifies the main identifiable costs and benefits. There are other transport and amenity impacts that have not been quantified and evaluated: such as benefits to pedal and motor cyclists, or easier conditions for pedestrians. However, these are judged to be small in comparison to the scale of the impacts assessed in this analysis.

In addition, the scheme has created an ability to influence traffic conditions in and around central London, thus enabling a wider range of policies and objectives to be pursued. Moreover, by delivery greater efficiency to the transport network serving the central area, the scheme may assist the continuing growth of the highly productive central London economy. This, in turn, would generate benefits for the national economy. However, any increased flexibility and potential longer-term economic impacts have not been taken into account in the analysis.

Background – TfL's earlier provisional assessment

TfL's *Fourth Annual Impacts Monitoring Report* provided provisional estimates of the costs and benefits of the central London scheme. The costs of operating the scheme cover the payments to TfL's contractors, principally the key service providers involved in operating and enforcing the scheme. Scheme benefits principally cover the time savings and improved journey time reliability for those using the road network in and around the charging zone as a result of reduced congestion.

According to this analysis, with the £5 charge the scheme generated £90m in net welfare benefits (2005 prices and values) for a year's operation. This comprised total operating costs of £110m, travel benefits of £230m and chargepayer compliance costs estimated at £30m.

TfL's updated and extended assessment

Continuing experience and analysis of the scheme has allowed TfL to reconsider these estimates on a fully *ex post* (measured out-turn) basis with the initial £5 charge. We have also attempted to produce comparative estimates for the scheme following the July 2005 Variations, when the charge was increased to £8. However, it must be noted that the latter assessment is based partly on *ex post* data and partly on the use of modelled projections.

The economic evaluation presented below brings together various estimates by TfL of the costs and benefits of the central London scheme, and has been undertaken in line with Department for Transport WebTAG principles. The principles indicate that the main components of the analysis should be as follows:

- The cost is the cost to public accounts.
- The benefits or disbenefits accruing to users of motorised transport modes should be monetised.
- Where it is possible to calculate monetary values for benefits or disbenefits accruing to pedestrians, cyclists and others, these benefits should be included in the overall analysis.

- Impacts not included in monetised analysis must be taken into account in overall value for money. These include impacts in relation to environmental, safety, economic, accessibility and integration objectives.

Public accounts

The three impacts of charging on the public accounts are on: Public Sector Revenues, Public Sector Costs, and changes in indirect tax revenues.

There is a net surplus to the public accounts of £28m per year with a £5 charge and £46m with an £8 charge. Details are presented in Table 7.1.

Table 7.1 WebTAG public accounts with £5 and £8 charges. £million per year. 2005 values and prices

	£5 charge		£8 charge	
	Vehicles/ occupants	Buses/ passengers	Vehicles/ occupants	Buses/ passengers
Transport for London charge revenues				
Individuals	72		79	
Business	143		157	
Operating costs	-109		-109	
Infrastructure costs	-25		-25	
Sub-total	81		102	
Central government tax losses				
Fuel duty	-25		-27	
VAT on public transport		-2		-2
VAT on charges	-11		-12	
Sub-total	-36	-2	-39	-2
Borough revenues				
Net parking revenue	-15		-15	
Sub-total	-15		-15	
Public accounts Net annual change	+28		+46	

In 2005, public sector revenues from the central London congestion charging scheme, with the £5 charge, totalled £190m. This included charge payments of £120m and penalty payments of £70m. With the charge at £8, annual revenues increased from about £190m to around £210m. However, taking into account WebTAG principles, consideration needs to be given to the unit of account in which payments are made. Thus, revenues are converted from factor costs to market prices by a factor of 1.2, which takes account of the average rate of indirect taxation in the economy.

Payments by individuals (non-business users) are assumed to be in market prices. Payments by business users are assumed to be in factor prices, since businesses can reclaim value added tax (VAT). Of the total charge payments, 62 percent are estimated to be made by business and 38 percent by individuals. Therefore, individuals account for £72m while business users account for £118m of charge

payments. In market prices, business users payments total £143m with the scheme generating revenues of £215m in total.

Public sector operating costs are TfL's congestion charging administrative and other costs plus payments to Capita and others, who operate the scheme on behalf of TfL. This is equivalent to £90m in terms of factor costs or £109m in market prices.

For the purpose of defining taxation revenue, the congestion charge affects indirect tax revenues. Reduced car use and fuel use mean a loss of fuel duty. Charge payments by individuals and increased bus, Underground and rail use mean a loss of indirect tax revenue because these are zero-rated for VAT. An allowance has also been made for the net loss in parking revenues to those boroughs inside the charging zone due to lower traffic levels in the zone.

Infrastructure costs of around £162m were incurred in implementing the scheme, equivalent to £196m in market prices. Major infrastructure items of expenditure were for traffic management measures, communications and public information for the charging scheme, systems set-up and management. These have been converted to an annual cost by depreciating over 10 years and applying an opportunity cost of 5 percent, to give an equivalent annual cost of about £25m.

Transport economic efficiency

Table 7.2 shows efficiency savings to consumers and business. Travel time and travel time reliability savings, vehicle operating cost savings and user charges are shown separately for business users and individuals – all non-business trips, made by individuals for their own personal reasons, including commuting. The effects on private sector revenues and operating costs are also shown to give a full effect on the business community.

With both a £5 charge and an £8 charge, road users as a whole gain more in time savings, reliability and vehicle operating costs than is expended on charge payments and compliance costs. Around one quarter of the estimated benefits to road users are estimated to accrue to chargepayers; with three quarters accruing to non-chargepayers who gain most of the benefits in inner and outer London and a significant proportion of benefits inside the charged area.

The imposition of charges in the central area leads to a reduction in vehicle kilometres in the inner and outer areas, which in turn leads to higher road speeds in these areas. The higher speeds and absence of charges can be expected to induce additional traffic in the inner and outer areas. The evaluation estimates that induced traffic could offset around 33 percent of the modelled reduction in traffic in these areas. This is equivalent to reducing the overall time saving and reliability benefit by 20 to 25 percent.

Table 7.2 Transport economic efficiency. £million per year. 2005 prices.

	£5 charge			£8 charge		
	Vehicles/ occupants	Bus/ passengers	Total	Vehicles/ occupants	Bus/ passengers	Total
Individual travellers (non-business travel)						
Travel time	54	35	89	65	35	100
Travel time reliability	5	8	13	5	8	13
Vehicle operating costs – fuel	5		5	6		6
Vehicle operating costs – non fuel	4		4	4		4
Chargepayer compliance costs	-6		-6	-5		-5
Chargepayer payments	-72		-72	-79		-79
Disbenefit to deterred trips	-12		-12	-19		-19
Sub total - individual benefits	-22	43	21	-23	43	20
Business travellers						
Travel time	142	0	142	163	0	163
Travel time reliability	22	0	22	27	0	27
Vehicle operating costs – fuel	10		10	10		10
Vehicle operating costs – non fuel	7		7	8		8
Chargepayer compliance costs	-16		-16	-14		-14
Chargepayer payments	-143		-143	-157		-157
Disbenefit to deterred trips	-8		-8	-12		-12
Sub total – business travellers	14	0	14	27	0	27
Business – private sector providers: additional bus services, car park operators						
Bus revenues	19		19	19		19
Bus operating costs	-18		-18	-18		-18
Net car park revenues	-10		-10	-10		-10
Sub total - business providers	-9		-9	-9		-9
Society impacts						
Accidents			14			14
CO_2			2			2
NO_x and PM_{10}			1			1
Sub total – society			17			17
Transport economic efficiency net annual benefits			+43			+53

Overall evaluation

- In market prices, the time and reliability savings to road and bus users are estimated at about £266m per year with a £5 charge and up to £303m with an £8 charge. The actual incremental traffic impacts of the charge increase to £8 are much less distinct than the original application of the £5 charge
- The principal changes in operating costs are the operating costs of the charging scheme, savings in vehicle operating costs, fuel and non-fuel, to road users and the additional operating costs of bus services.

- There are other costs – time, text or phone charges – incurred by users in registering their vehicles; these are shown as compliance costs. Deterred trips suffer a loss. There are savings in accidents and in the quantity of CO_2 and other air pollutants generated by vehicles.
- Infrastructure and other costs were incurred prior to the introduction of charging to facilitate the scheme.
- The principal financial impacts are user charges – charge payments and penalty payments by road users, a loss of tax revenues – fuel duty and VAT on charge payments and bus fares – to government, a loss in net parking revenues to local authorities and private sector operators and additional revenues to TfL arising from the charging scheme and to bus operators from the additional bus passengers.
- With a £5 charge there is an overall surplus of £71m. The annual benefits of £216m exceed scheme operating costs of £101m by £115m. This takes account of changes to public accounts in Table 7.1 and transport efficiency gains in Table 7.2, by a ratio of about 2:1. Benefits exceed operating costs and other financial impacts of £145m by £71m, by a ratio of around 1.5:1.
- With an £8 charge there is an overall surplus of £99m. The benefits of £245m exceed scheme operating costs of £99m by £146m, on the same basis by a ratio of up to 2.5:1. They exceed operating costs and other financial impacts of £146m by £99m, by a ratio of up to 1.7:1.
- The Public Accounts approach as defined by the Department for Transport indicates that the cost to be included in a cost benefit analysis is the cost to the public sector – incorporating 'Government' costs and revenues and the change in indirect tax revenues. But this is not a useful measure in the context of congestion charging since the congestion charge has a negative cost to the public accounts: the revenues from the charge and associated penalty payments exceed the sum of the scheme operating costs and the changes in indirect tax revenues.
- Thus the more traditional resource-based estimates of benefits and costs give benefit:cost ratios of around 2.0:1 and 2.5:1 with £5 and £8 charges. The Public Accounts approach, which also includes the net effects on public accounts, reduces these ratios to around 1.5:1 and 1.7:1 respectively.

Table 7.3 Impacts of the £5 and £8 central area charge. 2005 market prices and values. £million per year.

		Travel time and reliability		Operating costs		Other resources and surpluses		Financial impacts		Total	
		£5	£8	£5	£8	£5	£8	£5	£8	£5	£8
Car, van and goods vehicle users						Compliance cost		User charges			
	Business	164	190	17	18	-16	-14	-143	-157	22	37
	Individuals	59	70	9	10	-6	-5	-72	-79	-10	-4
Bus passengers	Individuals	43	43							43	43
Deterred trips	Business					-8	-12			-8	-12
	Individuals					-12	-19			-12	-19
Society	Accidents					14	14			14	14
	CO_2					2	2			2	2
	NO_x and PM_{10}					1	1			1	1
Transport for London/ Government/ boroughs	Fuel duty							-25	-27	-25	-27
	VAT							-13	-14	-13	-14
	Charging			-109	-109			215	236	106	127
	Additional buses			-18	-18			19	19	1	1
	Infrastructure					-25	-25			-25	-25
	Parking net revenues							-15	-15	-15	-15
Private parking	Net revenues lost							-10	-10	-10	-10
Total		266	303	-101	-99	-50	-58	-44	-47	71	99

Summary

The principal benefits of congestion charging in central London are time and reliability savings to road users continuing to travel within the charging zone, including bus users. These are estimated at around £220m to road users per year with a £5 charge and up to £260m with an £8 charge, plus benefits to bus users of up to £43m. There are other impacts on road users: road users still travelling in the zone have to bear transaction costs and deterred road users suffer a loss of surplus. Society benefits from reduced accident costs and CO_2 and pollution costs but incurred additional infrastructure costs to pave the way for the congestion charging scheme. These impacts are estimated at a net cost of around £50-60m per year.

The principal on-going costs are those of operating the scheme and of operating additional bus services to accommodate deterred trips. Continuing road users enjoy reduced vehicle operating costs. On-going costs are estimated at a net cost of £101m per year with a £5 charge and £99m per year with an £8 charge.

The principal financial impacts are the payments of (and receipts of) congestion charges and associated penalty payments, additional bus fares and lost fuel duty and VAT to government – since fuel consumption is reduced and there is more consumer expenditure on the congestion charge and on bus fares both of which are zero-rated for VAT. There is also a loss in net parking revenues to boroughs and private car parks

in the charging zone. There is a net surplus to the public purse of £28m with a £5 charge and £46m with an £8 charge.

Overall, using a typical year's operation, the identified benefits of the congestion charge exceed the identified costs by a ratio of around 1.5:1 with a £5 charge, and by up to 1.7:1 with an £8 charge. The benefits are dominated by time savings in central, inner and outer London and reliability savings in central London. The time savings in central London are based on observed flow and speed data before and soon after charging was introduced so are more certain. Time savings in inner and outer London are based on model outputs so are less certain. There is uncertainty attached to travel time reliability savings also, but the scale of the reliability savings estimated here is broadly consistent with previous estimates produced elsewhere.

In 2006 observed speeds in the charged area fell below those used in this evaluation, which were observed in 2003 and 2005 after the £5 and £8 charges had been introduced. There is a long experience in central London in particular, of traffic speeds falling even during periods when traffic flows have remained largely unchanged, as discussed in Section 3 of this report. This does not invalidate the benefit estimates quoted above, which have been derived from a comparison of post-charging observed and modelled conditions with observed and modelled conditions in 2002 serving as a proxy for the without-charging conditions in 2003 and 2005. Insofar as conditions in 2002 would have deteriorated by 2003 or 2005 without charging, the benefits quoted above may be an underestimate of the true benefits. However, insofar as the analysis does not take account of the generally declining working weekday levels of traffic in central and inner London and the second order consequences of reduced effective road capacity, it may be an overestimate of the true benefits.

The estimates set out here are TfL's current best estimate of the quantifiable impacts of the central London congestion charging scheme in its original configuration. As more evidence becomes available TfL will seek to refine these estimates.

A fuller analysis is available on the TfL website:
www.tfl.gov.uk/corporate/projectsandschemes/roadsandpublicspaces/2287.aspx.

Part 2:

Monitoring baseline for the western extension scheme

8. Introduction to the western extension

8.1 Purpose

In September 2005, after extensive consultation, the Mayor of London confirmed the Scheme Order for the extension westwards of the central London congestion charging zone.

Following a period of preparation and testing, the extension came into force on 19 February 2007. This section outlines the key features of the western extension that are relevant to an understanding of the monitoring programme that is associated with the scheme.

8.2 Why a western extension?

The success of the original congestion charging scheme implemented in February 2003 encouraged the Mayor to extend the benefits of congestion charging to other parts of central London. The commitment to consult on possible extensions to the original scheme was included in the Mayor's manifesto for the 2004 Mayoral election.

Following the Mayor's re-election, Transport for London developed proposals based on analysis that suggested that the greatest benefits from expanding the congestion charging scheme would come from a westward extension. The area covered by a western extension experienced higher levels of traffic congestion throughout the working day, compared to areas to the north, south and east of the original charging zone. While these areas also experience heavy traffic congestion this is more predominantly at peak times. Importantly, the western extension had suitable diversion routes around the boundary for traffic wishing to avoid an extended charging zone. The area is also well-served by public transport, providing alternatives to using the car.

Formal proposals for a western extension were published by TfL in a Variation Order in May 2005 and public consultation commenced shortly after. The consultation ended in August 2005 and a Report to the Mayor was submitted by TfL in September. On the basis of the representations received, a number of amendments were made to the Variation Order. Giving full consideration to the results of the consultation, the Mayor decided that, on balance, the interests of London and Londoners were best served by the western extension and confirmed the Variation Order, with certain modifications, on 29 September 2005.

8.3 Implementation

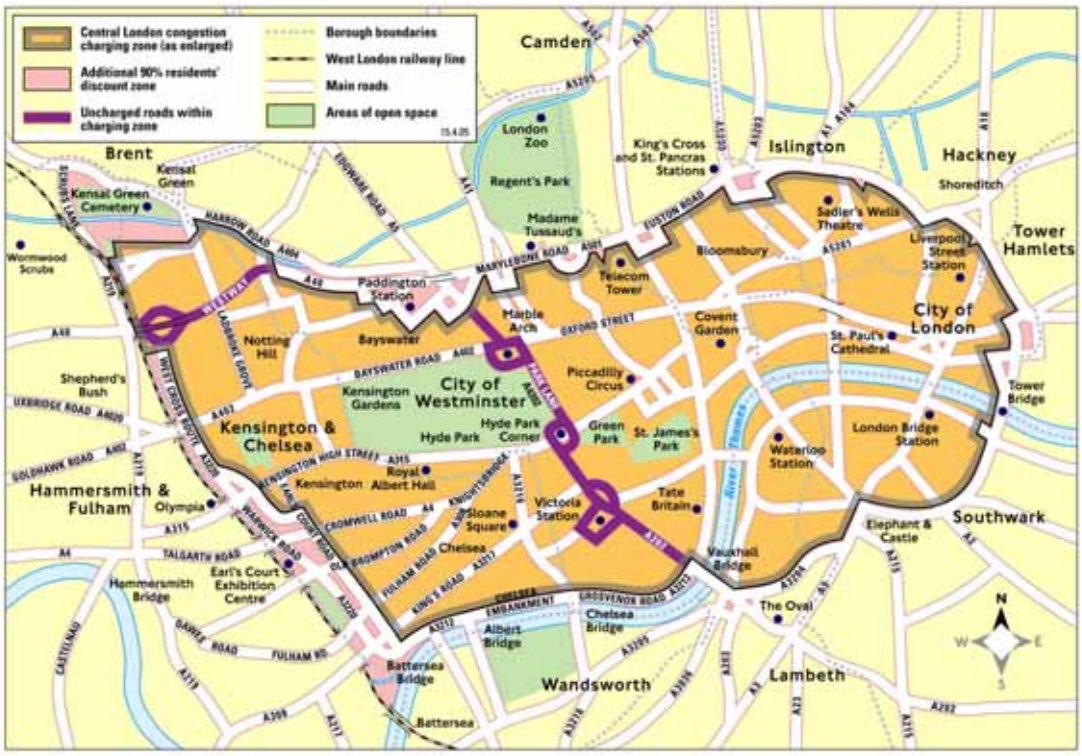
Work to implement the western extension then commenced. Contracts with existing suppliers were extended where appropriate and tenders issued where new services were required. The integration of existing systems and suppliers with new ones was a priority throughout the implementation process. By November 2005 implementation of infrastructure in the western extension zone had begun. Associated traffic management and complementary measures, being delivered in partnership with the London boroughs, also began to be delivered around this time.

In October 2006, TfL undertook a review and formally notified the Mayor that all arrangements were in place for the western extension to commence, as planned, on 19 February 2007. The public information campaign and registrations for western extension residents' discounts and other discounts then began.

The western extension came into force on 19 February 2007. One key feature of the extension was to change the hours of charging in the original central London zone from 07.00-18.30 to 07.00-18.00. From that date, both the original central London zone and the western extension operated the same charging hours.

8.4 Scheme overview

Figure 8.1 Map showing extended central London congestion charging zone.



The extension scheme created an extended charging zone in central London as shown by Figure 8.1.

Those driving in the extended zone during charging hours must pay a charge of £8 (or £10 if choosing to use the Pay Next Day facility). Failure to pay the charge results in a penalty charge. A range of discounts and exemptions are available for certain groups and vehicles. This includes a 90 percent discount for residents of the extended zone.

The extension zone operates in very similar way to the original central London zone. Vehicles are identified using automatic number plate recognition cameras and are checked against a database of those who have paid the charge or those who do not have to pay the charge because they are either exempt or registered for a 100 percent discount. Once a vehicle for which the charge has been paid has been successfully matched, the photographic images are automatically deleted from the database. For

those vehicles for which a charge has not been paid, the photographic images are kept for enforcement purposes.

The extended central London congestion charging zone operates as one zone, with the same charges, discounts and exemptions applying no matter where a vehicle is driven in the zone. There is no charge for driving on boundary roads around the zone. In addition, there are a number of routes that enable vehicles to cross the zone during charging hours without paying – the A40 Westway and a route through the centre of the extended zone running between the north and south, ie Edgware Road, Park Lane and Vauxhall Bridge Road.

8.5 Monitoring arrangements for the western extension

The following sections describe in detail the monitoring arrangements that TfL has put in place for the western extension, and provide a summary of available indicators describing conditions before the implementation of the scheme, against which emerging data following implementation can be set.

The approach builds on the arrangements for the original central London scheme, which have proven to be satisfactory in measuring and understanding the key effects of this scheme. The design of the monitoring work has taken account of representations received as part of the public and stakeholder consultations for the extended scheme. The monitoring programme benefits from experience with the central zone work, and has been adapted to take account of distinguishing operational and local features of the extended zone.

The aim is to achieve a robust understanding of the impacts of the extension scheme in five key areas:

- Impacts on road traffic volumes and road network performance.
- Impacts on public transport operations and travel behaviour.
- Impacts on people in general and specific groups in particular.
- Impacts on the economy, both in general and in relation to specific activities.
- Impacts on the environment, principally air quality.

In addition, information will be gathered on the operational performance and enforcement of the extended scheme.

The monitoring programme is intended to be flexible in scope, and it is expected that the coverage of the work will evolve over time in response to emerging interests and requirements.

The monitoring work will be managed by a team of permanent TfL staff, with independent contractors undertaking the key data collection elements. Key indicators relating to the operation and enforcement of the extended scheme will arise primarily from the service providers for the scheme.

The monitoring work takes place within the wider context of existing or planned monitoring work in London. This means that, as with the original central London

scheme, much of the monitoring work will involve the collation of data from established TfL, GLA or other outside sources.

Outputs from the monitoring work will be published in definitive annual reports, together with other periodic reports where appropriate. Reports will be published in hard copy and on the internet. Part 3 of this report (Section 14) provides a summary of early findings from the monitoring work in relation to the western extension, reflecting approximately three months of operation of the extended scheme.

9. Western extension zone: traffic patterns

9.1 Introduction

This section describes the main elements of the traffic monitoring programme for the western extension to the central London charging scheme and presents a selection of baseline data for 2005 and 2006, reflecting conditions prior to the introduction of the extension.

For the purposes of this section, the western extension zone is considered separately from the original central London zone. During 2006, aggregate traffic conditions in the central zone have been largely unaffected by preparations for the western extension, and the monitoring of key central London zone indicators has continued on a similar basis to previous years. Findings from this element of the work for the original central zone are summarised in Section 2 of this report.

9.2 Scope

The aim of the work described here is to enable TfL to understand the changes to the amount and composition of traffic in and around the western extension following on from the introduction of the extended scheme.

This section focuses on the elements of the work that are designed to give a detailed, medium-term view of traffic changes associated with the extension. As full results from the earliest corresponding post-implementation surveys will not be available until Summer 2007, this section concentrates on presenting a 'baseline' of pre-extension data for 2005 and 2006, against which emerging results across 2007 can be set.

A sub-set of this work is aimed at giving very early feedback on traffic changes over the first weeks and months following implementation of the extended scheme. The approach taken for this, together with some initial findings, are set out in Section 14 of this report.

9.3 Approach

As with the monitoring of the central London scheme, the basic approach is to periodically count traffic flowing across a series of strategic cordons and screenlines, each providing a 'key indicator' of one aspect of traffic conditions. Counts taken at the same times of year, before and after the implementation of the western extension, then provide indicators of changes to traffic volumes and composition that may be associated with the extension.

- A traffic counting cordon typically encloses an area, such as the western extension zone itself. All vehicles crossing into and out of the area are counted. Cordons are typically used to measure radial traffic movements, eg traffic entering or leaving the western extension zone.
- A traffic counting screenline divides an area of interest into two parts, enabling traffic moving between the two parts of the area to be counted. These are

typically, but not exclusively, used here to measure orbital traffic movements, eg traffic circulating around the outside of the western extension zone.

- An area-based indicator, comprising a representative selection of point-based samples on the road network within an area or on a key route, can also be used to estimate changes in traffic volumes on an area-wide, or vehicle-kilometre, basis.

The methodology uses both permanent automatic traffic counters and manual classified counts in combination.

- Automatic counters provide continuous data on traffic volumes (total vehicles with four or more wheels), but are relatively expensive to install and maintain and can therefore only be used at a sub-set of the sites of interest.
- Periodic one-day manual classified counts allow examination of changes by individual vehicle types (including two-wheeled vehicles) and can be deployed widely over the area of interest, but are subject to greater sampling error than continuous counts.

Automatic counts are capable of providing early feedback on the impacts of the extension. Given an adequate time-series, they can also allow variations in traffic levels caused by, for example, seasonal effects to be taken into account in any assessment of scheme impacts.

Because manual counts are effectively one-day samples of traffic flow, they are best undertaken at times of the year when traffic flows approximate most closely to the annual average, particularly avoiding the Christmas, Easter and Summer holiday periods. To this end the monitoring work described is largely based on counts taken during the Spring and Autumn 'neutral' counting periods. These run from April until June and from September until October (avoiding public and school holiday periods). Where 'annualised totals' are quoted, these are simply the average of comparable counts taken during the two neutral counting periods of each year, rather than a true annual average daily flow.

Sample error can be reduced by undertaking manual counts at the same site more frequently. This approach has been used for many of the key manual count based indicators described in this section, with some sites being counted more than once in each neutral counting period, and with some subsidiary counts taken in January and August, to give some appreciation of variations in traffic flows across the year.

Typically, all sites comprising a cordon, screenline or area-based indicator would be counted in any one neutral counting period, spread over a period of weeks to minimise the effect of any short-term disruptions to the road network on the resulting estimate. However, sub-sets of sites can be counted more frequently or monitored continuously, to track developing trends or seasonal effects, provided that the statistical properties of the sub-set are recognised in any subsequent interpretation.

This approach is particularly useful with permanent automatic traffic counters. These are typically located on a sub-set of the busier routes in any one cordon or screenline, and provide a continuous view of traffic trends, albeit based on a sample

of the roads comprising the indicator concerned and therefore possibly subject to sample bias as a result. This facility to obtain rapid feedback on how traffic levels have responded to the introduction of the western extension was used to good effect in the early weeks following implementation, as described in Section 14.

9.4 Key indicators

There are 22 key traffic volume indicators for the western extension, covering some 460 individual traffic counting sites: 60 permanent automatic, 400 periodic manual. These are described in the following sections and can be divided into four key groups in terms of the type of movement interest:

- traffic entering or leaving the western extension;
- traffic circulating within the western extension;
- traffic circulating on the boundary routes immediately outside of the western extension, including the free passage (ie uncharged) route between the original and extended charging zones;
- traffic movements in inner London beyond the immediate area of the western extension – both radial and orbital movements.

In addition:

- a further sub-set of indicators have been defined looking in detail at traffic interactions between the existing central and western extension zones across the free passage route, since implementation of the western extension is expected to affect traffic conditions in the existing central London charging zone;
- TfL has also undertaken counts at a selection of individual sites in response to specific issues or stakeholder concerns.

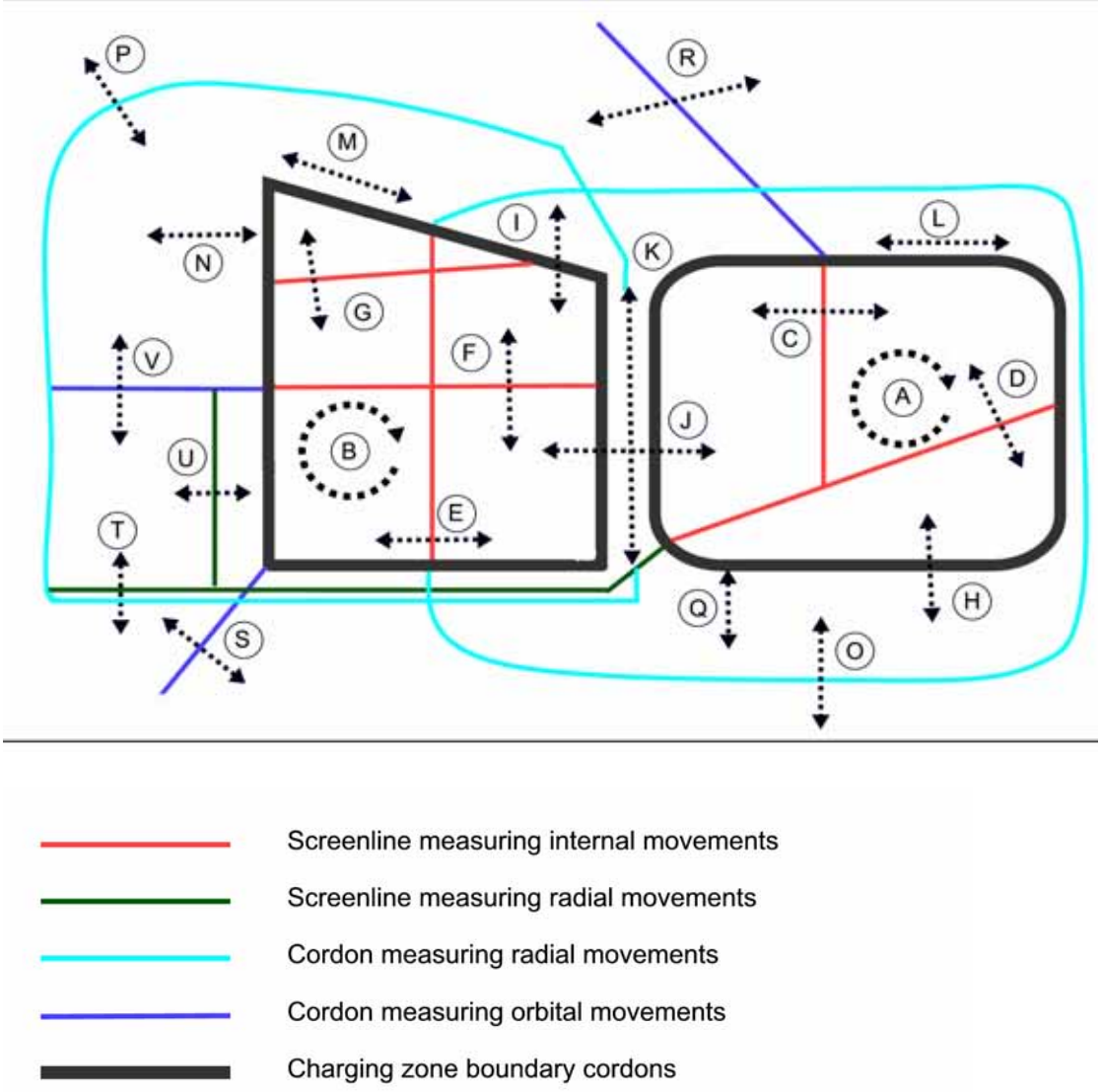
Generally, there are several indicators for each key traffic movement of interest. Collectively, and taking the particular strengths and weaknesses of each indicator into account, they should over time build to provide a comprehensive and definitive picture of the traffic impacts of the extension scheme. The key indicators are illustrated diagrammatically in Figure 9.1, listed in Table 9.1, and are further described in each relevant section.

Note that the description above does not include established indicators for the central zone. These are described in Section 2, alongside the latest findings for 2006. The new indicators for the western extension have been designed to complement these existing indicators, which will continue to be monitored during 2007 and provide important additional information by which TfL will be able to assess the impacts of the enlarged central London zone.

Table 9.1 Description of the key traffic counting cordons and screenlines for congestion charging monitoring in central London.

Ref.	Target movement	Sampling method
A	Circulating traffic – central zone	Area-based indicator – automatic and manual counts (central zone vehicle kilometres driven indicator)
B	Circulating traffic – western extension	Area-based indicator – automatic and manual counts (western extension vehicle kilometres driven indicator)
C	Circulating traffic – central zone	Screenline – manually counted (northern screenline within central zone north of Thames)
D	Circulating traffic – central zone	Screenline – manual and automatic counts (Thames screenline within central zone)
E	Circulating traffic – western extension	Screenline – manually counted – some automatic counts (western extension internal north-south screenline)
F	Circulating traffic – western extension	Screenline – manually counted with some automatic counts (western extension internal east-west screenline)
G	Circulating traffic – western extension	Screenline – manually counted (western extension A40 Westway screenline)
H	Entering and exiting traffic – central zone	Cordon – manual and automatic counts (central zone boundary cordon)
I	Entering and exiting traffic – western extension	Cordon – manual and automatic counts (western extension boundary cordon)
J	Traffic moving between central and western extension zones	Paired screenline – manual and automatic counts (free passage route screenlines)
K	Traffic circulating on the free passage route	Link counts – manual and automatic (free passage route vehicle kilometres driven indicator)
L	Traffic circulating on the Inner Ring Road (eastern boundary)	Link counts – manual and automatic (Inner Ring Road/eastern boundary vehicle kilometres driven indicator)
M	Traffic circulating on the western boundary	Link counts – manual and automatic (western boundary vehicle kilometres driven indicator)
N	Traffic approaching the western extension zone at the boundary route	Cordon – manually counted (western extension boundary approach cordon)
O	Traffic approaching the central zone in inner London	Cordon – manually counted (TfL central London cordon)
P	Traffic approaching the western extension in inner London	Cordon – manually counted (western extension annulus cordon)
Q	Traffic approaching the central zone at the boundary route	Cordon – manually counted (central zone boundary approach cordon)
R	Traffic making orbital movements in inner London	Screenline– manually counted (northern screenline outside central zone)
S	Traffic making orbital movements in inner London	Screenline – manually counted (south-west screenline)
T	Traffic making orbital movements in inner London	Screenline – manual and automatic counts (western extension external Thames bridges)
U	Radial traffic approaching the western extension	Screenline – manual and automatic counts (west London railway screenline)
V	Orbital traffic circulating around the western extension	Screenline – manual counts (western extension external east-west screenline)

Figure 9.1 Diagrammatic representation of the key traffic counting cordons and screenlines for congestion charging monitoring in central London.



9.5 TfL's expectations for the traffic impacts of a western extension

Table 9.2 shows a summary of TfL's projections for the traffic volume impacts of a western extension, as developed for TfL's Report to the Mayor in 2005, following public consultation on detailed proposals for a western extension.

The traffic projections are expressed in terms of a percentage change against representative pre-charging conditions. To reflect uncertainties in the modelling work and also the responses of chargepayers, ranges are quoted. The 'lower sensitivity' projection range assumes that chargepayers would be relatively insensitive to the new charge. Therefore, relatively more would continue to travel into the zone as before and pay the charge, and the observable traffic change would be less. The 'higher sensitivity' projection assumes a greater degree of response to the new charge, with more drivers choosing to avoid travelling into the zone, and a proportionately greater observable traffic change.

Table 9.2 Projections of the traffic impacts of a western extension, September 2005. Rounded estimates.

		Cars	Vans	Lorries	Potentially chargeable vehicles	Taxis	Buses, Coaches	Total 4(+) wheeled vehicles
Current conditions (modelled)	CZ payers	56,000	14,000	5,000				
	Non CZ payers							
	-Terminating	41,000	11,000	2,000	54,000			
	-Through	21,000	6,000	1,000	28,000			
	-Exempt/discounted	17,000	2,000					
	Total	135,000	33,000	8,000	82,000	33,000	8,000	217,000
Post-charging (modelled) lower sensitivity	CZ payers	56,000	14,000	5,000				
	Non CZ payers							
	-Terminating	23,000	11,000	2,000	36,000			
	-Through	9,000	4,000	1,000	14,000			
	-Exempt/discounted	17,000	2,000					
	Total	106,000	31,000	8,000	50,000	36,000	9,000	189,000
	Percentage change	-22%	-6%	0%	-39%	9%	10%	-13%
Post-charging (modelled) higher sensitivity	CZ payers	55,000	13,000	5,000				
	Non CZ payers							
	-Terminating	17,000	10,000	2,000	29,000			
	-Through	7,000	4,000	1,000	11,000			
	-Exempt/discounted	17,000	2,000					
	Total	96,000	29,000	7,000	40,000	37,000	9,000	178,000
	Percentage change	-28%	-12%	-3%	-51%	10%	15%	-17%

The remainder of this section sets out the baseline pre-extension measurements against which TfL would expect to observe the actual changes. Given the various uncertainties in the projections, the best assessment of the performance of the extension would be in terms of the ranges applicable to the projections, using a 'basket' of more than one observed indicator in each case.

9.6 Traffic entering the western extension

During 2005 and 2006 there were 99 points at which motorised traffic could enter the western extension zone. Comprehensive manual classified counts were undertaken during the Spring and Autumn 'neutral' counting periods in each year, forming a complete cordon around the western extension zone. For this indicator, broadly comparable counts were also undertaken during 2003 and 2004, these earlier counts having been harmonised to represent the final boundary and operational hours of the extension zone as defined in TfL's Report to the Mayor of 2005 and as implemented in February 2007.

Figure 9.2 shows the available time-series by main vehicle type for traffic entering the western extension zone. Approximately 250,000 vehicles entered the extension zone during future charging hours on a typical 2005/2006 weekday. Cars, including minicabs, comprise a little over half of the traffic entering the zone, with vans and lorries accounting for a further 17-18 percent, such that approximately 72 percent of the traffic would be potentially liable for the charge. However, some of these will already be paying the charge because they also enter the original central zone; others will be liable only to the discounted charge for residents' vehicles.

The picture is one of slowly-declining traffic between 2003 and 2006, reflecting the general 'background' decline in traffic activity in central and inner London referred to elsewhere in this report, although the composition of the traffic has remained broadly consistent.

Figure 9.2 Traffic entering the western extension zone across all inbound roads. 07.00-18.00, 2003 to 2006.

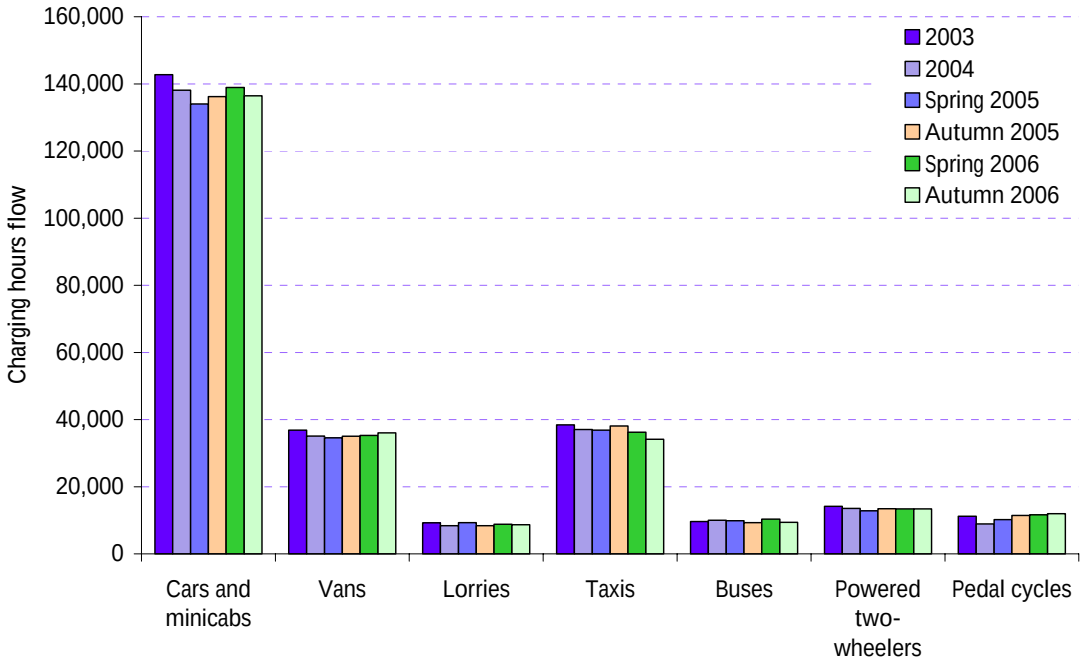


Table 9.3 compares traffic volumes and vehicle proportions entering the future western extension before charging in 2005 and 2006 with equivalent data for the central London charging zone in 2002 (before the introduction of charging there) and 2006. The total volume of four-wheeled traffic entering the future extension zone in 2005/2006 was approximately two thirds of that entering the central zone in 2002 before charging.

Table 9.3 Traffic entering the western extension zone across all inbound roads. 07.00-18.00, 2005 and 2006. Including selected central zone indicators for comparison.

Vehicle type	2005 average (000s)	2006 average (000s)	Percentage of total 2005	Percentage of total 2006	Percentage of central zone 2002	Percentage of central zone 2006
All vehicles	250	253	100%	100%	100%	100%
Four or more wheels	226	228	90%	90%	88%	84%
Potentially chargeable	179	182	72%	72%	70%	59%
- Cars and minicabs	135	138	54%	55%	51%	39%
- Vans	35	36	14%	14%	15%	16%
- Lorries and others	9	9	4%	3%	4%	4%
Non chargeable	71	70	28%	28%	30%	41%
- Licensed taxis	38	35	15%	14%	15%	20%
- Buses and coaches	10	10	4%	4%	3%	5%
- Powered two-wheelers	13	13	4%	5%	7%	9%
- Pedal cycles	11	12	4%	5%	4%	7%

Note that the proportions for the central London charging zone have been re-based for this purpose in view of the revised operating hours for the scheme (07.00 to 18.00) and may therefore differ slightly from those previously reported.

Permanent automatic traffic counters have been placed at 21 higher-flow entry points to the extension zone. These were progressively installed during 2006 and therefore provide a partial baseline that is suitable for measuring the short-term impacts of the extension, as well as for longer-term tracking of traffic trends following implementation. This indicator, comparing conditions shortly before the implementation of the extension with those immediately afterwards, is described in Section 14.

9.7 Traffic leaving the western extension

Comprehensive manual classified counts were also undertaken during the Spring and Autumn 'neutral' counting periods at the 102 points where motorised traffic could leave the extension zone. As with entering traffic, annualised average data are available for 2005/2006, as well as comparable data for 2003 and 2004.

Figure 9.3 and Table 9.4 shows the available time-series by main vehicle type for traffic leaving the western extension zone. Approximately 255,000 vehicles left the extension zone during future charging hours on a typical 2005/2006 weekday. The background trend of slowly-declining traffic, and the traffic composition profile, are

very similar to that for traffic entering the extension zone.

Figure 9.3 Traffic leaving the western extension zone across all outbound roads. 07.00-18.00, 2003 to 2006.

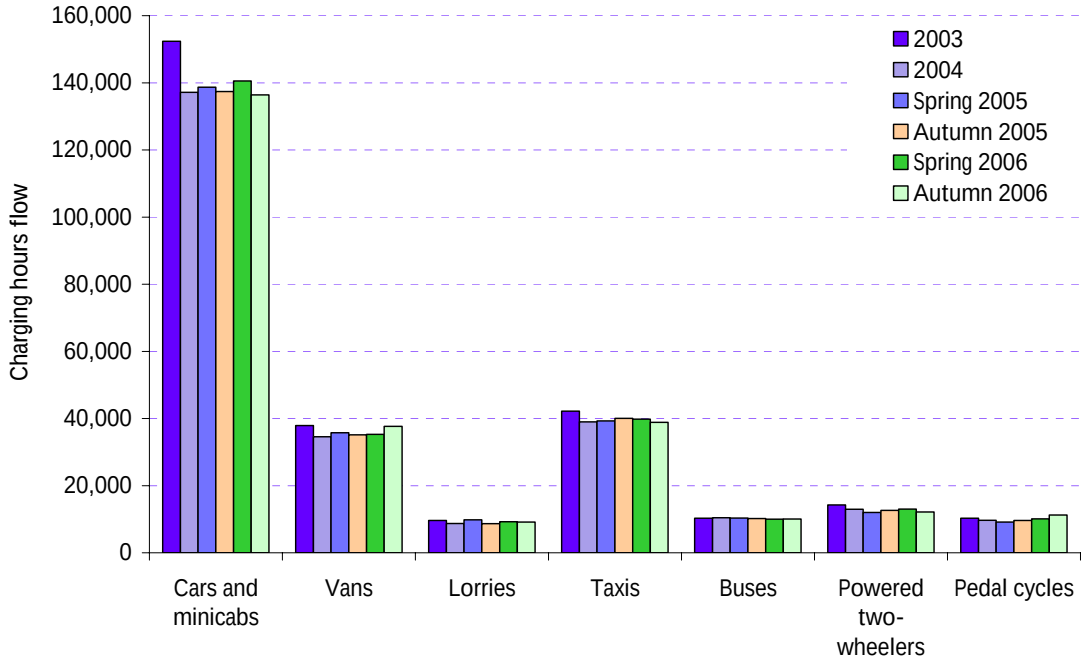


Table 9.4 Traffic leaving the western extension zone across all outbound roads. 07.00-18.00, 2005 and 2006. Including selected central zone indicators for comparison.

Vehicle type	2005 average (000s)	2006 average (000s)	Percentage of total 2005	Percentage of total 2006	Percentage of central zone 2002	Percentage of central zone 2006
All vehicles	255	257	100%	100%	100%	100%
Four or more wheels	233	234	91%	91%	91%	88%
Potentially chargeable	183	184	72%	72%	71%	61%
- Cars and minicabs	138	139	54%	54%	50%	39%
- Vans	36	37	14%	14%	17%	18%
- Lorries and others	9	9	4%	4%	5%	5%
Non chargeable	72	73	28%	28%	29%	39%
- Licensed taxis	40	39	16%	15%	16%	21%
- Buses and coaches	10	10	4%	4%	4%	5%
- Powered two-wheelers	12	13	5%	5%	6%	7%
- Pedal cycles	9	11	4%	4%	3%	5%

A short-term automatic counter based indicator of the change in traffic leaving the western extension zone across a sample of 21 high-flow exit points following implementation is described in Section 14.

9.8 Characteristics of traffic entering and leaving the western extension

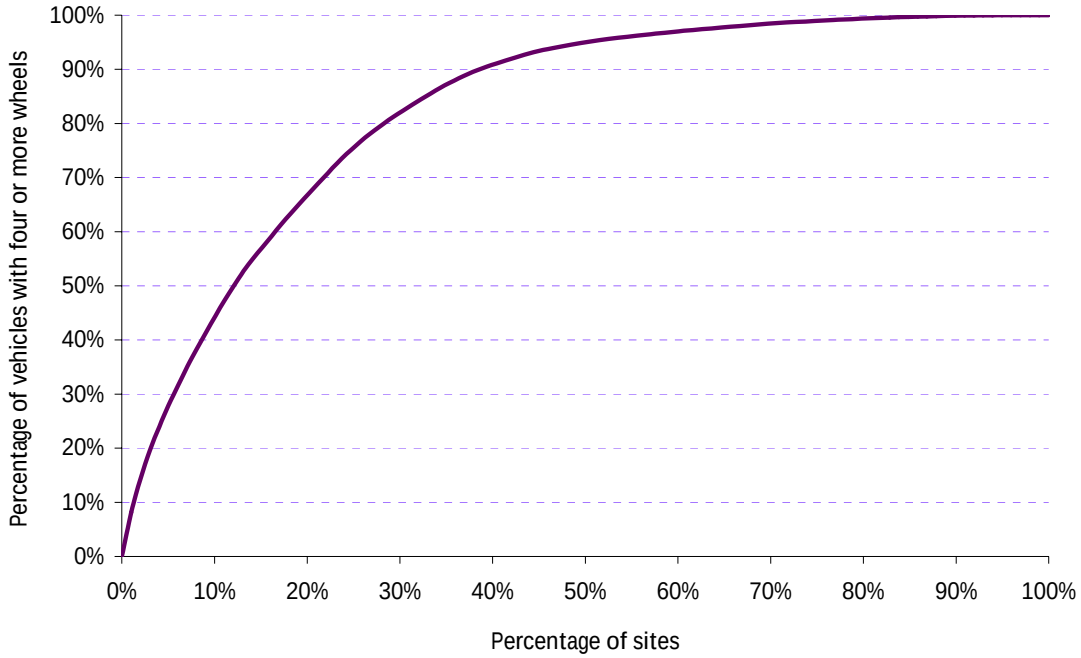
These manual classified counts provide much information on the characteristics of traffic entering and leaving the western extension prior to the start of the charging. This section highlights some key features of interest.

Distribution of traffic volumes across sites

The 99 sites providing entry into the western extension vary considerably in terms of the total volume and type of traffic carried. The greater proportion (60 percent) of traffic flowing into the zone is carried by a relatively small number of roads (15 percent). Placing automatic traffic counters on these 'key routes' provides an economical means of tracking day-by-day trends in traffic entering and leaving the extension zone. The majority of crossing points are minor roads, collectively carrying the remainder of the traffic.

Figure 9.4 shows the cumulative contribution of each entry point, ranked in descending order of flow, to the total traffic flowing into the zone.

Figure 9.4 Cumulative profile of traffic entering the western extension zone across all inbound roads ranked by volume of traffic carried. 07.00-18.00, 2006.



Distribution of entries and exits over the counting day

Figure 9.5 shows how the volume of traffic entering the western extension zone varies according to the time of day. The profile shows recognisable morning and

evening peak periods, these being relatively more pronounced in the western extension than observed in the central zone in 2002 before the introduction of charging (see also Figure 2.2). Inter-peak flows into the extension zone are typically 80 percent of peak flows – at about 11,000 and 14,000 vehicles per half hour respectively.

Figure 9.6 shows the corresponding distribution for traffic leaving the western extension. This profile is noticeably more uniform than that observed in the original central zone before the introduction of charging in 2002, with flows building progressively during the day and the highest flows being observed in the evening peak period.

Note that the western extension zone is directly adjacent to the original central London zone. Therefore, tidal flows to and from central London would be expected to influence traffic crossing into and out of the extension zone. In particular, a significant proportion of traffic moving into the extension zone from the east would have moved out of the central zone immediately beforehand, and vice versa.

Figure 9.5 Traffic entering the western extension zone by time of day. Annualised weekdays for 2005 and 2006.

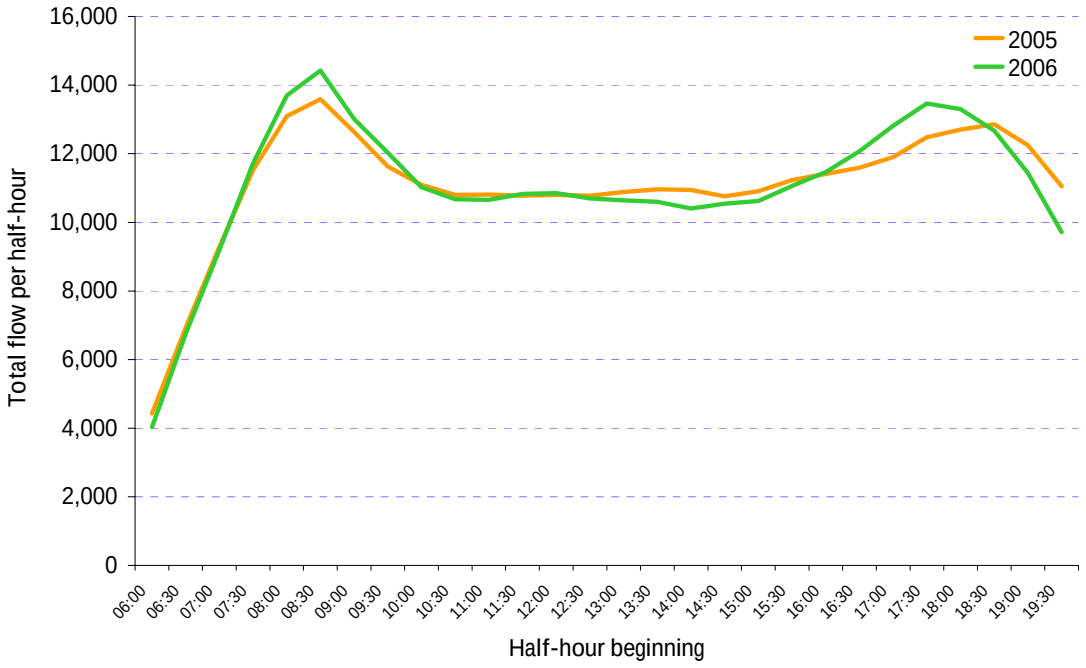
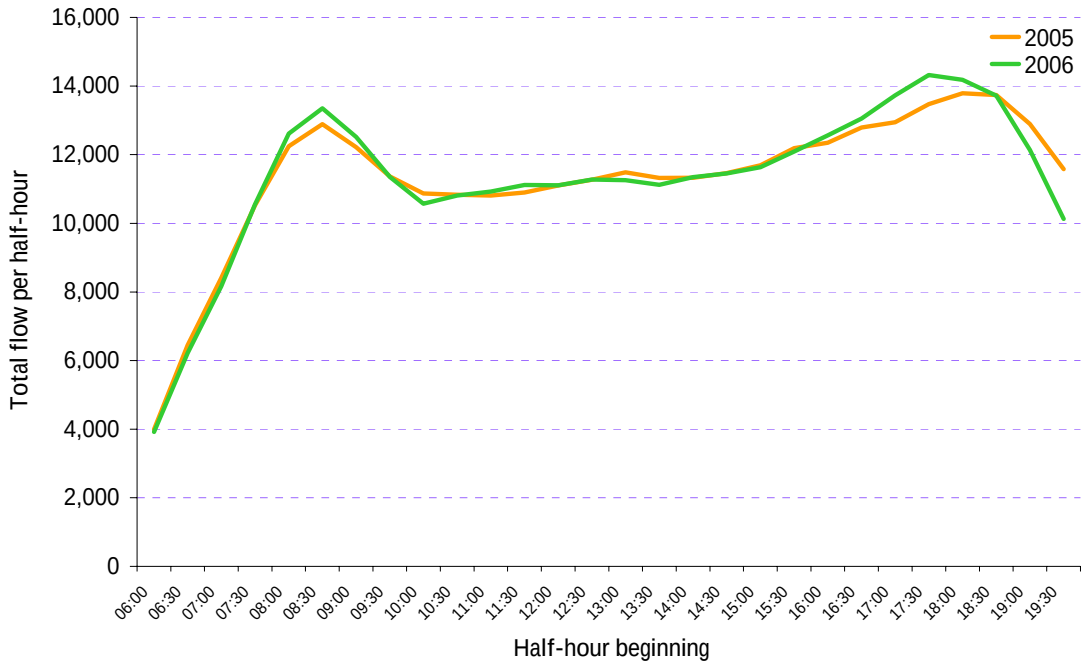


Figure 9.6 Traffic leaving the western extension zone by time of day. Annualised weekdays for 2005 and 2006.



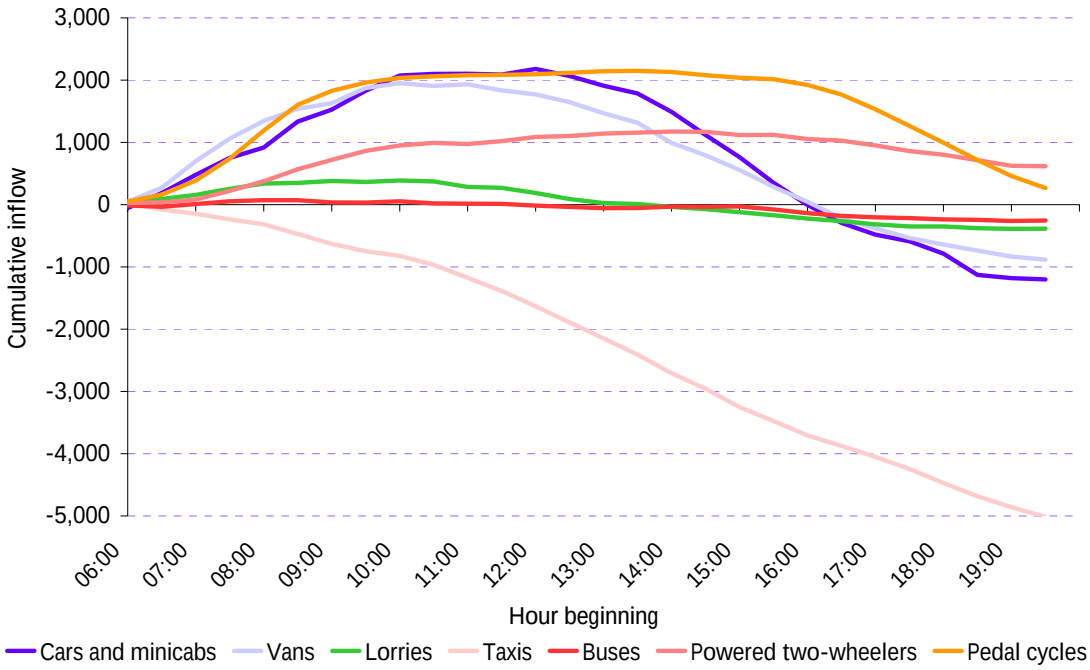
Balance of inbound and outbound flow

Knowledge of through traffic proportions, and the extent to which traffic volumes moving to, from and within the extension zone vary by time of day, will allow responses to charging to be more fully understood.

Figure 9.7 shows the cumulative number of vehicles that are present in the western extension across the counting day for the combined Spring and Autumn 2006 boundary counts. It is based on the cumulative difference of inbound and outbound movements and so does not include wholly 'internal' vehicles that are present throughout the counting day.

For most vehicle types the pattern is an intuitive one, with small net inflows during future charging hours. Interestingly, however, the absolute magnitude of these 'excess' vehicles is much smaller than for the central zone, never exceeding 10 percent of the absolute number of entering vehicles per time period for cars and minicabs, for example. This probably reflects two particular features of the extension zone: firstly, a greater preponderance of 'through' trips compared to the central zone and, secondly, a greater proportion of traffic within the zone being comprised of local trips by (the relatively greater number of) residents. Note that these are pre-charging values for the western extension, and also that the substantial 'through' traffic on the elevated A40 Westway is not included in this analysis. The anomalous cumulative outflows for taxis reflect road network changes between the Spring and Autumn counts for 2006, notably the re-opening of Bishop's Bridge, affecting taxi flows around Paddington station.

Figure 9.7 Balance between vehicle inflows and outflows. Traffic crossing the western extension zone boundary. 07.00-18.00, 2006 only.



9.9 Traffic circulating within the western extension

Changes to volumes of traffic circulating within the western extension zone are another key set of indicators of scheme impacts. The most appropriate indicator of change is that of vehicle kilometres driven within the extension zone. Such an indicator is, however, difficult to measure with a high degree of statistical precision and should not therefore be viewed in isolation.

Supporting indicators for circulating traffic have therefore also been developed using strategic screenlines within the extension zone. Three of these have been adopted for this purpose, although it should also be noted that, whilst these are 'watertight' in terms of covering 100 percent of the movements of interest, they are also based on a relatively small number of counting sites and therefore subject to considerable volatility:

- A screenline running north-south through the extension zone, broadly dividing the zone into an 'eastern' third and a 'western' two-thirds.
- A screenline running east-west through the extension zone broadly aligned with the northern edge of Hyde Park.
- A screenline following the elevated section of the A40 Westway, running east-west through the north-western part of the extension zone.

Vehicle-kilometres driven within the western extension

This indicator is only available for 2006. A total 33 sites, randomly spread across the western extension so as to be broadly representative of area-wide traffic conditions, were counted in both Spring and Autumn 'neutral' survey periods. Observed traffic

volumes were then factored by road length, according to a relatively coarse classification of road type, to give an indicator of total vehicle kilometres driven within the zone. Note that this indicator is therefore optimised to detect *change* in the amount of circulating traffic, rather than to give a precise estimate of the absolute level of vehicle kilometres driven within the western extension zone.

Table 9.5 summarises the calculated estimates of vehicle kilometres driven by main vehicle type for 2006.

Table 9.5 Indicative vehicle-kilometres driven within the western extension zone during charging hours (millions). 07.00-18.00, 2006 only. Including selected central zone indicators for comparison.

Vehicle type	Spring 2006	Autumn 2006	2006 average	Percentage of total 2006	Percentage of central zone 2002 for comparison	Percentage of central zone 2006 for comparison
All vehicles	1.11	1.14	1.12	100%	100%	100%
Four or more wheels	1.00	1.02	1.00	89%	88%	84%
Potentially chargeable	0.84	0.87	0.85	76%	69%	58%
- Cars and minicabs	0.65	0.68	0.67	60%	47%	34%
- Vans	0.15	0.16	0.15	13%	18%	19%
- Lorries and others	0.04	0.03	0.04	3%	4%	5%
Non chargeable	0.26	0.27	0.27	24%	31%	42%
- Licensed taxis	0.12	0.12	0.12	11%	16%	20%
- Buses and coaches	0.03	0.03	0.03	3%	3%	5%
- Powered two-wheelers	0.06	0.06	0.06	5%	8%	9%
- Pedal cycles	0.05	0.06	0.06	5%	4%	7%

During 2006 before implementation of the extension, roundly 1 million kilometres were driven by vehicles with four or more wheels in the western extension zone during the future charging hours on a typical weekday. This was about 70 percent of the equivalent level of traffic activity in the original central zone in 2002 just prior to the introduction of charging there, and is about 15 percent less than the original central zone in 2006 with charging at £8.

In terms of traffic composition (all vehicles, kilometres driven), cars and minicabs comprise about 60 percent of western extension traffic, compared to 47 percent in the central zone in 2002 pre-charging, and 34 percent in 2006 post-charging. Around 76 percent of traffic in the western extension is potentially liable for the charge (but

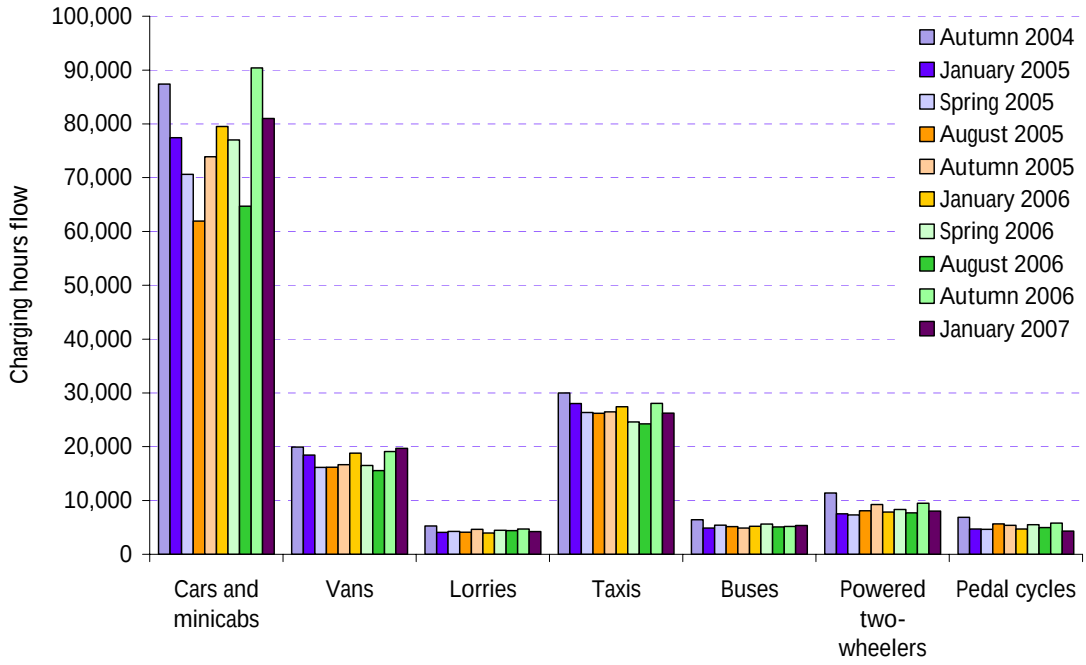
may be entitled to a resident's discount or other discount or exemption, eg as a licensed minicab), compared to about 69 percent in the central zone in 2002, and 58 percent in 2006 with charging at £8.

The count data behind these estimates can be analysed in a number of other ways. This may be useful in the event, for example, of network disruptions affecting the comparability of the year-on-year counts, as has been seen with the monitoring for the original central zone (Section 2), or for analysing possible differential responses to charging by road type or sub-area. One of these is to consider the total population of vehicles observed, or the average population of vehicles across all sites. For vehicles with four or more wheels, the equivalent observed values for 2006 were 55,900 and 1,700 respectively. These relatively low average flows reflect the predominance of minor roads in the sample, reflecting the relative contributions to overall road length in the western extension zone.

Traffic crossing the north-south internal screenline within the western extension

The internal north-south screenline is a portion of the long-standing TfL central London cordon, historically counted in Autumn each year. For this purpose, it provides an indicator of traffic moving between the eastern third and western two-thirds of the extension zone. For 2005 and 2006, the screenline was counted four times each year (January, Spring, August and Autumn). Figure 9.8 shows flows by main vehicle type for all counts during 2005 and 2006, including for comparison the Autumn count for 2004 and a count taken in January 2007.

Figure 9.8 Traffic crossing the internal north-south screenline. 07.00-18.00, 2005 and 2006. Both directions combined by main vehicle type.



Flows across this screenline were somewhat variable during 2005 and 2006. In part, this reflects seasonal influences, with counts taken during August markedly lower than those at other times, together with statistical uncertainties associated with these counts. Even so, Table 9.6, based on the average of the Spring and Autumn counts in 2005 and 2006, shows flows in 2006 to have been some 10 percent higher overall than in 2005.

Table 9.6 Traffic crossing the internal north-south screenline. 07.00-18.00, 2005 and 2006. Both directions combined by main vehicle type.

Vehicle type	2005 annualised average flow (000s)	2005 percentage of total flow	2006 annualised average flow (000s)	2006 percentage of total flow
All vehicles	138	100%	152	100%
Four or more wheels	125	90%	138	90%
Potentially chargeable	93	67%	106	70%
- Cars and minicabs	72	52%	84	55%
- Vans	16	12%	18	12%
- Lorries and other	5	3%	5	3%
Non chargeable	45	33%	46	30%
- Licensed taxis	26	19%	26	17%
- Buses and coaches	5	4%	5	4%
- Powered two-wheelers	8	6%	9	6%
- Pedal cycles	5	4%	6	4%

Traffic composition at this screenline is broadly similar to that in Table 9.5, with somewhat fewer cars and minicabs counterbalanced by more licensed taxis, probably reflecting the orientation of this screenline with respect to the major east-west radial routes passing through the extension zone.

Traffic crossing the east-west internal screenline within the western extension

The internal east-west screenline runs from West Carriage Drive in the east to Addison Road in the west and contains seven survey sites. It provides an indicator of traffic moving between the northern and southern parts of the western extension. For 2005 and 2006, the screenline was counted four times each year (January, Spring, August and Autumn). Table 9.7 summarises traffic flows for 2005 and 2006, based on the Spring and Autumn 'neutral' period counts only.

Table 9.7 Traffic crossing the internal east-west screenline. 07.00-18.00, 2005 and 2006. Both directions combined by main vehicle type.

Vehicle type	2005 annualised average flow (000s)	2005 percentage of total flow	2006 annualised average flow (000s)	2006 percentage of total flow
All vehicles	49	100%	52	100%
Four or more wheels	45	92%	48	92%
Potentially chargeable	38	77%	41	77%
- Cars and minicabs	31	63%	33	62%
- Vans	6	13%	7	13%
- Lorries and other	1	2%	1	2%
Non chargeable	11	23%	12	23%
- Licensed taxis	6	12%	6	12%
- Buses and coaches	1	3%	1	2%
- Powered two-wheelers	3	5%	3	5%
- Pedal cycles	1	3%	2	3%

As with the north/south screenline, 2006 flows were some seven percent higher than 2005. However, as is also the case with the north-south screenline, historical counts taken during the Autumn (only) of 2003 and 2004 indicate higher flows: 58,000 and 55,000 vehicles respectively. The vehicle mix at this screenline suggests a slightly higher proportion of potentially-chargeable vehicles than is typical for the other indicators of traffic within the extension zone, again perhaps reflecting the orientation of this screenline towards orbital (ie north-south) movements across the extension zone.

Traffic crossing the A40 Westway screenline within the western extension

The A40 Westway screenline consists of five count sites. These nevertheless cover 100 percent of traffic moving under the elevated section of this road in the north-west part of the western extension zone. For 2005 and 2006, the screenline was counted four times each year (January, Spring, August and Autumn). Table 9.8 summarises traffic flows for 2005 and 2006, based on the Spring and Autumn 'neutral' period counts only.

Table 9.8 Traffic crossing the internal A40 Westway screenline. 07.00-18.00, 2005 and 2006. Both directions combined by main vehicle type.

Vehicle type	2005 annualised average flow (000s)	2005 percentage of total flow	2006 annualised average flow (000s)	2006 percentage of total flow
All vehicles	37	100%	38	100%
Four or more wheels	33	90%	35	92%
Potentially chargeable	31	83%	32	84%
- Cars and minicabs	24	64%	25	65%
- Vans	6	15%	6	16%
- Lorries and other	1	3%	1	3%
Non chargeable	6	17%	6	16%
- Licensed taxis	1	3%	1	3%
- Buses and coaches	2	5%	2	5%
- Powered two-wheelers	2	4%	2	4%
- Pedal cycles	2	5%	2	5%

Indicated flows for 2006 at this screenline are slightly higher than for 2005. There are no counts prior to 2005 at this screenline.

9.10 Traffic on the boundary route

The boundary route arrangements for the western extension zone are more complex than for the original central zone. From a monitoring perspective the following are the key points of interest:

- Traffic moving on the portion of the boundary route running between the original central London zone and the western extension zone (the 'free passage route').
- Traffic circulating on the remainder of the boundary route for the extension zone, excluding the free passage route portion (the 'western boundary').
- Traffic on the elevated section of the A40 Westway, partly running through the area of the western extension zone but uncharged under the arrangements for the extension scheme.

For these indicators two measures are possible. The first is a simple 'vehicle population' based indicator, based on the aggregate number of vehicles observed across all counting points, which may include multiple observations of the same unique vehicle. The limited extent of the boundary route makes it feasible to count each of the main 'key links' which make up the route. As well as making for a relatively robust indicator, this also means that traffic conditions at specific locations along the boundary route can be scrutinised in detail.

A more sophisticated measure of change is to estimate vehicle kilometres driven, by multiplying the observed flows at each site by the length of the road link to which

each individual count relates. This takes account of the differing characteristics of the links that make up the route of interest, and more accurately reflects the balance between available network capacity and changed traffic patterns.

As with traffic entering and leaving the extension zone, the following sections are based on periodic manual classified counts. Automatic counters have also been located on a selection of boundary route links, including all key links on the free passage route between the two zones. Owing to the limited period that these have been available, they do not provide a lengthy time series representing pre-extension conditions. However, they do provide a good indicator of changed conditions across the period of the implementation of the extension scheme and are described in this context in Section 14.

Traffic on the free passage route

This indicator comprises 14 manual count sites covering all major links on the free passage route between the two charging zones. All sites are counted four times per year, with the key annual change indicator based on the average of the Spring and Autumn 'neutral period' counts. Table 9.9 summarises results for 2005 and 2006, in terms of both the absolute number of vehicles observed (ie population) and calculated vehicle kilometres.

Table 9.9 Vehicle population and estimated vehicle kilometres (vkm) driven on the boundary route (free passage route only), including percentage change. 07.00-18.00, 2005 and 2006.

Vehicle type	2005 vehicle population (000s)	2005 estimated vkm (000s)	2006 vehicle population (000s)	2006 estimated vkm (000s)	2006 vs. 2005 population	2006 vs. 2005 vkm
All vehicles	260	151	253	140	-2%	-8%
Four or more wheels	243	142	236	130	-3%	-8%
Potentially chargeable	181	108	176	99	-2%	-8%
- Cars and minicabs	125	77	120	68	-4%	-12%
- Vans	43	24	44	25	+3%	+3%
- Lorries and other	13	7	13	7	-2%	-9%
Non chargeable	79	44	77	41	-3%	-7%
- Licensed taxis	44	25	42	22	-4%	-11%
- Buses and coaches	19	10	18	10	-5%	-6%
- Powered two-wheelers	11	6	11	6	+1%	-3%
- Pedal cycles	5	2	6	3	+7%	+23%

Flows on this key route in 2006 were somewhat lower than those recorded in 2005. The total number of vehicles counted was 3 percent lower in 2006, but this leads to a vehicle kilometre estimate that is some 8 percent lower (vehicles with four or more wheels). Whilst this difference is actually within the applicable statistical error ranges, it does illustrate the potential effect of different counting methods on the resulting estimates of change, and the need to look across more than one indicator in any assessment of western extension traffic impacts. Taking an average of 2005 and 2006 as representative of pre-extension conditions, a population of 240,000 vehicles with four or more wheels were observed during future charging hours on a typical day, corresponding to an estimated vehicle distance driven on the free passage route of 136,000 vehicle kilometres.

Traffic circulating on the remainder of the boundary route excluding the free passage route (the 'western boundary')

This indicator comprises 24 count sites covering all major links on the remainder of the boundary route excluding the free passage route. All sites are counted four times per year, with the key annual change indicator based on the average of the Spring and Autumn 'neutral period' counts. Table 9.10 summarises results for 2005 and 2006, in terms of both the absolute number of vehicles observed (population) and calculated vehicle kilometres. The vehicle-kilometre based indicator has an indicative statistical precision of plus/minus 5 percent at the 95 percent confidence level for year-on-year change (all vehicles).

Table 9.10 Vehicle population and estimated vehicle kilometres (vkm) driven on the boundary route (western boundary only), including percentage change. 07.00-18.00, 2005 and 2006.

Vehicle type	2005 vehicle population (000s	2005 estimated vkm (000s)	2006 vehicle population (000s	2006 estimated vkm (000s)	2006 vs. 2005 population	2006 vs. 2005 vkm
All vehicles	412	363	416	361	+1%	-1%
Four or more wheels	380	335	384	333	+1%	-1%
Potentially chargeable	357	316	357	311	0%	-1%
- Cars and minicabs	255	225	255	222	0%	-1%
- Vans	76	68	78	68	2%	0%
- Lorries and other	27	23	25	21	-8%	-7%
Non chargeable	55	48	59	50	+6%	+6%
- Licensed taxis	15	13	19	15	+23%	+18%
- Buses and coaches	8	7	8	7	0%	+1%
- Powered two-wheelers	23	21	23	20	-2%	-1%
- Pedal cycles	9	8	9	9	+5%	+7%

Here, observed flows in 2005 and 2006 were more closely comparable, and the conversion between population and vehicle kilometre indicators produces estimates of change that are very similar. Taking an average of 2005 and 2006 as representative of pre-extension conditions, a population of 382,000 vehicles with four or more wheels were observed during future charging hours on a typical day, corresponding to an estimated vehicle distance driven on the western boundary route of 333,000 vehicle kilometres.

Traffic on the elevated section of the A40 Westway

The elevated section of the A40 Westway runs geographically through the northern part of the western extension zone, but it is not possible to either join or leave this road between Wood Lane and Paddington. It is also not possible to conduct conventional traffic counts on the elevated section itself. The route is not charged and therefore has the status of a free passage route through the extension zone.

To monitor any possible changes, TfL has undertaken manual count and video surveys of joining/leaving traffic at both Wood Lane and Paddington junctions. These should give a robust indicator of any traffic changes on this key route in due course.

9.11 Wider indicators of the traffic impacts of a western extension

The above indicators, describing traffic entering, leaving and circulating within the western extension zone, together with traffic circulating on the boundary route, will provide the most immediate indicators of the traffic impacts of the western extension scheme. However, the extension will also affect traffic more widely in inner London, as trips formerly made to and from the extension either divert around the zone (using the network of routes beyond the immediate boundary route) or cease to be made by road (eg in the case of car occupants switching to public transport). Whilst the latter would tend to lead to lower general traffic volumes in an 'annulus' around the extension zone, particularly on the major radial routes approaching the zone, the former could lead to locally-increased traffic, particularly on orbital routes.

A series of indicators have been established to monitor these effects, as summarised in Table 9.11. Brief descriptions of each indicator, alongside representative values for pre-extension conditions in 2005 and 2006, are given. Note that in some cases secondary indicators are also available from permanent automatic counters located at selected counting points. These are considered in Section 14.

Table 9.11 Key indicators of traffic activity outside the western extension zone.

Indicator	Quantity of interest	Number of sites and count frequency (manual counts only)
Boundary route approach cordon	Radial traffic crossing on to the western extension boundary route from inner London outside the western extension zone	95 sites, counted 2 times per year
West London railway screenline	Radial traffic approaching extension zone from the west	8 sites, counted 4 times per year
Western extension annulus cordon	Radial traffic approaching the zone from south, north and west in inner London	37 sites, counted 2 times per year
Western extension external Thames bridges	Traffic crossing the river Thames to the south and west of the extension zone	9 sites, counted 4 times per year
Western extension external east-west screenline	Traffic making orbital movements around the western extension zone in inner west London	16 sites counted 2 times per year
South west screenline	Traffic making orbital movements in inner London to the south-west of the western extension zone	5 sites counted 2 times per year
External northern screenline	Traffic making orbital movements in inner London to the north of the western extension zone	19 sites counted once per year

Boundary route approach cordon

This cordon measures radial traffic crossing on to the western extension boundary route from inner London outside the western extension zone. It consists of 95 counting sites forming a 'watertight' cordon, including the slip roads on to and off of the A40 Westway, immediately adjacent to the outer edge of the boundary route. Counting at this cordon started in 2006, with counts in both Spring and Autumn 'neutral' counting periods. Table 9.12 summarises measured volumes at this cordon for an average of the 2006 counts by direction.

Table 9.12 Radial traffic flows across the western extension boundary route approach cordon. 07.00-18.00, 2006.

Vehicle type	2006 average inbound flow (000s)	2006 percentage of inbound flow	2006 average outbound flow (000s)	2006 percentage of outbound flow
All vehicles	363	100%	345	100%
Four or more wheels	331	91%	313	91%
Potentially chargeable	278	77%	262	76%
- Cars and minicabs	205	56%	193	56%
- Vans	59	16%	55	16%
- Lorries	15	4%	15	4%
Non chargeable	85	23%	82	24%
- Licensed taxis	42	11%	39	11%
- Buses and coaches	12	3%	11	3%
- Powered two-wheelers	19	5%	19	5%
- Pedal cycles	13	4%	13	4%

West London railway cordon

The limited number of crossing points of the West London railway line provide a 'watertight' screenline for measuring radial traffic approaching the western extension zone from the west. Eight sites are counted four times per year.

Table 9.13 shows annualised volumes for both directions combined, based on a combination of the Spring and Autumn 'neutral period' counts in both 2005 and 2006.

Table 9.13 Combined direction radial traffic flows across the West London railway screenline. 07.00-18.00, 2005 and 2006.

Vehicle type	2005 average two-way flow (000s)	2005 percentage	2006 average two-way flow (000s)	2006 percentage
All vehicles	156	100%	166	100%
Four or more wheels	141	90%	151	91%
Potentially chargeable	125	80%	135	81%
- Cars and minicabs	96	61%	107	64%
- Vans	23	15%	22	13%
- Lorries and other	6	4%	6	4%
Non chargeable	31	20%	31	19%
- Licensed taxis	11	7%	11	7%
- Buses and coaches	5	3%	5	3%
- Powered two-wheelers	9	6%	8	5%
- Pedal cycles	6	4%	6	4%

Indicated flows in 2006 were some 7 percent higher than in 2005, mirroring similar apparent increases across internal screenlines within the extension zone. Therefore, a representative pre-extension value for two-way traffic across this screenline during future charging hours is 146,000 vehicles with four or more wheels.

Western extension annulus cordon

This cordon measures radial traffic approaching the western extension zone in inner London. In contrast to the boundary approach cordon described above, which is located immediately adjacent to the boundary route, this cordon is located in inner London at a typical distance of 1-3 km from the western extension zone. All 37 sites are counted twice per year, during the Spring and Autumn 'neutral' counting periods. Table 9.14 shows annualised bi-directional flows 2005 and 2006.

Table 9.14 Combined direction traffic flows across the western extension annulus cordon. 07.00-18.00, 2005 and 2006.

Vehicle type	2005 average two-way flow (1000s)	2005 percentage	2006 average two-way flow (1000s)	2006 percentage
All vehicles	523	100%	560	100%
Four or more wheels	481	92%	518	92%
Potentially chargeable	439	84%	474	85%
- Cars and minicabs	333	64%	358	64%
- Vans	83	16%	93	17%
- Lorries and other	23	4%	24	4%
Non chargeable	84	15%	86	15%
- Licensed taxis	26	5%	28	5%
- Buses and coaches	15	3%	16	3%
- Powered two-wheelers	25	5%	25	4%
- Pedal cycles	17	3%	18	3%

As with several other indicators described in this Section, indicated flows in 2006 were some 8 percent higher than in 2005. The representative pre-extension bi-directional flow across this cordon would therefore be 500,000 vehicles (future charging hours, vehicles with four or more wheels).

Western extension 'external' Thames bridges screenline

In a similar manner to the West London railway screenline, the limited number of bridges crossing the River Thames between Vauxhall Bridge in the east and Kew Bridge in the west provide an effective 'watertight' screenline to the south and west of the extension zone. Nine bridges are counted four times per year. Table 9.15 shows annualised volumes in both directions for 2005 and 2006, based on counts taken in the Spring and Autumn 'neutral' counting periods in each year.

Table 9.15 Combined direction traffic flows across the western extension 'external' Thames bridges screenline. 07.00-18.00, 2005 and 2006.

Vehicle type	2005 average flow (000s)	2005 percentage of total flow	2006 average flow (000s)	2006 percentage of total flow
All vehicles	190	100%	204	100%
Four or more wheels	174	91%	186	91%
Potentially chargeable	162	85%	174	85%
- Cars and minicabs	124	65%	132	65%
- Vans	31	16%	33	16%
- Lorries and other	8	4%	9	4%
Non chargeable	28	15%	30	15%
- Licensed taxis	6	3%	5	3%
- Buses and coaches	6	3%	7	3%
- Powered two-wheelers	10	5%	11	5%
- Pedal cycles	7	3%	8	4%

This indicator was affected by the temporary closure of Battersea Bridge in Autumn 2005, although it would be expected that the majority of traffic affected would have diverted to nearby alternative bridges on this screenline and been counted there instead. As with other indicators in this section, flows in 2006 were generally higher than in 2005, by 7 percent for vehicles with four or more wheels.

External western screenline

This cordon measures traffic making orbital movements around the western extension zone in inner London. 16 sites are counted twice a year, during the Spring and Autumn 'neutral' counting periods. Note that data are available for this screenline for 2004, 2005 and 2006.

Table 9.16 shows that flows for 2005 and 2006 were effectively identical, with a bi-directional total during future charging hours of 131,000 vehicles. Of particular note at this and other 'external' indicators is the relatively low proportion of total flow represented by taxis, buses and two-wheeled vehicles.

Table 9.16 Orbital traffic flows across the western extension external screenline. Combined directions, 07.00-18.00, 2005 and 2006.

Vehicle type	2005 average flow (000s)	2005 percentage of total flow	2006 average flow (000s)	2006 percentage of total flow
All vehicles	140	100%	140	100%
Four or more wheels	131	94%	131	94%
Potentially chargeable	125	90%	126	90%
- Cars and minicabs	97	69%	99	71%
- Vans	22	16%	21	15%
- Lorries and other	7	5%	7	5%
Non chargeable	15	10%	13	10%
- Licensed taxis	3	2%	3	2%
- Buses and coaches	2	2%	2	2%
- Powered two-wheelers	5	4%	5	4%
- Pedal cycles	4	3%	4	3%

External south-west screenline

This cordon measures traffic making orbital movements around the western extension zone in the area of north Wandsworth. Five sites, forming a short watertight screenline, are counted twice a year, during the Spring and Autumn 'neutral' counting periods. Note that counting on this screenline did not commence until Autumn 2005. Table 9.17 shows the available time series. Flows for 2006 were slightly lower than 2005, with typically 65,000 vehicles with four or more wheels crossing the screenline during future charging hours.

Table 9.17 Orbital traffic flows across the external south-west screenline. Combined directions, 07.00-18.00, 2005 and 2006.

Vehicle type	Autumn 2005 flow (000s)	Autumn 2005 percentage of total flow	Average 2006 flow (000s)	2006 percentage of total flow
All vehicles	74	100%	70	100%
Four or more wheels	67	90%	63	90%
Potentially chargeable	63	84%	59	84%
- Cars and minicabs	46	62%	43	61%
- Vans	13	17%	13	18%
- Lorries and other	4	6%	4	6%
Non chargeable	12	16%	11	16%
- Licensed taxis	2	2%	2	3%
- Buses and coaches	3	4%	2	3%
- Powered two-wheelers	5	7%	5	6%
- Pedal cycles	3	4%	3	4%

External northern screenline

This cordon measures traffic making orbital movements around the combined original and western extension zones in inner north-west London. It extends from Marylebone Road to the North Circular Road. All 19 sites are counted in the Autumn 'neutral' counting period each year. Table 9.18 shows combined direction volumes for 2005 and 2006.

Table 9.18 Orbital traffic flows across the external northern screenline. Combined directions, 07.00-18.00, 2005 and 2006.

Vehicle type	Autumn 2005 flow (000s)	Autumn 2005 percentage of total flow	Autumn 2006 flow (000s)	2006 percentage of total flow
All vehicles	174	100%	174	100%
Four or more wheels	164	94%	165	94%
Potentially chargeable	152	87%	154	88%
- Cars and minicabs	111	64%	115	66%
- Vans	30	17%	29	17%
- Lorries	10	6%	9	5%
Non chargeable	23	13%	21	12%
- Licensed taxis	8	5%	7	4%
- Buses and coaches	4	2%	4	2%
- Powered two-wheelers	7	4%	6	3%
- Pedal cycles	4	2%	4	2%

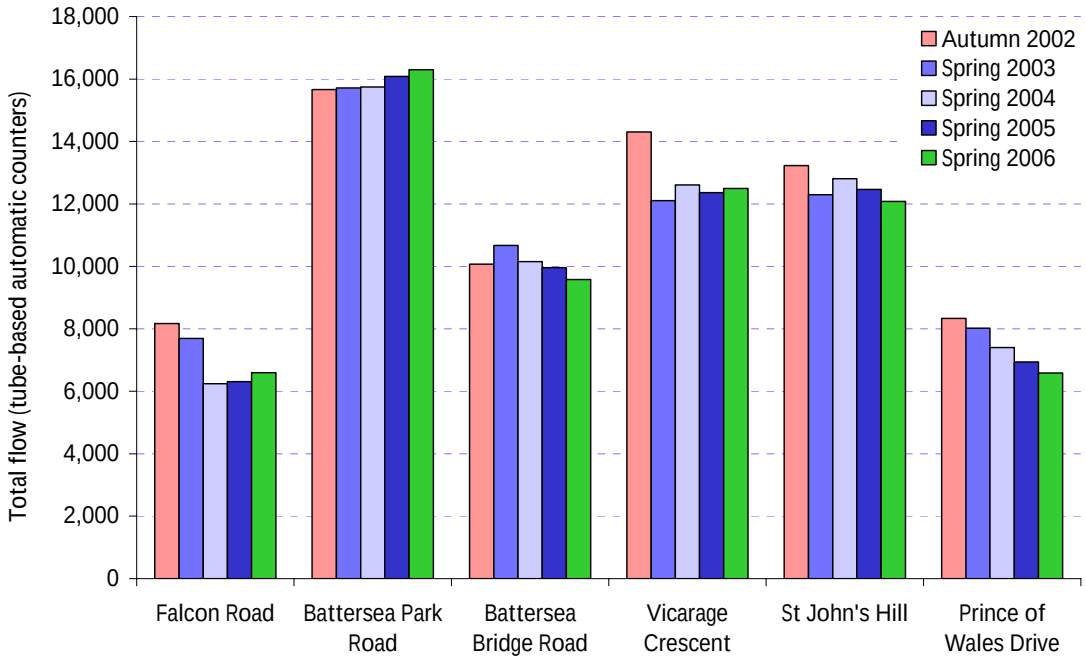
Indicated flows are very similar for both 2005 and 2006, with typically 164,000

vehicles with four or more wheels crossing this screenline in both directions during future charging hours.

Traffic on selected roads in the London Borough of Wandsworth

Traffic on selected roads in the London Borough of Wandsworth has been monitored since 2002 as part of the monitoring arrangements for the original central London scheme. As these sites are particularly relevant to the western extension, they are considered in this section (see also Section 2.10). Figure 9.9 shows the available time series for these counts extending back to 2002.

Figure 9.9 Traffic changes on local roads in Wandsworth. All vehicles (tube ATCs). 07.00-18.30, weekdays.



The overall picture has been one of slowly declining traffic levels year-on-year, in common with other indicators previously reported in connection with the central London scheme. Aggregate flows across monitored sites during 2006 were marginally lower than 2005. As with the other indicators of the wider traffic impacts of the western extension, continued measurements at these sites following the introduction of the extension should build over time into a comprehensive appreciation of the impacts of the extension scheme outside the zone.

9.12 Summary of key points

TfL has put in place a comprehensive set of traffic volume indicators to help monitor and understand the traffic impacts of the western extension. There are 22 key indicators, together with a number of supporting indicators covering about 460 individual counting sites.

These have been intensively monitored during 2005 and 2006 to provide a comprehensive baseline of data describing pre-extension conditions. Counts to be

undertaken during 2007 following introduction of the western extension can be compared against these earlier counts and will over time build into a key source of data describing the impacts of the extension scheme.

The monitoring arrangements for the extension scheme operate alongside existing arrangements for the central London zone. These will continue largely unchanged during 2007, and will have a particular role to play in measuring any 'consequential' impacts of the extension scheme on traffic conditions in the original central London zone.

10. Western extension zone: congestion

10.1 Introduction

This section describes the methods being used to monitor trends in traffic congestion in relation to the western extension, and sets out available data describing conditions before the implementation of the extended scheme. It opens with a restatement of the definition of 'congestion', as given in TfL's *First Annual Impacts Monitoring Report.*

10.2 A definition of congestion

The principal objective of the western extension is to reduce congestion in and around the extension zone. It is expected to do this by reducing the amount of traffic moving to, from and within the extension zone during charging hours, thus allowing the remaining vehicles to move more easily.

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 travelling speeds. On an urban road network with many junctions the delay as a result of increased traffic is experienced primarily as increased time in queues at junctions. The net effect in both cases is to increase the amount of vehicle minutes spent to travel a given distance.

It is this extra or 'excess' delay that is defined as 'congestion'. Congestion can therefore be thought of as the delay that vehicles impose upon each other. However, this takes place in the context of the available capacity of the network, which in an urban road network will affect the level of congestion at any given level of traffic throughput.

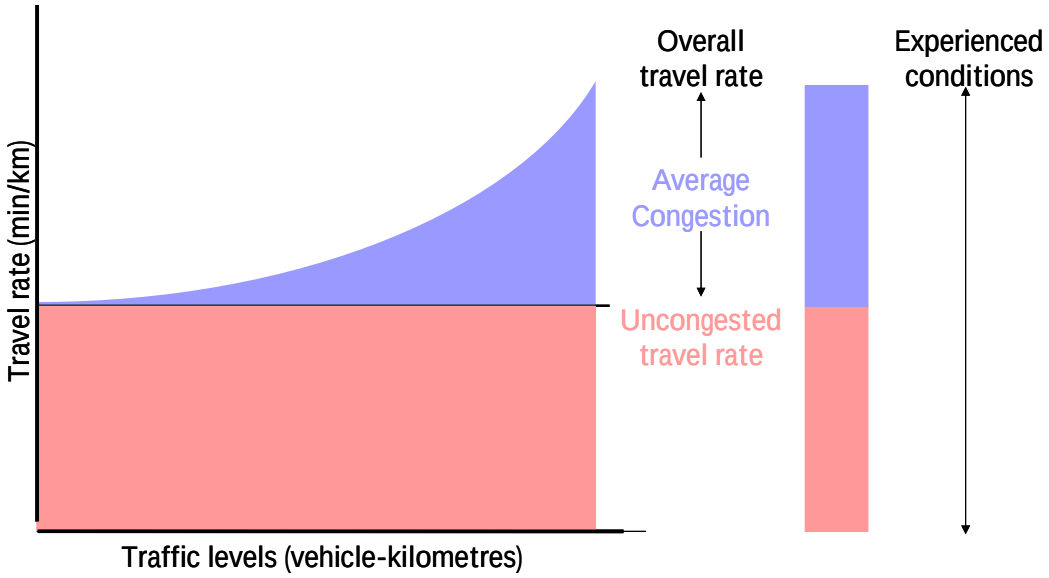
Capacity is influenced by a combination of the basic physical characteristics of the network (topology, carriageway size), the disposition of kerbside parking and loading, various traffic control measures (speed limits, traffic signal settings, bus priority measures etc.) and a range of more transient events such as road and street works, accidents, incidents and the weather. In urban areas, the frequent incidence of junctions will typically act as the most powerful limitation on traffic throughput. Put another way: on urban road networks most congestion occurs at junctions where the imposition of delays by vehicles on other vehicles is most prevalent. For any given level of traffic (vehicle kilometres), different network configurations and management regimes will produce different patterns of travel times, and hence different average levels of congestion.

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 the road network were optimal and its traffic was also 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.

Figure 10.1 illustrates these ideas. The intensity of congestion, in terms of the delay experienced by the average road user, is seen to rise in a non-linear way as the amount of traffic increases. The total amount of congestion on the whole network will, however, vary according to the absolute level of vehicle kilometres driven.

Figure 10.1 Congestion increases with traffic levels.



10.3 Approach

TfL's monitoring of the original central London congestion charging zone established a methodology for measuring congestion that has proven satisfactory in detecting changes associated with that scheme, and also for tracking trends and developments over the years since 2003 when the original scheme was introduced (see Section 3). The monitoring for the western extension adopts and extends this approach to comprehensively cover the extension zone and surrounding area, whilst maintaining established programmes in relation to the central London zone.

TfL's approach defines congestion in terms of the average 'excess' or 'lost' travel time experienced by users of a road network. Excess travel time is the time spent over and above that which would apply under notionally 'uncongested' or 'free-flow' conditions. These concepts are more fully defined in TfL's *First Annual Impacts Monitoring Report*. At this point it is important to note that:

- Congestion is essentially a relative quantity, expressed in terms of additional travel time over and above a selected 'baseline' for the particular network of interest. Both the baseline and the relativities will differ between networks.
- It is also characteristically non-linear, in that the rate of increase or decrease in the intensity of congestion differs at different traffic flows. For example, at high-flow conditions, a small additional increment of traffic can lead to a disproportionate increase in congestion. The reverse also applies.

- Travel time is more usefully expressed in terms of a travel rate. This is simply the inverse of the average speed, expressed as the average time (in minutes) required to travel one kilometre.

Therefore, it is possible to define and measure both an 'uncongested travel rate' when the network is free-flowing, and a 'congested travel rate', when the traffic on the network is greater than that giving rise to free-flow conditions. The intensity of congestion is the difference (in minutes per kilometre) between the two (ie an 'excess travel rate').

In practical terms in and around central London, the uncongested travel rate is taken to be that applying when traffic is at its lightest, during the early hours of the morning (typically 03.00-05.00). Similar measurements are then taken during other periods of the day (eg AM peak), these typically reflecting conditions when traffic is heavier and average network speeds slower, or travel rates are higher. This leads to two quantities for any given network and time period:

- the amount of vehicle kilometres driven on the network;
- the amount of time (vehicle hours or vehicle minutes) taken to travel this distance.

The average travel rate is simply the total time divided by the total distance.

In measuring these quantities, it is important to account for the fact that different road links in the network have different lengths and different levels of traffic. A simple 'average' of speed measurements taken on a basket of links, or the average speed of a survey vehicle travelling around the network, would therefore be misleading, as each link would contribute differently to the total vehicle kilometres and vehicle hours on the network. Therefore, it is necessary to adjust (weight) survey data to ensure that the resulting statistics are representative of what would be experienced by an 'average' driver travelling around the network at the time to which the survey applies.

It is also important to note that measured travel rates for the same network will differ depending on the survey method used. Provided that these differences are relatively small, and that any apparent trends are broadly replicated between the different data sources, this is not a significant problem. It does however mean that the adopted baseline (uncongested) travel rate is more meaningful as a relative – as opposed to absolute – measure of network performance.

10.4 Moving car observer surveys

The basis of congestion monitoring is therefore the measurement of travel rates across representative road networks in and around the extended charging zone. For practical purposes this is defined to be a coherent sub-set of the more traffic-significant roads in the network, reflecting the fact that these account for the large majority of key junctions and vehicle kilometres driven.

The primary method that has been used for the central zone is the 'moving car observer' survey, sometimes also referred to as the 'floating car' technique. For this

method, an instrumented car (driver plus on-board observer) is driven around the network of interest on a set of pre-defined routes, according to a set of rules designed to ensure that the vehicle emulates as closely as possible the behaviour of surrounding traffic. So, for example, survey drivers attempt to equalise the vehicles that overtake the survey vehicle and those which it itself overtakes.

Instruments on board the survey car record the time and distance covered, and over the course of any one survey will return a time for the vehicles' transit over elements of the network for the time period of interest. Because the vehicle records both distance and time, the impact of different link lengths is already taken into account in the returned data.

To reflect the fact that different links also carry different volumes of traffic, link-by-link data are subsequently weighted by data from separate surveys of traffic flows on each of the survey links ('flow weighted'). In this way, observed travel rates on links carrying high volumes of traffic contribute proportionately more to the out-turn statistic than smaller roads carrying relatively light traffic.

10.5 Moving car observer surveys for the original central London zone

The moving car technique was first used to measure traffic speeds in London in the late 1940s, although only data from the mid-1970s survive. During the 1980s and 1990s, three surveys were consistently carried out, typically at 2 to 3 year intervals, and using broadly consistent networks. These were:

- A survey of central London, then defined as the 'central London statistical area'. This area is somewhat larger than the original central London congestion charging zone, covering the Inner Ring Road and an annulus typically extending 1-2 kilometres outside of the charging zone, including the eastern part of the western extension zone.
- A survey of inner London, this being the network of major roads between the edge of the central area survey and the North and South Circular Roads. Note that this survey covered the remainder of the western extension area, allowing early comparisons between conditions here and the rest of inner London.
- A survey of outer London, typically being the network of major roads beyond the North and South Circular Roads out to the Greater London boundary.

For TfL's monitoring of the central London congestion charging zone, the long-standing central area survey was adopted without change, except that the frequency with which the survey was carried out was increased from once every three years to once every two months; and additional survey periods were added to cover the periods immediately before and immediately after charging hours.

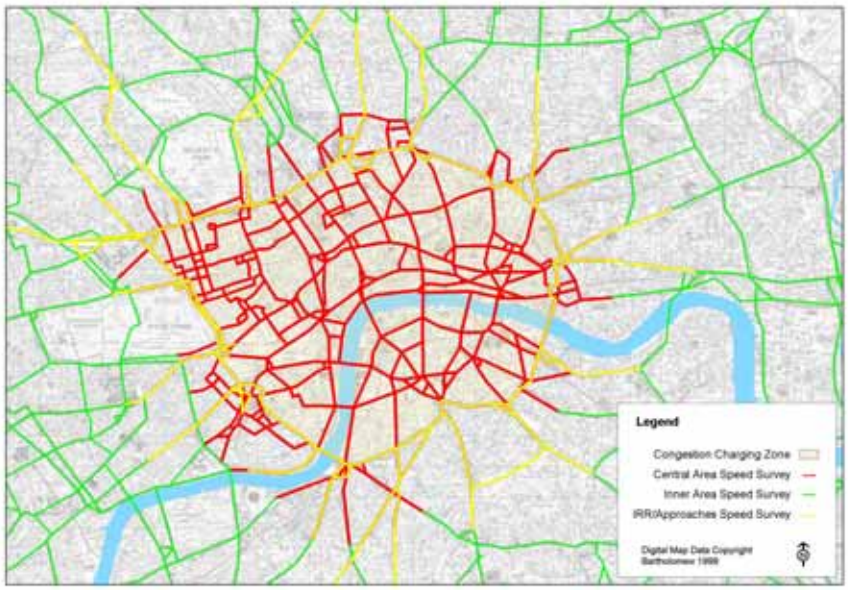
An important aspect of the methodology for these surveys is that they are optimised to give a medium-run view of average congestion which is not unduly distorted by transient events, such as accidents, temporary closures or weather conditions. Since a two-month period during which to complete the central London survey is (and always has been) specified to meet this requirement, the survey effort in central

London has been effectively continuous from the start of 2002. Furthermore, recent measurements are entirely compatible with available historic measurements. Data from these surveys are fully described in Section 3.

An additional survey was implemented from 2002 measuring congestion on the Inner Ring Road, the most obvious diversionary route for drivers wishing to avoid entering the central London zone, and the approaching radial routes. This reflected the fact that the coverage of these key routes by the established central London survey was not optimal for congestion charging purposes. This survey has been typically undertaken 2-4 times per year, each survey relating to a two-month survey period.

To measure any wider effects in inner London, TfL increased the frequency of the established inner London survey to yearly, this survey taking place over a four-month window. The established outer London survey remained unchanged and operated to the historic three-yearly frequency. Figure 10.2 illustrates the scope of these surveys in central and inner London.

Figure 10.2 Moving car observer survey networks in and around the original central London congestion charging zone.



10.6 Moving car observer surveys for the western extension

The aforementioned existing moving car observer surveys were not ideal for monitoring the impacts of the western extension. From the start of 2005 therefore, TfL introduced two new dedicated surveys, although both had been undertaken on occasions prior to this date.

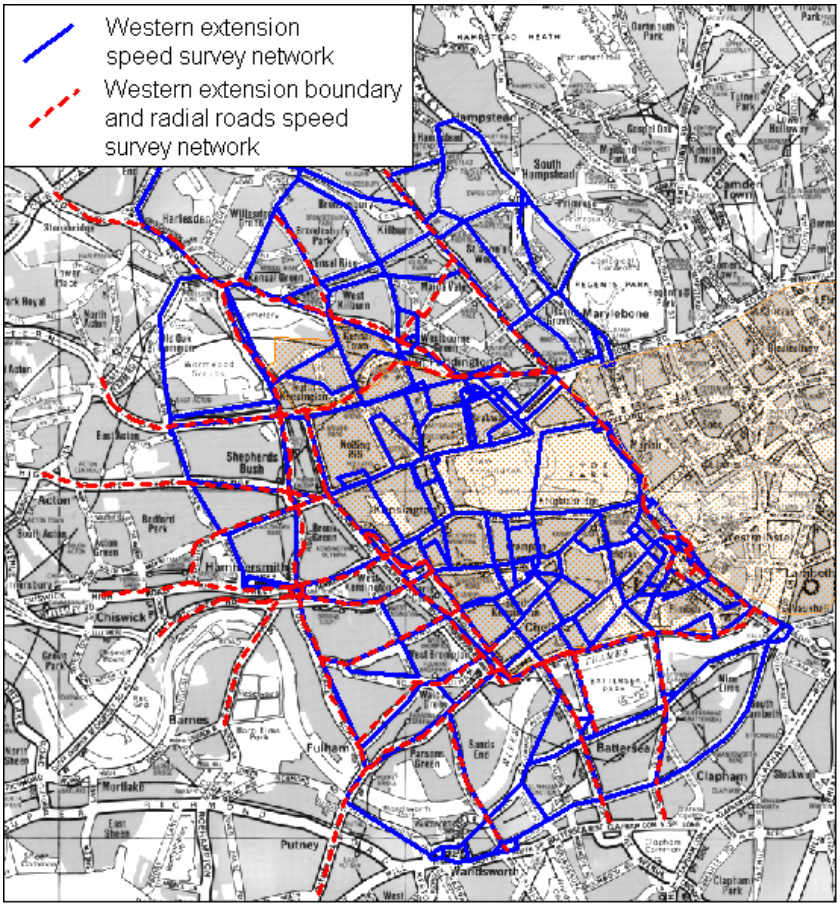
One survey covers the network within and immediately outside the extension zone – the 'Western Extension Survey'. This is equivalent to the established central London survey, and is the primary indicator for congestion inside the extension zone. It also gives supporting information on congestion trends on the boundary routes and the wider network of radial and orbital roads immediately around the extension zone.

A feature of note is that this survey covers a greater proportion of the roads in the extension zone than either of the earlier surveys for central and inner London. This means, all other things being equal, that baseline 'uncongested' travel rates would be expected to be somewhat higher than those previously derived for the extension zone from a sparser network of roads (ie slower average night-time speeds).

A second new survey covers the boundary routes around the western extension zone in greater detail, including fuller coverage of turning movements on to and off of these routes, as well as giving a greater coverage of the network of roads beyond the extension zone. This survey – the 'Western Extension Boundary Routes Survey', is therefore the primary indicator for conditions on the boundary and immediately outside the western extension zone.

Figure 10.3 shows the overlapping networks covered by these two surveys.

Figure 10.3 Dedicated moving car observer survey networks for the western extension.



Both new surveys are specified to be spread over a two-month period, as in the central zone. The western extension survey runs continuously, with six surveys per year. The western extension boundary routes survey runs less frequently, typically between two and four times per year. Both new surveys provide estimates of congestion for six time periods across the charging day, which can be considered separately or in combination, to be set against a baseline estimate of 'uncongested' conditions, taken periodically between 03.00 and 05.00. The survey time periods are as follows:

- morning shoulder period – the period immediately before the start of charging hours (06.00-07.00);
- morning (AM) peak period (07.00-10.00);
- morning inter-peak period (10.00-13.00);
- afternoon inter-peak period (13.00-16.00);
- afternoon (PM) peak period (16.00-18.00) – note revised charging hours;
- evening shoulder period – the period immediately after the end of charging hours (18.00-20.00).

No changes have been made to the existing survey arrangements for the central London congestion charging zone, other than a minor adjustment to the survey period (fieldwork schedules) for the afternoon peak period and to fall within the revised charging hours, and these have a role in measuring any consequential impacts of the western extension on traffic conditions in the central zone.

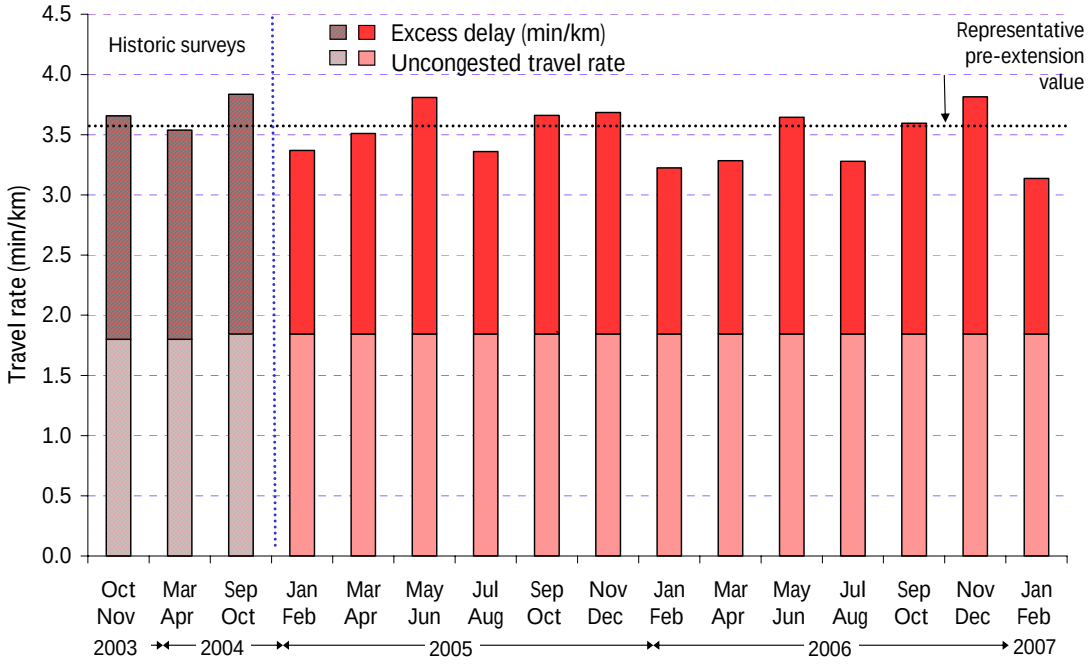
10.7 Congestion in the western extension

Figure 10.4 shows the available time-series of congestion measurements for the major road network inside the western extension. As the definition of the proposed extension zone changed whilst the scheme proposals were being developed, these observations have been harmonised so that all surveys relate to the extension zone and charging hours as they were implemented in February 2007.

Surveys of travel rates under uncongested conditions in the early hours of the morning returned a value of 1.8 minutes per kilometre. This means that traffic inside the extension zone at this time travels at an average network speed of around 33 kilometres per hour. This is comparable to the equivalent value for the central London congestion charging zone, which is 1.9 minutes per kilometre or 31 kilometres per hour. It is however, slightly slower than values obtained from early estimates based on a combination of existing surveys for the central and inner areas, reflecting the different networks involved. This value is represented by the lighter-shaded portion of the bars in Figure 10.4.

Note that for Figure 10.4, and also Figures 10.6, 10.7 and 10.8, the travel rate values up to and including those for January/February 2007 reflect the prevailing central zone charging hours (07.00-18.30). However, all of the individual survey fieldwork runs were timed to complete before 18.00, anticipating the revised charging hours from the implementation date of the western extension. From the March/April 2007 survey, charging hours travel rates will be quoted on a basis that accounts for the lower proportionate contribution of the PM peak survey period to average charging hours travel rates, although this is not expected to materially affect comparisons.

Figure 10.4 Congestion in the western extension, 07.00-18.30. Moving car observer surveys.



The picture for the surveys of daytime speeds has been relatively consistent across the available time series, albeit somewhat variable between individual surveys, with average travel rates typically varying between 3.2 and 3.8 minutes per kilometre, in part reflecting seasonal effects. Table 10.1 sets out the resulting key indicators of congestion inside the western extension before the start of the extension scheme, excluding those surveys conducted before the start of 2005, and averaging across all available surveys for each of 2005 and 2006.

Table 10.1 Representative average travel rates in the western extension for 2005 and 2006. Future charging hours (07.00-18.00). Moving car observer surveys.

Year	Charging hours travel rate	Night-time travel rate	Charging hours excess delay
2005 average	3.6 min/km	1.8 min/km	1.8 min/km
2006 average	3.5 min/km	1.8 min/km	1.7 min/km

This yields a representative pre-extension value for congestion inside the western extension zone of 1.75 minutes per kilometre; the average of the values for both years. With a night-time travel rate of 1.8 minutes per kilometre, this corresponds to an average network speed during charging hours of around 17 kilometres per hour.

TfL's projections are for congestion within the zone to reduce by between 17 and 24 percent following the introduction of the extension.

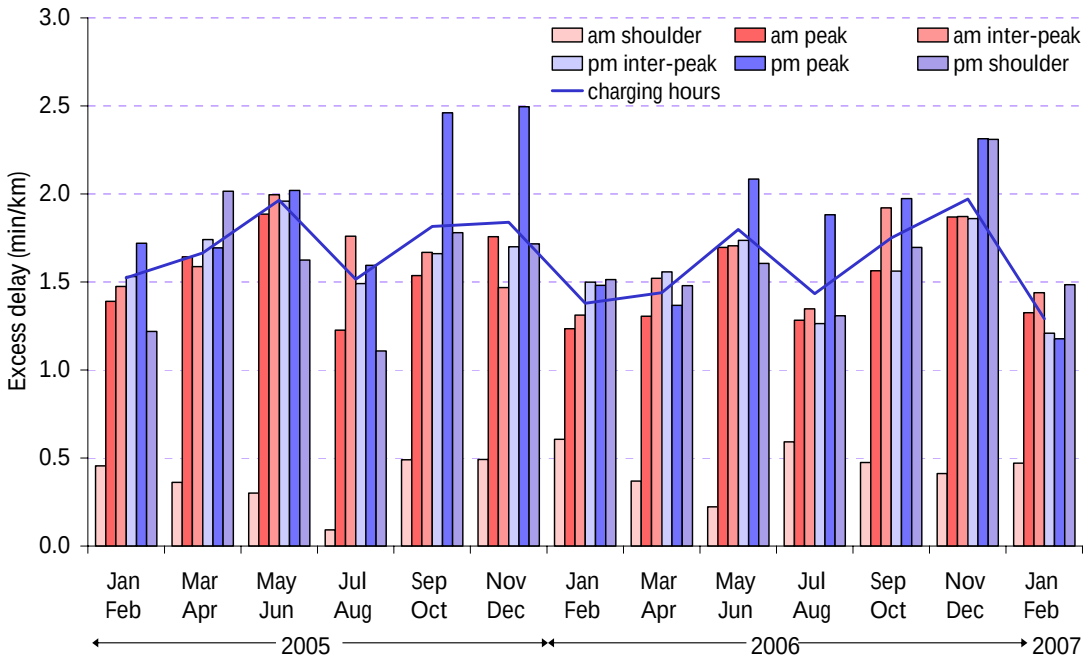
The available time series for this survey makes an interesting comparison with those for the original central zone and inner London, described in Section 3. The deterioration in conditions that characterised the central and inner London data during 2006 was not apparent and, taking statistical considerations into account,

indicated congestion levels inside the western extension were effectively identical for 2005 and 2006.

Possible reasons for this might include an unusually high incidence of road and streetworks in and around the extension zone during 2004/2005, these consequently being less of a factor during 2005/2006. The extension of urban traffic control, assisted by the advanced SCOOT system of computerised coordination of traffic signal settings in the run-up to the introduction of the western extension, may also have been a factor. The latter was intended to improve junction performance in advance of the introduction of the scheme, but was mainly focused on the boundary routes and surrounding area, rather than within the extension zone itself. It would seem nevertheless that the influences on network performance in the original central zone in 2006 did not apply to the extension zone.

Figure 10.5 shows how congestion varies across the day. The most obvious feature of this graph is the unusual variability in congestion in the PM peak period. Although this will reflect a variety of individual incidents and features, it is consistent with known medium-term capacity-limiting roadworks on major through routes, probably in the outbound (from central London) direction.

Figure 10.5 Excess delays by time period within the western extension.



10.8 Congestion on the western extension boundary route

The boundary route for the western extension includes (working clockwise) the free passage route, Chelsea Embankment, both arms of the Earls Court One Way System, Holland Road, the West Cross Route, Scrubs Lane and Harrow Road. The introduction of the western extension may result in small increases to traffic on the boundary route. In turn, these could lead to small increases in congestion on this route, although better management of the road network, including substantial upgrades to

the urban traffic control infrastructure introduced ahead of the scheme, would be expected to largely offset this. This was also observed with the Inner Ring Road around the original central London zone.

Two surveys provide estimates of congestion on the western extension boundary route. The western extension survey provides an estimate on a continuous two-monthly basis, but the coverage of this survey is not representative of all movements using this route, particularly the range of turning movements on to and off of this route. The dedicated western extension boundary routes survey provides an estimate that more comprehensively represents conditions experienced by typical users of this route, but is only undertaken periodically.

Figure 10.6 shows the available time-series of congestion measurements from the (main) western extension survey. Surveys of travel rates under uncongested conditions in the early hours of the morning returned a value of 1.7 minutes per kilometre for this route. This is represented by the lighter-shaded portion of the bars in Figure 10.6. The pattern of excess delays tends to mirror that for the area inside the extension zone, in this case typically falling between 0.9 and 1.4 minutes per kilometre. Average values for 2005 and 2006 are 1.2 and 1.1 minutes per kilometre respectively, leading to a representative pre-extension value for congestion on the boundary route of 1.15 minutes per kilometre.

Figure 10.6 Travel rates on the western extension boundary route, 07.00-18.30. Western extension moving car observer survey.

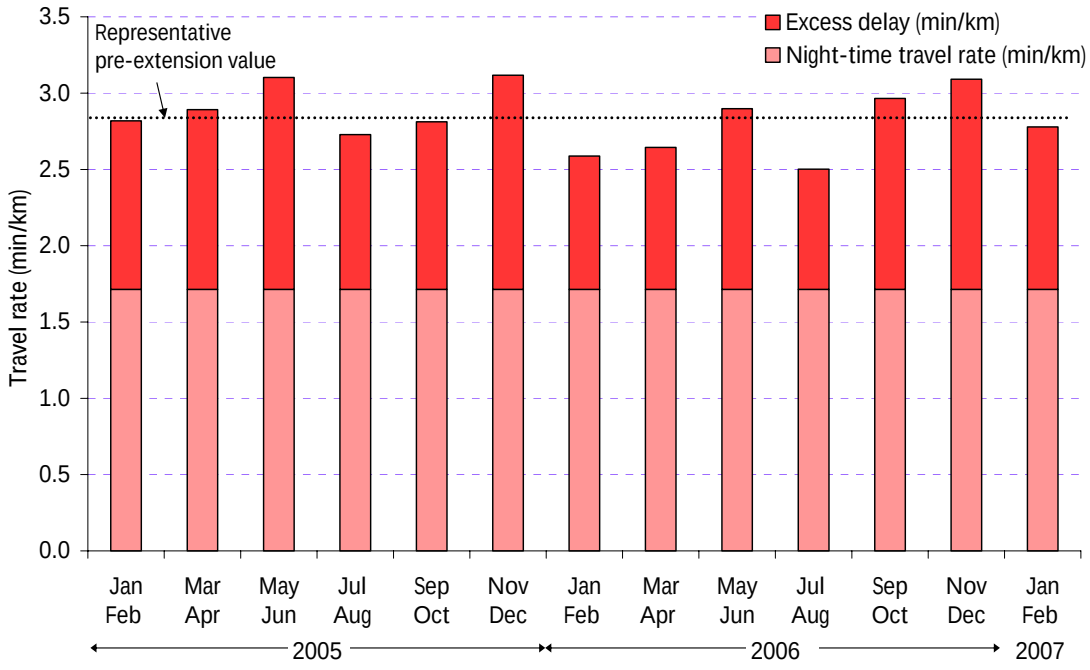
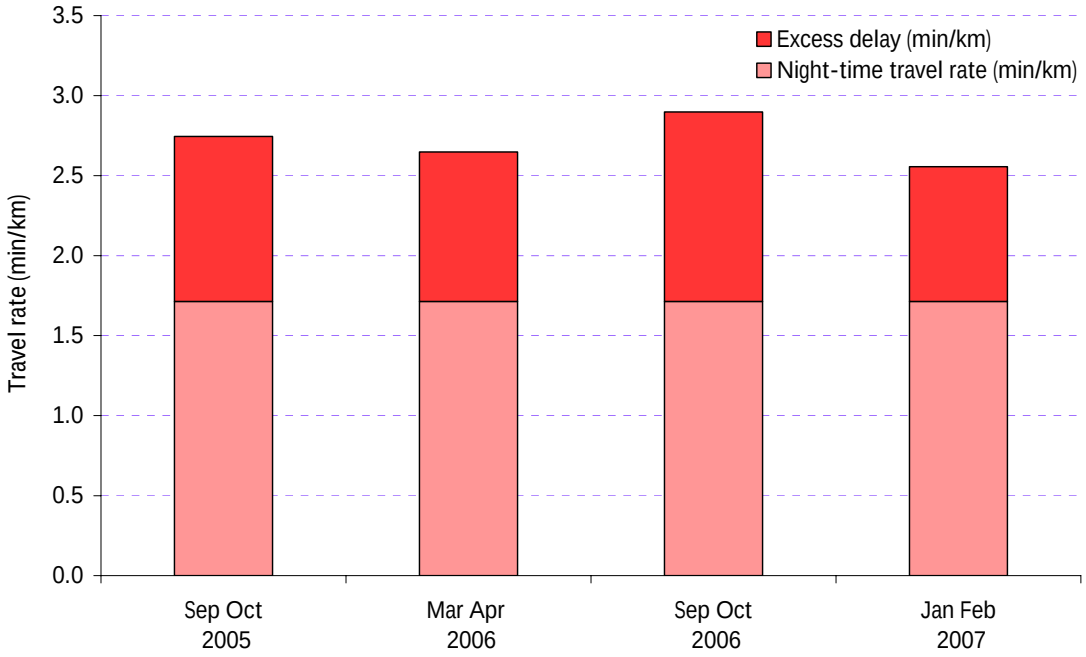


Figure 10.7 shows equivalent data from the western extension boundary route survey. In this case, only four surveys have been carried out prior to the introduction of the extension, three of which (the Spring and Autumn surveys) can be considered representative in seasonal terms. Taking again the observed value for delays under uncongested conditions of 1.7 minutes per kilometre and averaging across all three

representative surveys, this survey returns a representative value for pre-extension excess delays of 1.0 minutes per kilometre, which is slightly lower than the equivalent value obtained from the western extension speed survey (above).

Figure 10.7 Travel rates on the western extension boundary route, 07.00-18.30. Western extension boundary routes moving car observer survey.



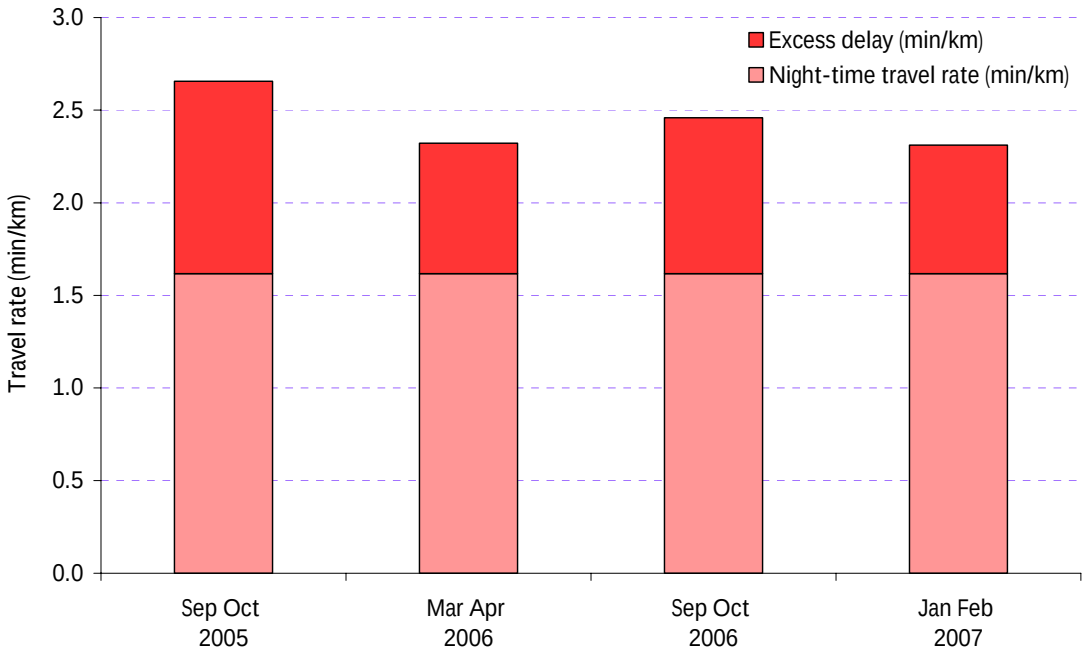
Typical excess delays on the western extension boundary route before the introduction of the extension are therefore 1.15 (western extension) or 1.00 (western extension boundary routes) minutes per kilometre, depending on the survey used.

10.9 Radial routes approaching the western extension zone

Figure 10.8 shows the available time-series of congestion measurements for main radial routes approaching the western extension, as measured by the western extension boundary route survey. This indicator is equivalent to that adopted for the central zone monitoring radial approaches, and is intended to quantify any effects on the performance of these roads arising from changes in traffic flow resulting from the western extension. TfL expects that there may be small reductions to congestion on these routes resulting from less traffic moving to and from the extension zone.

A representative observed value of 1.6 minutes per kilometre has been taken to represent the uncongested travel rate on these routes. Observed excess delays are typically below 1.0 minute per kilometre, the average of the three available representative surveys (Spring and Autumn only) being 0.9 minutes per kilometre. This value is therefore taken as representative of pre-extension conditions on these routes.

Figure 10.8 Travel rates on radial routes to and from the western extension, 07.00-18.30. Western extension boundary routes moving car observer survey.



10.10 Camera-based measurements of congestion in and around the western extension

Moving car observer surveys probably remain the most effective means of tracking long-run trends in congestion in relation to congestion charging, and have again been adopted as the primary method for this aspect of the monitoring. However, automatic number plate reading cameras again potentially provide a second 'independent' view of congestion trends. The principal limitation on the use of this technology, which involves on-street infrastructure, is the short time frame between the availability of consistent and complete data from this source, and the implementation of the extension. Whilst therefore of limited value in tracking the before versus after impacts of the extension scheme itself (see also Section 14), data from these cameras will be of longer-term value in measuring trends following the introduction of the extension.

10.11 Summary of key points

TfL has put in place comprehensive surveys of traffic speeds and congestion in and around the western extension, with full baseline data available from the start of 2005. These new surveys complement those associated with the original central London zone, which will continue unchanged.

Trends in congestion observed during 2005 and 2006 in the western extension zone differed from those seen elsewhere in London in that there was no apparent overall deterioration in congestion during 2006. This is one of the several emerging indicators in this Part of the report that suggests that the influences on traffic conditions during 2005 and 2006 in and around the western extension zone were somewhat different to those applying more generally in central and inner London.

11. Western extension zone: public transport, accidents and air quality

11.1 Introduction

This section deals with the impacts of the western extension on public transport, road traffic accidents and air quality. It sets out available data describing pre-extension conditions against which changes observed after the introduction of the extended scheme can be set.

It is expected that the introduction of the extension will bring an increase in the proportional use of public transport comparable to that which accompanied the original central London zone in 2003 (see Section 4). In anticipation of this, TFL has introduced enhancements to the bus network in and around the extension zone in the months prior to implementation.

Smaller proportional impacts are expected on patronage on the Underground and National Rail networks in and around the western extension zone.

The introduction of the extension is expected to remove a proportion of traffic from roads within the extended zone. As a result, road traffic accidents are expected to reduce independently of any prevailing background trends. This would be similar to the beneficial impact the original central London zone had on road safety.

The extension will also affect air quality. Reduced volumes of traffic and higher average speeds in the extension zone are expected to feed through to reduced emissions of key pollutants from road traffic here. On the other hand, marginal increases to traffic on the boundary routes could lead to corresponding small increases to emissions. In both cases, however, the complexity and diversity of other influences on air quality mean that the attributable impacts of the scheme are unlikely to be measurable over the medium term.

11.2 Buses

Bus patronage

TfL has made a number of enhancements to the bus services in and around the western extension zone, as part of a wider review of bus services in this part of London. In part these enhancements reflect the need to cater for additional demand for bus services when the extension is implemented as displaced car occupants elect to use public transport, and buses become more attractive with reduced traffic congestion.

TfL's approach to measuring changed bus patronage follows that applied for the original central zone. Counts of bus passengers entering and leaving the extension zone were therefore undertaken during the autumn of 2004, 2005 and 2006 to provide a time-series of data prior to implementation of the extension. In addition, use will be made of ongoing counts undertaken by London Buses at strategic locations on the bus network as part of the 'Keypoints' survey.

Tables 11.1 and 11.2 show the estimated number of buses and bus passengers entering and leaving the western extension zone, in the morning peak period and during future charging hours (07.00-18.00) respectively. On a typical weekday in 2006, the number of passengers entering the zone in the morning peak was 31,800 while the number leaving the zone was 26,500. During future charging hours the equivalent numbers were 95,400 and 91,200 respectively.

The available data suggest a general downward trend in both the number of buses and bus passengers year-on-year from 2004, despite improvements to the level of service. The causes of this are not immediately apparent and may reflect either inconsistencies in the counts or road/bus network configuration changes.

Table 11.1 Number of bus passengers and buses observed crossing the western extension zone boundary in the morning peak period (07.00-10.00), 2004 to 2006.

	Inbound			Outbound		
	Passengers	Buses	Passengers per bus	Passengers	Buses	Passengers per bus
2004	34,600	1,420	24	25,200	1,320	19
2005	30,800	1,380	22	25,400	1,280	20
2006	31,800	1,370	23	26,500	1,340	20

Table 11.2 Number of bus passengers and buses observed crossing the western extension zone boundary during future charging hours (07.00-18.00), 2004 to 2006.

	Inbound			Outbound		
	Passengers	Buses	Passengers per bus	Passengers	Buses	Passengers per bus
2004	103,700	4,860	21	96,700	4,640	21
2005	98,700	4,760	21	96,100	4,400	22
2006	95,400	4,760	20	91,200	4,580	20

Average bus occupancies across all entry and exit points to the zone were estimated to be in the range of 20-23 passengers per bus in the 2006 survey. These figures are comparable to those observed in the original central zone and do not suggest any significant overcrowding problems on the local bus network ahead of the implementation of the extension scheme. Figures 11.1 and 11.2 illustrate the average bus occupancies for the different time periods, based on the above volume counts.

Figure 11.1 Average number of passengers per bus, inbound, crossing the western extension zone boundary, 2004 to 2006.

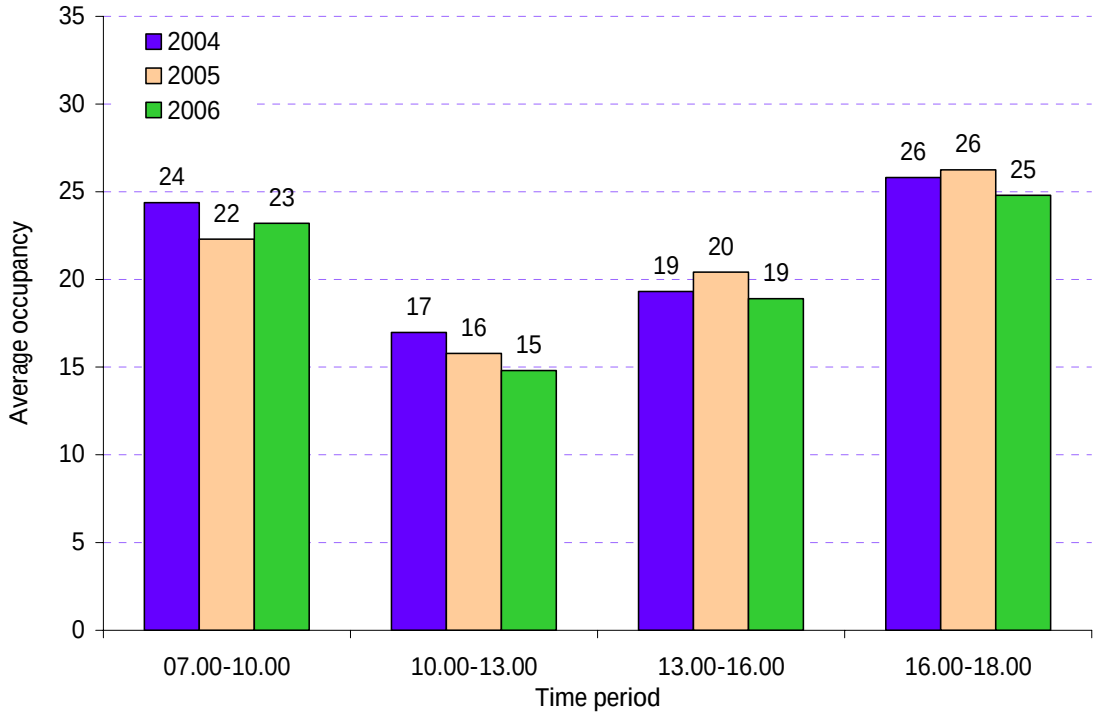
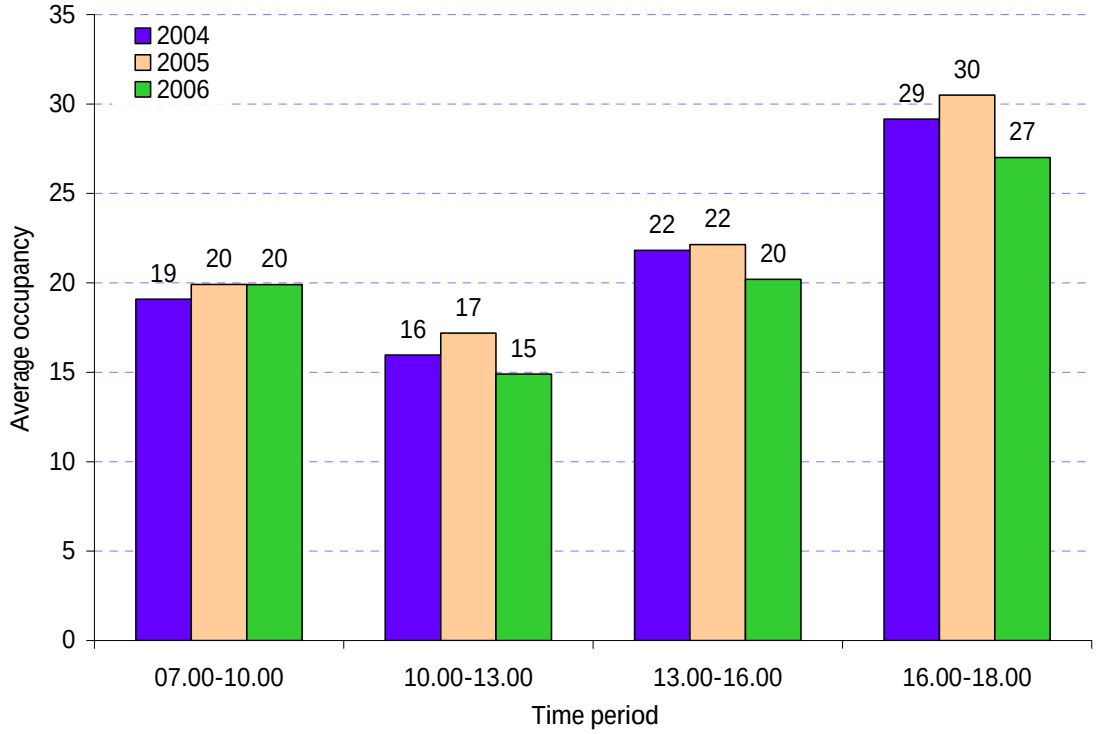


Figure 11.2 Average number of passengers per bus, outbound, crossing the western extension zone boundary, 2004 to 2006.



Bus network supply

London Buses developed a programme of proposed enhancements to bus services in inner west London ahead of a western extension. These improvements were mainly implemented in the latter half of 2006 in anticipation of the extension but also to deliver wider benefits to bus passengers in west London. They are also complementary to the general development of bus transport in London. London Buses had also consulted with borough officers, local stakeholders and the public as part of the detailed development of the proposals.

The enhancements are summarised in Table 11.3. Priority has been given to providing additional capacity on the network, particularly in the morning peak period. The enhancements that were implemented deliver 4,800 additional spaces on buses in the morning peak for people travelling to the extended zone from south, west and north London. The additional capacity is being delivered through increased frequencies, and through the replacement of single deck buses with double deck buses on selected routes.

Other changes include re-routeing of some services and extension of some existing routes to serve additional areas. Finally, one completely new route has been added, route 452, running between Kensal Rise and Wandsworth Road.

Table 11.3 Bus service enhancements in inner west London.

Improvement	Number of routes affected
Frequency enhancements	18
Extended service	6
Double deck buses	2
Re-routed service	1
New route	1

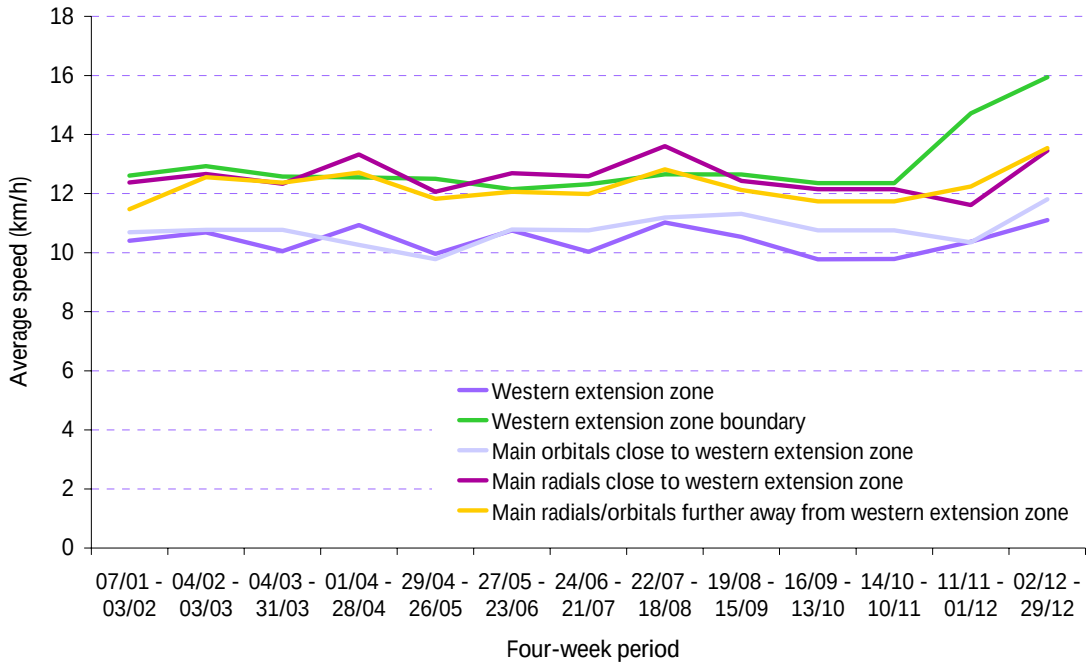
Bus network speeds

The introduction of the extension scheme is expected to reduce congestion within the zone and therefore have a positive impact on overall bus journey times. As a consequence, average bus speeds are expected to increase although they will reflect a wider range of factors than general traffic speeds. In order to monitor the effects of the extension scheme on bus speeds, data from automatic vehicle location beacons at the roadside, will monitor speeds from a sample of bus routes. These routes have been sub-divided by segment and grouped in the following areas:

- routes within the western extension zone;
- routes along sections of road on the western extension zone boundary;
- routes on sections of road on main orbital roads close to the western extension zone;
- routes on sections of road on main radial roads close to the western extension zone;
- routes on sections of road on main radial and orbital roads further away from the western extension zone.

Figure 11.3 shows bus speeds for the above areas in four-week periods for a year prior to the introduction of the western extension. In 2006 the average speed of buses travelling on the sampled roads inside the western extension was 10.4 kilometres per hour while on the sampled boundary road route segments the bus speed was faster, at 12.9 kilometres per hour.

Figure 11.3 Average bus journey speeds for selected sections of road, 07.00-18.30. January 2006 to December 2006.



Bus service reliability

One measure of bus service reliability is excess waiting time, which is the additional waiting time at bus stops experienced by passengers over and above what would have been the average waiting time if the services ran exactly as scheduled. For the purposes of monitoring the impact of the extension scheme on bus reliability, all high frequency routes have been allocated to one of the following groups:

- western extension – routes operating wholly within or crossing the western extension zone;
- western extension boundary – routes operating along the western extension boundary roads;
- western extension radial – routes operating outside the western extension in a radial direction in relation to the zone;
- western extension orbital – routes operating orbitally around the western extension boundary, but not on the boundary route itself.

Figure 11.4 shows the excess waiting time for high frequency routes in the groups described above, for four-week reporting periods from the beginning of 2005. Routes within the western extension zone have been performing better, having the lowest

excess waiting time, while routes outside the western extension zone appear to have the longest excess waiting time.

Figure 11.4 Bus excess waiting time. High frequency routes weekday future charging hours. January 2005 to January 2007.

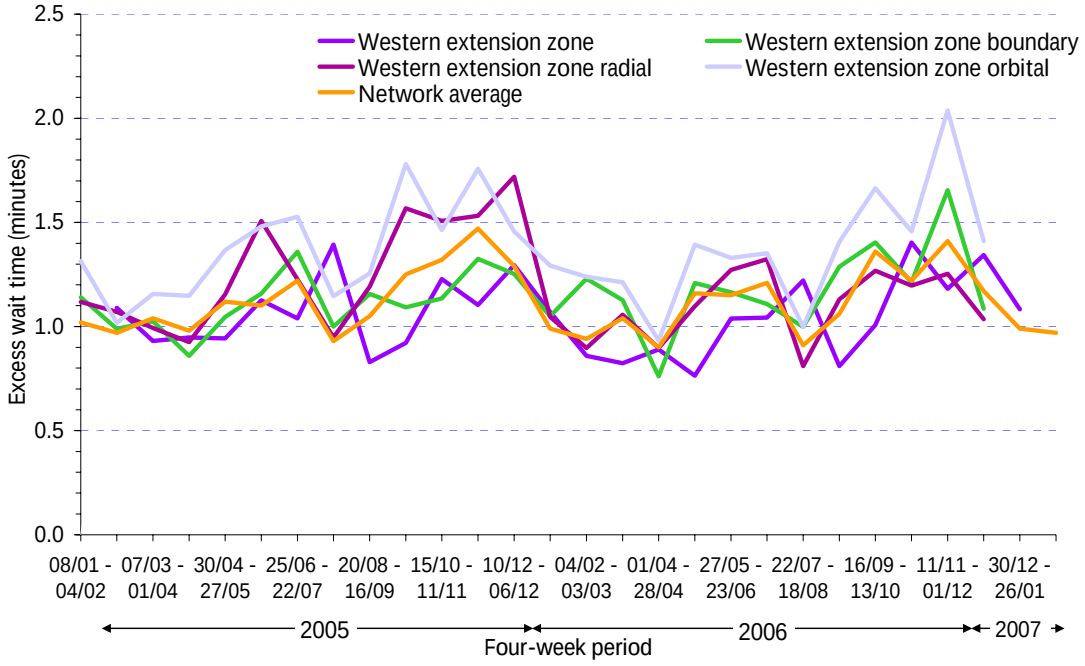
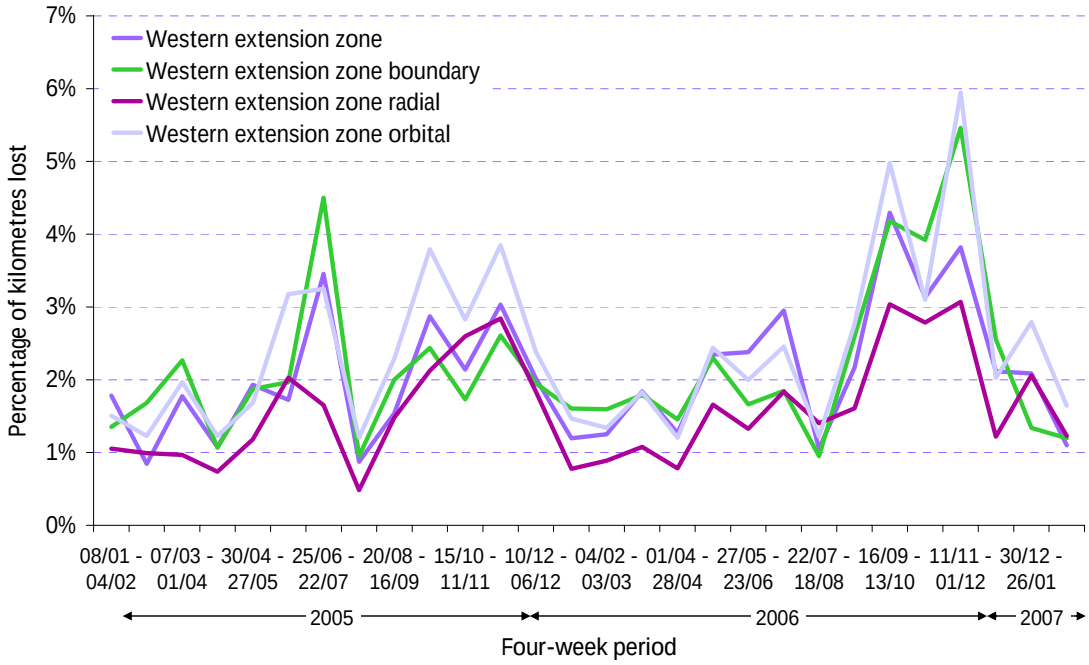


Figure 11.5 Percentage of bus kilometres lost due to traffic delays, January 2005 to January 2007.



Another indicator of bus reliability is kilometres lost due to traffic congestion. These are bus kilometres not operated, as a proportion of those scheduled, due to poor

traffic conditions. Figure 11.5 shows lost kilometres in and around the western extension in the last two years. It shows a tendency towards small increases in the percentage of kilometres lost, particularly on the boundary and orbital routes and, to a lesser extent, on routes inside the western extension zone. This trend is superficially at variance with that for general traffic congestion in and around the extension zone (see Section 10).

11.3 Underground

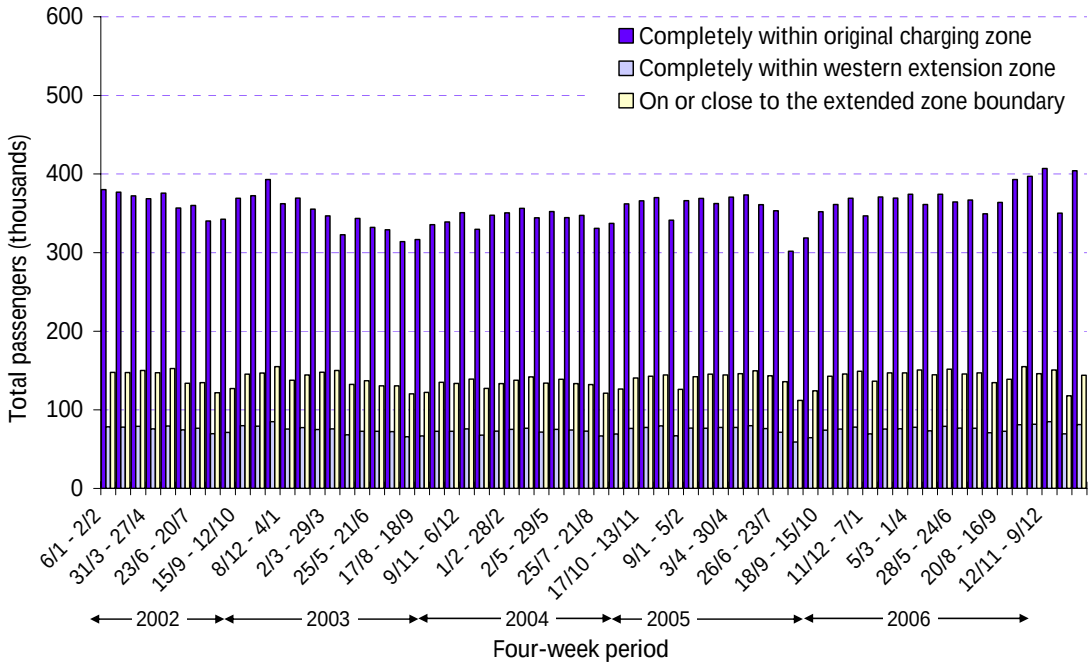
Underground patronage

The introduction of the western extension is expected to lead to small increases in the number of passengers using the Underground. However, this is not expected to be significant overall. Some Underground passengers may shift to bus in response to the new services and the expected improved performance. As with the original central zone, trends in Underground patronage will be monitored through the analysis of Underground Ticketing System gate data, in terms of passenger entrances and exits, at groups of stations reflecting the extension zone geography.

In order to facilitate the reporting for the western extension zone it was necessary to establish new groupings for Underground stations. Fare Zone 1 was therefore divided into three groups: the stations completely within the original central London zone, the stations completely within the western extension zone and the stations on or close to the extended congestion charging zone boundary. Note that these groupings overlap with those used for monitoring the original central zone, as described in Section 4.

The most immediate indicator of the impacts of the extension would be changes in the number of passengers exiting stations in the extension zone in the morning peak period. The reference figures are considered to be those for the most recent 12 four-week reporting periods. For this period: the average number of passengers exiting stations completely within the original charging zone was 376,000; the number of passengers exiting stations in the western extension zone was 77,000; and the number of passengers exiting stations on or around the boundary was 144,000. Figure 11.6 shows the trend in passenger exits at stations in the three groups within Fare Zone 1 by four-week reporting periods from 2002 to 2006.

Figure 11.6 Passengers exiting Underground stations in and around the western extension during the weekday morning peak period (07.00 to 10.00).



11.4 National Rail

National Rail patronage

As with the original central London scheme it is anticipated that a some drivers will transfer to National Rail services, although the provision and role of the National Rail network in the western extension is significantly differently to the central zone. Furthermore, the number of passengers involved is expected to be very small, such that a detectable effect on total passenger numbers is not expected.

TfL undertook one day passenger counts in Spring 2006 at all National Rail stations in or on the boundary of the western extension zone in order to establish a baseline for passenger numbers on National Rail services. These surveys will be repeated in Spring 2007.

There are six National Rail stations in or around the western extension zone: Victoria, Paddington, Willesden Junction, Kensington Olympia, West Brompton and Kensal Rise. The character of these stations and their catchment varies considerably, from major central London termini on the one hand to primarily local stations on orbital rail routes on the other.

The following tables summarise the 2006 data. For methodological reasons, stations are surveyed in the inbound direction only in the morning peak period. A survey of outbound passengers is undertaken across the whole of the survey day.

The busiest station is Victoria, with 50,000 passengers arriving in the morning peak period. Paddington is the second busiest station in the area, with 21,000 passengers arriving during the morning peak period. As part of the monitoring for the original central London zone, similar passenger counts were undertaken in 2002 and 2003 at

Victoria and Paddington, amongst other central London stations. These can be compared to the 2006 counts for the western extension (Tables 11.4 and 11.5).

The total number of passengers arriving in the morning peak at Victoria was slightly lower in 2006 than in 2002 and 2003, while the number of outbound passengers was higher. A similar comparison for Paddington shows that the total inbound flow in 2006 was similar to the 2002 equivalent, while the total outbound flow in 2006 was lower than in 2002. These variations are not atypical for terminal counts as the actual number of passengers observed on the counting day can be affected by a range of operational and extraneous factors.

Table 11.4 Passenger flows at Victoria and Paddington stations by year.

	2002	2003	2006
Victoria			
Inbound (07:00-10:00)	52,000	58,000	50,000
Outbound (06:00-20:00)	97,000	88,000	103,000
Paddington			
Inbound (07:00-10:00)	20,000	18,000	21,000
Outbound (06:00-20:00)	53,000	46,000	49,000

The remaining four stations in the western extension area have substantially lower flows than the two central London termini. In the morning peak period 3,000 passengers arrived at Willesden Junction in the 2006 Spring survey, with 2,000 at Kensington Olympia and 1,300 at West Brompton. At Kensal Rise the total number of arriving passengers in the morning peak was just 350.

Tables 11.5 and 11.6 summarise these counts. Kensington Olympia and West Brompton are similar to the two central London termini in showing a typical central London station pattern with high inbound flows in the morning and high outbound flows in the evening. The pattern for Kensal Rise and Willesden Junction is different, reflecting the particular catchments involved. Kensal Rise serves a predominately residential area and this is reflected in the very low inbound morning peak flows and outbound evening peak flows. Willesden Junction was characterised by near-identical morning inbound and outbound passenger flows in the 2006 survey.

Table 11.5 Passengers arriving at western extension National Rail stations, morning peak period (07.00-10.00).

Victoria	Paddington	Willesden Junction	Kensington Olympia	West Brompton	Kensal Green
50,000	21,000	3,000	2,000	1,300	350

Table 11.6 Passengers departing from western extension National Rail stations by time period.

Time Period	Victoria	Paddington	Willesden Junction	Kensington Olympia	West Brompton	Kensal Green
AM peak period (07.00-10.00)	9,000	8,000	4,000	1,000	400	2,000
All day (06.00-19.00)	103,000	49,000	11,000	3,000	2,000	3,000
Charging hours (07.00-18.00)	69,000	37,000	9,000	2,000	2,000	3,000

11.5 Accidents involving personal injury

Table 11.7 shows the number of reported road traffic accidents involving personal injury within the western extension zone, on the boundary roads and on the free passage route for 2004 and 2005. The corresponding figures for the central London congestion charging zone, the Inner Ring Road and Greater London are also included for comparison although they refer to slightly different reporting hours.

Reported injury accidents inside the western extension zone appeared to have increased substantially in 2005, while the trend in all other areas in central London, including the western extension boundary route, has been for accident numbers to reduce. This is a counter-intuitive and so far unexplained finding, which does not seem to arise from any known problems with the base accident data. Furthermore, it does not appear to be related to certain streetscape initiatives that have been pursued in the extension zone in recent years. TfL will keep emerging accident trend data for the western extension under close review.

Table 11.7 Total reported personal injury road traffic accidents by area, 2004 and 2005.

		Western extension zone	Western extension zone boundary	Free through route	Original charging zone	Inner Ring Road	Greater London
2004	**Weekdays 07.00-18.00**	**355**	**252**	**104**	**1,131**	**374**	**16,200**
(Mar '04 - Feb '05)	Weekdays 00.00-07.00;18.00-24.00	188	150	70	389	172	5,488
	Weekends all day	148	91	7	346	167	6,715
	Total	691	493	181	1,866	713	28,403
2005	**Weekdays 07.00-18.00**	**422**	**247**	**83**	**1,001**	**352**	**15,135**
(Mar '05 - Feb '06)	Weekdays 00.00-07.00;18.00-24.00	214	133	53	321	133	4,993
	Weekends all day	149	73	9	307	147	6,137
	Total	785	453	145	1,629	632	26,265

Note: original charging zone, Inner Ring Road and Greater London refers to accidents from 07.00 to 19.00.

11.6 Severity of accidents

Table 11.8 shows the breakdown of reported accidents by severity. The apparent increase in accidents within the western extension zone in 2005 is again evident, with reported collisions having increased by almost 20 percent in the most recent period. Reported collisions on the boundary road of the western extension and on the free passage route have declined over the past year, following the more general declining trend across London.

Table 11.8 Reported personal injury road traffic accidents by area and severity. 07.00-18.00, 2004 and 2005.

	Western extension zone		Western extension boundary		Free through route		Original charging zone		Inner Ring Road		Greater London	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Fatal	3	3	0	1	0	1	4	3	0	2	91	94
Serious	39	59	35	29	13	8	138	124	41	50	1,726	1,756
Slight	314	362	217	217	91	74	989	874	333	300	13,978	13,285
Total	356	424	252	247	104	83	1,131	1,001	374	352	15,795	15,135

Notes:
1. Year runs from March to February
2. Original charging zone, Inner Ring Road and Greater London refers to accidents from 07.00 to 19.00

11.7 Vehicle involvement in accidents

Table 11.9 shows vehicle involvement in reported personal injury road traffic accidents for 2004 and 2005. Over this period there was an absolute increase in most types of road user involvement, mirroring the increased number of collisions.

Table 11.9 Accident involvement by vehicle type within the western extension zone. 07.00 to 18.00, 2004 and 2005.

Year	Pedestrian	Pedal cycle	Powered two-wheeler	Car	Taxi	Bus or coach	Goods vehicles	Other	Total
Mar 2004 - Feb 2005	99	64	119	224	17	47	39	12	621
Mar 2005 - Feb 2006	117	86	146	281	40	45	69	10	794

11.8 Air quality: nature and scope of impacts

TfL made projections of the air quality impacts of the western extension as part of the development of the scheme. These were reported in summary form in TfL's Report to the Mayor, September 2005. The key conclusions from the supporting research were that:

- Within the extension zone, reflecting reduced traffic and increases in average network speed, emissions of Oxides of Nitrogen (NO_x) were expected to decrease by about 4 percent, and emissions of fine particulate matter (PM_{10}) were expected to reduce by 5 percent. These are as a proportion of all road traffic emissions for an annual average day with/without the extension scheme.
- On the boundary route, reflecting possible marginal increases to traffic, emissions of NO_x and PM_{10} were expected to increase by up to a maximum of 1 percent overall. On the free passage route between the original central zone and the western extension, increases might be up to 2 percent, but these latter reflected a superseded set of traffic projections for this route, with later projections suggesting that traffic on the free passage route would remain largely stable.
- In the original central London zone, emissions of both pollutants were expected to increase by perhaps 1 percent as a consequence of expected small increases in traffic and congestion resulting from the extension scheme.
- More widely in inner London, reflecting small overall reductions in traffic, emissions of NO_x and PM_{10} were both expected to decrease by about 2 percent.

- Commensurate net reductions in emissions of Carbon Dioxide (CO_2) were expected, reflecting overall reductions to traffic volumes.
- These expected reductions are proportionately smaller than those reported for the original central zone (see Section 4), reflecting the slightly lower magnitude of expected traffic change, the different vehicle type mix and vehicle fleet improvements since 2002/2003

In all cases, and as with the original central zone, the diversity of factors affecting the expression of these emissions changes on out-turn ambient air quality mean that detectable and attributable changes to pollutant concentrations are unlikely to be observable over the medium term.

11.9 Impact on emissions

Emissions are estimated using the London Atmospheric Emissions Inventory, part of a wider air quality toolkit produced by the GLA. This uses traffic data mostly observed from traffic counts and moving car observer speed surveys, in terms of measured volumes and speeds on individual major road links. It then applies emissions factors to derive an estimate of the amount of key pollutants emitted from road traffic sources across an area.

This can be combined with estimates of emissions from other sources (eg industrial and domestic sectors), and used as inputs to air quality models designed to estimate out-turn concentrations of pollution in the atmosphere for a given activity scenario.

Estimation of the emissions impact of the western extension therefore requires detailed information on changes to traffic volumes, composition and speeds. These will be gathered under the programme described in Sections 9 and 10 of this report and applied to the London Atmospheric Emissions Inventory when available.

The resulting emissions estimates can be compared to equivalent estimates using traffic data gathered during 2006 (before implementation) to derive estimates of changes due to the extension scheme, taking into account the parallel contribution of background changes to the emissions efficiency of the vehicle fleet, which can be significant.

11.10 Trends in ambient air quality

Overall approach

As has been seen with the central London scheme, trends in measured ambient air quality would not necessarily be expected to reflect a discernible impact from the western extension over the medium term. There are many reasons for this, as explained in previous annual impacts monitoring reports. Nevertheless, all other things being equal, reduced emissions from road traffic would contribute to relative overall improvements in air quality.

The western extension zone includes a number of continuous air quality monitoring sites in roadside and background locations. As with the original central London

scheme, trends in air quality within and surrounding the extension zone will be tracked using of running annual mean charts comparing pollution levels recorded by distinct groups of sites as defined in Table 11.10. These groups differ slightly from those used in the analysis for the original central London zone as some sites have closed, new sites have opened and some previously outside of the original zone are now within the extension zone.

Table 11.10 Continuous air quality monitoring sites used for monitoring the impacts of the extended central London charging zone. Showing host borough.

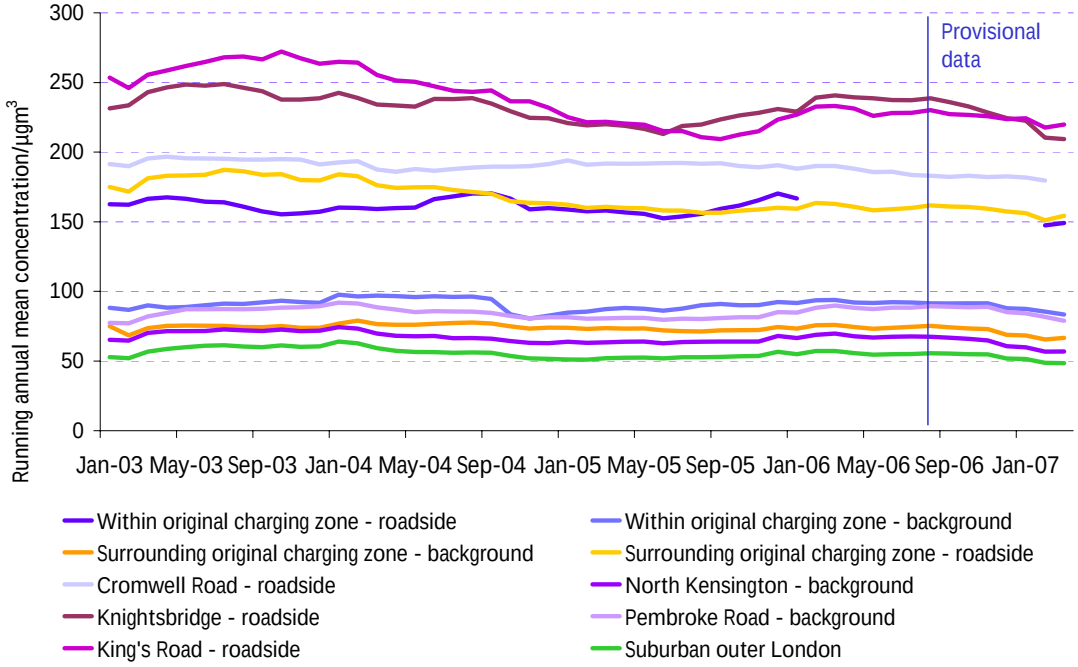
Background Sites	Roadside Sites
Sites in suburban outer London	
Slade Green, LB Bexley Kingsbury, LB Brent Eltham, LB Greenwich Cranford, LB Hounslow Teddington, RB Richmond-u-Thames (NO_X only) Thornton Heath, LB Croydon (PM_{10} only)	Not applicable
Sites surrounding the extended charging zone	
Upper Street, LB Islington Poplar, LB Tower Hamlets Ealing Town Hall, LB Ealing (NO_X only) Bethnal Green, LB Tower Hamlets (PM_{10} only) Elephant & Castle, LB Southwark (NO_X only)	Acton High Street, LB Ealing Holloway Road, LB Islington Chiswick High Road, LB Hounslow Mile End Road, LB Tower Hamlets (NO_X only) Swiss Cottage, LB Camden (PM_{10} only) Hammersmith Broadway, LB H&F (PM_{10} only)
Sites within the western extension zone	
North Kensington, RBK&C Pembroke Road, RBK&C (NO_X only)	Cromwell Road, RBK&C Kings Road, RBK&C (NO_X only) Knightsbridge, RBK&C (NO_X only)
Sites within the original central London zone	
Russell Square, Bloomsbury, LB Camden Senator House, City of London (NO_X only) Horseferry Road, City of Westminster (NO_X only)	Shaftesbury Avenue, LB Camden

Trends for sites within the extended charging zone are presented individually to provide as much detail as possible. These trends are therefore likely to appear to be more variable than for other comparator sites, as trends in the latter will have been averaged over a group of similar sites. Sites outside of the extended charging zone have been selected to be as representative as possible of their class. This means, for example, that results from the group of sites classed as ‘background’– surrounding the extended charging zone should be broadly representative of trends in air quality away from busy roads in this part of London. Each site or groups of sites does have its own individual characteristics depending on its geographical location, proximity to roads and the mix of vehicles on surrounding roads and care should therefore be taken when comparing results between sites and areas.
The following figures set out the baseline of available measurements extending back to 2003, against which emerging trends following the implementation of the extension can be set.

Oxides of Nitrogen (NO_x)

Figure 11.7 shows running annual mean concentrations for NO_x. This is an important contributor to NO_2, which is the pollutant for which National Air Quality Strategy objectives exist. In common with the trends previously observed in relation to the original central London zone, NO_x concentrations have tended to fall – slowly but consistently – over recent years. As expected, individual sites within the extended charging zone show trends that are more variable, but all are consistent with the overall trend of small decreases.

Figure 11.7 Running annual mean NO_x concentrations at western extension indicator sites.



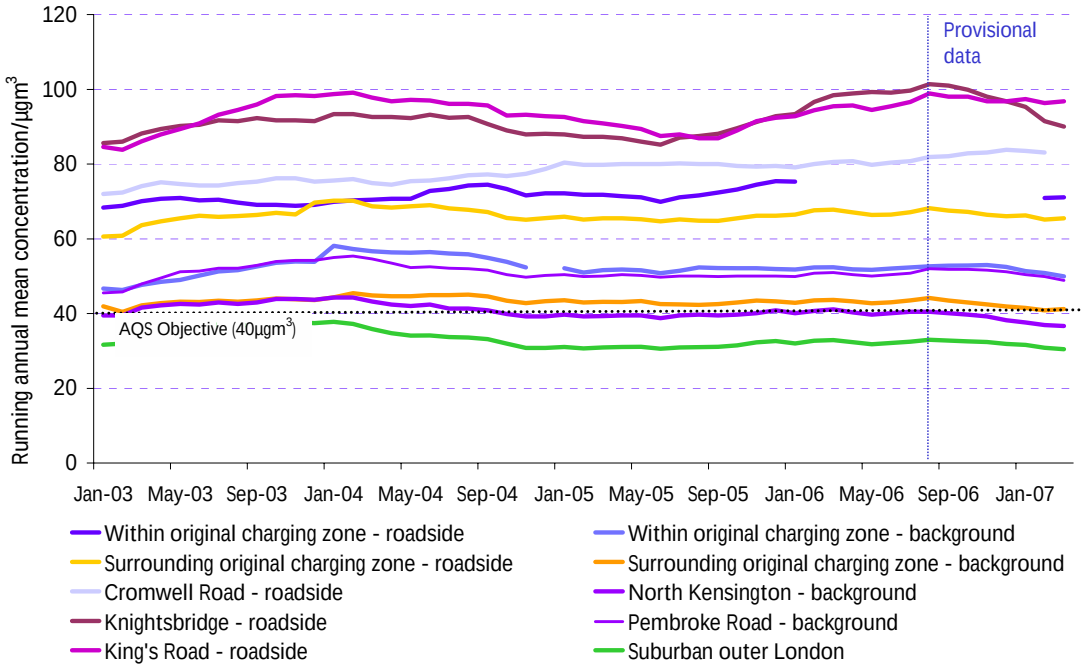
Nitrogen Dioxide (NO_2)

Figure 11.8 shows running annual mean concentrations for NO_2 at the same groups of sites. As noted in Section 4, NO_2 concentrations have shown a tendency to plateau or increase slightly over recent years, this trend being contrary to what might have been expected given steadily reducing NO_x concentrations. Increases to the proportion of NO_x that is emitted directly in the form of NO_2, reflecting increasing use of diesel vehicles and changes to vehicle and emissions abatement technology are thought to be contributory factors.

For current purposes it is interesting to understand whether recent trends inside the western extension zone differ materially from those at comparator sites outside. Bearing in mind the tendency to greater variability for the measurements from individual sites, Figure 11.8 does tend to suggest that the rate of recent increases in NO_2 at sites within the western extension zone is greater than that seen elsewhere. NO_2 concentrations, expressed as a running annual mean, have recently been up to 20 percent higher than the lowest values over recent years at each of the individual sites inside the western extension zone – a greater increment than seen in the comparator site groupings.

There are various possible reasons for this trend. However, since the western extension has not been in operation over the time period covered by this graph, it is clearly not related to congestion charging, although it will form an important backdrop to the interpretation of any possible western extension impacts that emerge over the coming years.

Figure 11.8 Running annual mean NO_2 concentrations at western extension indicator sites.



Fine particulate matter (PM_{10})

PM_{10} is a key pollutant for which health-based national air quality objectives exist. These are currently exceeded in many locations in central and inner London. TfL is developing proposals for a London wide Low Emission Zone, proposed for implementation from early 2008, which will specifically target reduced emissions of PM_{10} in London.

There are two key measures of PM_{10}. The first is concentrations in the atmosphere, as a mass per unit volume of air. Figure 11.9 shows such a 'concentration' graph, using the same groupings of monitoring sites as used for NO_x/NO_2 (above).

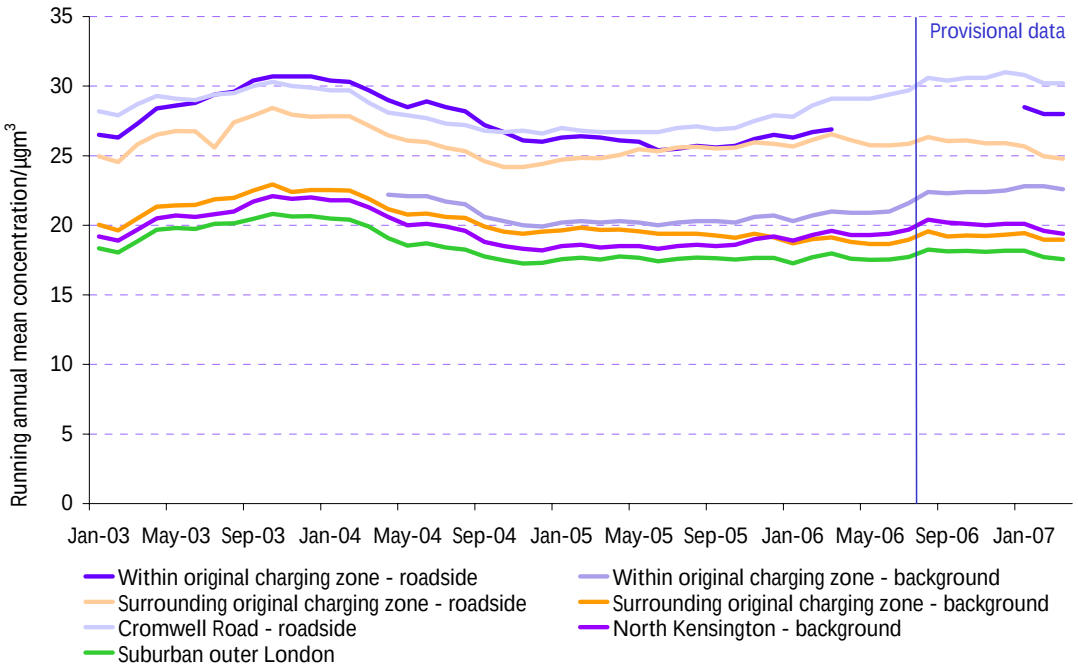
The second, which relates directly to the National Air Quality Strategy objective, is the number of days in any one year that the prescribed concentration (50µgm^3) is exceeded. The National Air Quality objectives for 2005 permit this on no more than 35 occasions in any one year. Figure 11.10 shows the 'exceedence' graph that corresponds to the trends in concentrations shown in Figure 11.9.

In interpreting these graphs it is important to note that prevailing concentrations are routinely close to the 2005 objective threshold. Therefore, small overall increases to concentrations can trigger disproportionate increases in the exceedence day statistic.

This was seen in the central zone during the hot weather of 2003 immediately following the introduction of the original central London scheme. Conversely, small decreases in prevailing concentrations can reduce the number of exceedence days markedly. This is one anticipated consequence of the proposed London Low Emission Zone.

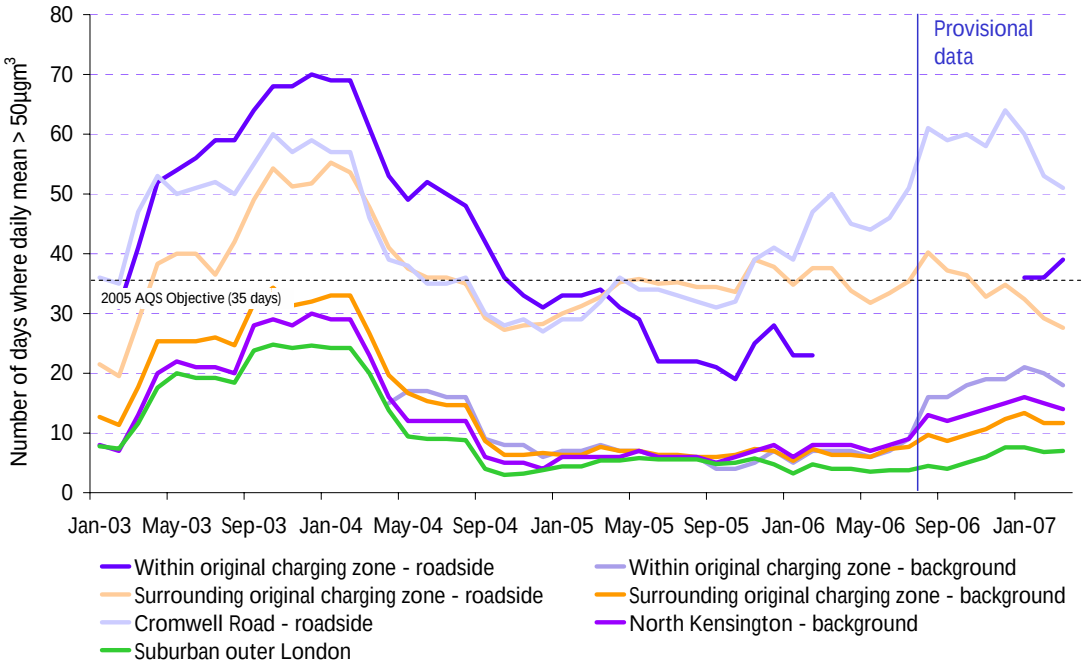
Looking at Figure 11.9, the overall trend in PM_{10} concentrations is fairly indeterminate and similar to that observed in relation to the original central scheme. Only very small reductions in PM_{10} concentration are perceptible at the majority of sites. With the exception of Cromwell Road, which shows a recent tendency towards increase, sites within the western extension zone show similar characteristics to those outside.

Figure 11.9 Running annual mean PM_{10} concentrations at western extension indicator sites.



In terms of exceedence days (Figure 11.10), sites within the western extension generally follow the wider trend, with the exception of Cromwell Road, which registers a comparatively large increase. The greater variability of the exceedence day statistic, as discussed above, is evident from a comparison of these two graphics.

Figure 11.10 Running annual mean count of PM_{10} exceedence days at western extension indicator sites.



11.11 Summary of key points

The introduction of the western extension to the congestion charging scheme is expected to affect the number of passengers using buses and also impact on bus service provision and reliability in a similar way to the original central London congestion charging zone. Patronage effects on Underground and National Rail are expected to be relatively small. A comprehensive programme of passenger counts and operational and reliability measures will be used to assess these impacts.

Recent figures in personal injury road traffic accidents in and around the western extension zone are atypical compared to both the original charging zone and the rest of London and no single clear factor has yet been identified to explain these figures. Trends in road traffic accidents will continue to be tracked through data provided by TfL's London Accident Analysis Unit, which should allow any differential trends in the number of types of accidents affecting the western extension zone across the implementation period to be characterised.

Changes to road traffic emissions arising from changed traffic patterns will be assessed using the London Atmospheric Emissions Inventory, based on observed changes in traffic patterns arising from the wider traffic monitoring work described in this report. Trends in ambient air quality will be tracked using data from numerous established air quality monitoring sites that form part of the London Air Quality Network.

12. Western extension zone: business and economic impacts

12.1 Introduction

This section describes the business and economic research programme for the western extension to the central London congestion charging scheme. The programme builds upon the research previously conducted for the original central London zone and has been developed in collaboration with GLA Economics.

The objectives for monitoring business and economic trends within the western extension zone remain similar to those established in 2002 for the central zone, namely:

- To assess the aggregate impact of the western extension on business and economic activity, both within the extension zone and more widely, taking into account wider economic trends.
- To understand how the business community perceives, responds to and is affected by the western extension.
- To measure the range and intensity of impacts upon business 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 extended business and economic research programme for the western extension incorporates the following elements:

- A review of available economic datasets.
- The development of new economic indicators for business activity within the western extension and boundary locations.
- Surveys of business attitudes towards charging and its perceived impacts on turnover and on customers.
- Quantitative surveys of visitors to retail establishments within the western extension zone and at boundary locations to establish more localised changes to consumer trends after the extension of the charging zone.
- Direct liaison with businesses via collaboration on research projects, and interaction with the business community via the established Congestion Charging Business Reference Group.
- Analysis of wider economic factors affecting business performance within the western extension zone, such as tourism trends and the White City retail development.

12.2 Characteristics of the western extension zone

The western extension zone differs in a number of respects to the original central London zone. These features are likely to condition the impacts of charging in the extension zone, and have influenced the design of the monitoring work. Key features

emerging from the analysis of conditions and trends before implementation of the extension scheme are:

- Compared to the central charging zone, the western extension zone has relatively less representation in the financial and business services sector in terms of employee jobs and business units.
- By contrast, the western extension zone has relatively high representation in sectors such as retail, education and health, and hotels and restaurants.
- The recent trend in employment in the western extension zone has very closely reflected general economic activity in London as a whole.
- With the exception of 2005, the number of business units in the western extension zone has contracted every year since 2001. The growth in 2005 was due to strong increase in new business units in the finance and business services sectors, as well as in health.
- In the western extension zone, VAT (Value Added Tax) registrations have outnumbered deregistration in all years since the mid-1990s.
- The long-run trend in weekday retail footfall in the western extension zone has been slightly downward since around the beginning of 2005. The 14 weeks of post implementation data that are currently available do not show any significant change in retail footfall traffic that might be related to the introduction of the extension scheme.
- Local residents represent the largest proportion of shoppers in the western extension zone.
- Tourism is a major factor within the western extension zone. Kensington and Chelsea along with Westminster are in the top three most visited boroughs in London.
- Rental value growth of office properties in the western extension zone was stronger than that of the central charging zone over last four years or so.
- The western extension zone makes up about 3 percent of all property sales in Greater London. However, the western extension zone has some of the most expensive properties in the capital.

12.3 Framework for assessing business and economic impacts

Quantitative assessments of business impacts are limited by the quality and quantity of the available input data. In general, transport costs are a relatively minor aspect of much business activity and the effects of the congestion charge on business operations and customer disposable income are marginal. However, it is possible that some businesses will be more than marginally affected – either positively or negatively – though attributing this to congestion charging can be difficult.

In simple terms, the macroeconomic impact of road user charging can be divided into ‘supply side’ and ‘demand side’ effects, alongside some redistribution of economic activity. The scale of these effects will be determined by the actual cost of paying the charge and the impacts on journey times and journey costs brought about by the charging scheme (see also Section 5)

Table 12.1 summarises the business and economic impact monitoring programme which aims to gauge the impact of charging on businesses and the economy in the western extension zone.

Table 12.1 Western extension zone business and economic impacts monitoring programme.

Subject	Survey	Indicators	Post western extension introduction data available
Businesses and employees	London Development Agency Business Survey	Employment, business numbers, turnover, profitability	Apr-08
	The Beta Model analysis	Number of enterprises, survival rates, formations and deformations	Jul-08
	Dunn & Bradstreet business database analysis	Turnover and profits	Feb-09
	Annual Business Inquiry	Employee numbers and business units	Feb-09
	VAT registrations data	Number of business registrations and deregistrations	Dec-08
	London Congestion Charging Business Survey	Business reactions and attitudes to the scheme	Dec-07
	Labour Force Survey	Shift-workers employed within and driving into western extension zone	Jul-08
Retail	SPSL	Changes in retail traffic in the zone	Mar-07
	London Retail Sales Monitor (central London)	Changes in retail traffic in the zone	Mar-07
	Western extension zone 'visitor' survey	Shoppers/diners/boundary business users behaviour in the zone	Feb-08
	Western extension zone shoppers exit survey	Exit survey and shopper counts at retail stores on Kings Road and SW3	Dec-07
Tourism	Tourism analysis	Visitor trends	Apr-08
Property	Investment Property Databank	Commercial property prices and rental yields	Dec-07
	Land Registry analysis of residential property prices	Residential property prices and sales volumes	Dec-07

The common approach of all these studies will be to compare business performance inside the western extension zone with business performance outside the zone, both before and after the introduction of the scheme. This is measured by such variables as number of businesses or sites, numbers of employees, and sales and profits.

12.4 General economic trends

Annual Business Inquiry

The Annual Business Inquiry is compiled by the Office for National Statistics. It enables comparison of employment and business units at a relatively fine level of geographic and industrial disaggregation.

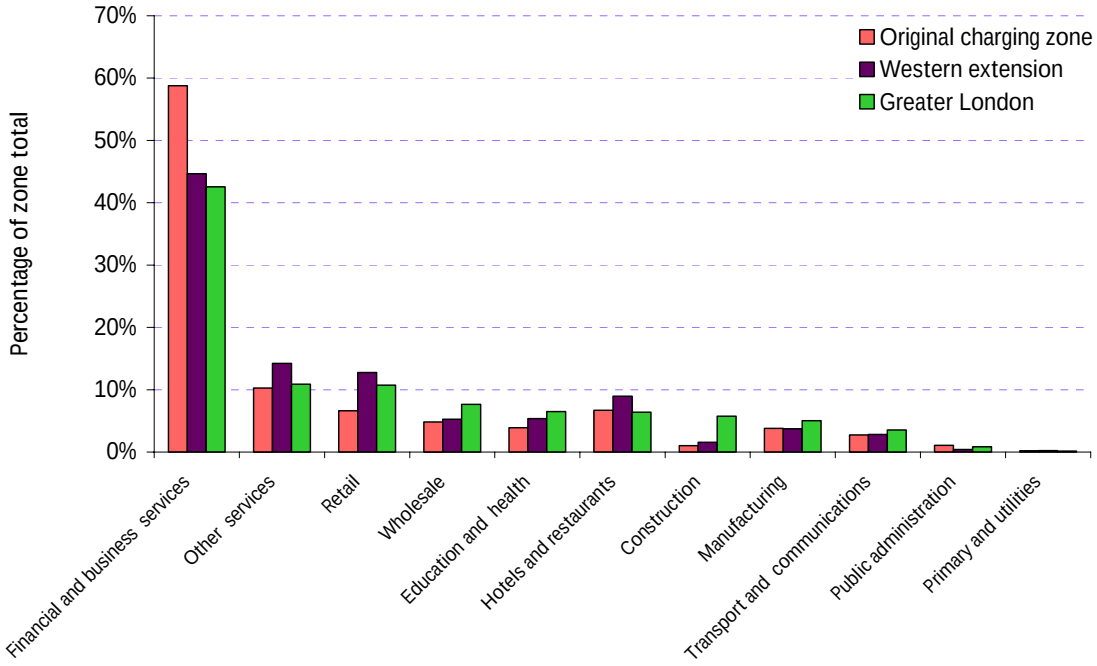
Compared to the original central London zone, the western extension is relatively less represented in the financial and business services sector in terms of employee jobs and business units, as Table 12.2 shows. By contrast, the western extension zone is relatively more represented in sectors such as retail, education and health, and hotels and restaurants, as seen in Figure 12.1.

Table 12.2 Employee jobs by business sector in the western extension, compared to the original central London charging zone and Greater London.

	Western extension zone		Central London zone		Greater London	
	Employee jobs	% of zone total	Employee jobs	% of zone total	Employee jobs	% of Greater London
Financial and business services	57,900	29%	592,600	50%	1,326,700	33%
Education and health	31,600	16%	96,700	8%	689,700	17%
Other services	15,600	8%	83,900	7%	266,700	7%
Hotel and restaurants	33,000	17%	89,900	8%	299,800	7%
Transport and communication	9,600	5%	82,100	7%	312,000	8%
Public administration	11,300	6%	84,700	7%	243,200	6%
Retail	26,400	13%	65,100	6%	375,700	9%
Manufacturing	6,400	3%	37,500	3%	204,500	5%
Wholesale	4,900	2%	29,300	2%	206,100	5%
Construction	2,000	1%	10,700	1%	123,300	3%
Primary and utilities	800	0%	2,500	0%	9,800	0%
Total	199,500	100%	1,174,900	100%	4,057,500	100%

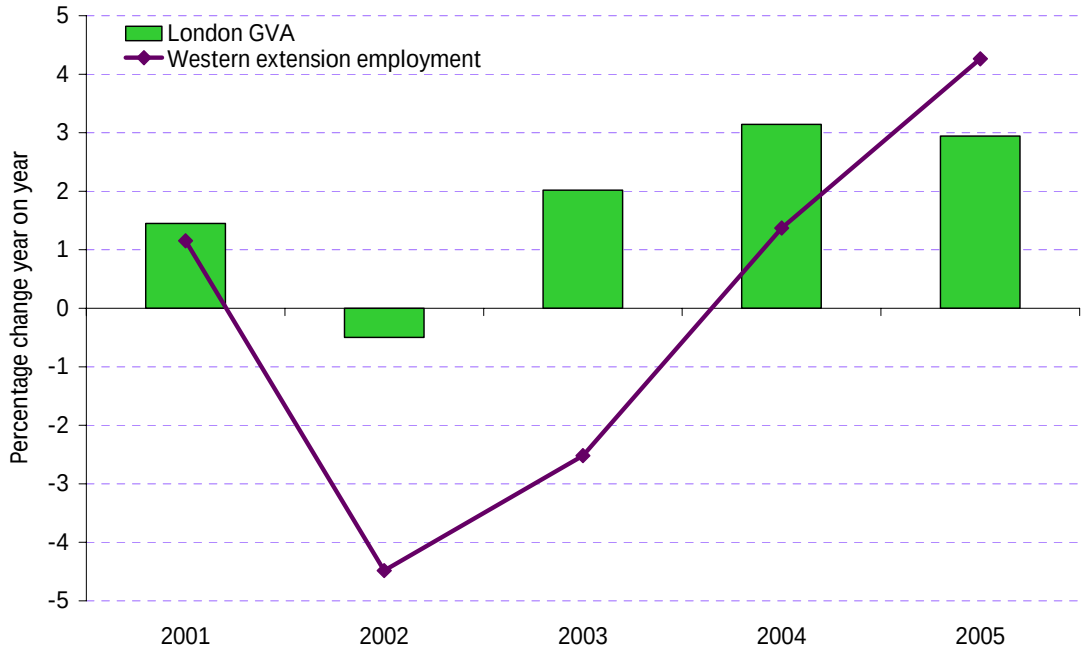
Source: Annual Business Inquiry, Office for National Statistics, January 2007 (rounded).

Figure 12.1 Business units by sector in the western extension compared to the original central London charging zone and Greater London.



Source: Annual Business Inquiry, Office for National Statistics, January 2007.

Figure 12.2 Annual percentage change in employment in the western extension and trend in London Gross Value Added (GVA). 2001 to 2005.

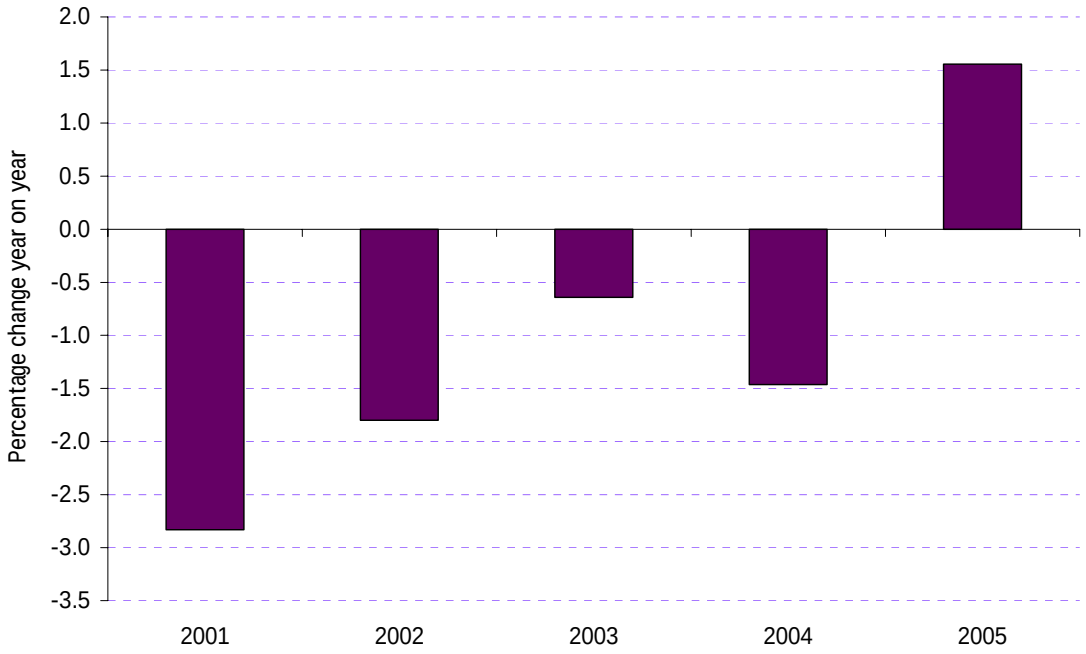


The recent trend in employment in the western extension has very closely reflected general economic activity in London. Over recent years, growth in western extension zone employment has closely corresponded to economic growth in London as a whole. Figure 12.2 shows that recently there has been a prolonged period of

economic strength. This has lifted employment in the area of the western extension, with growth in excess of 4 percent per annum in 2005.

With the exception of 2005, the number of business units in the western extension zone has contracted every year since 2001 as shown in Figure 12.3. The growth in 2005 was due to the strong increase in new business units in the finance and business services sectors, as well as in health.

Figure 12.3 Annual percentage change in business units in the western extension zone. 2001 to 2005.



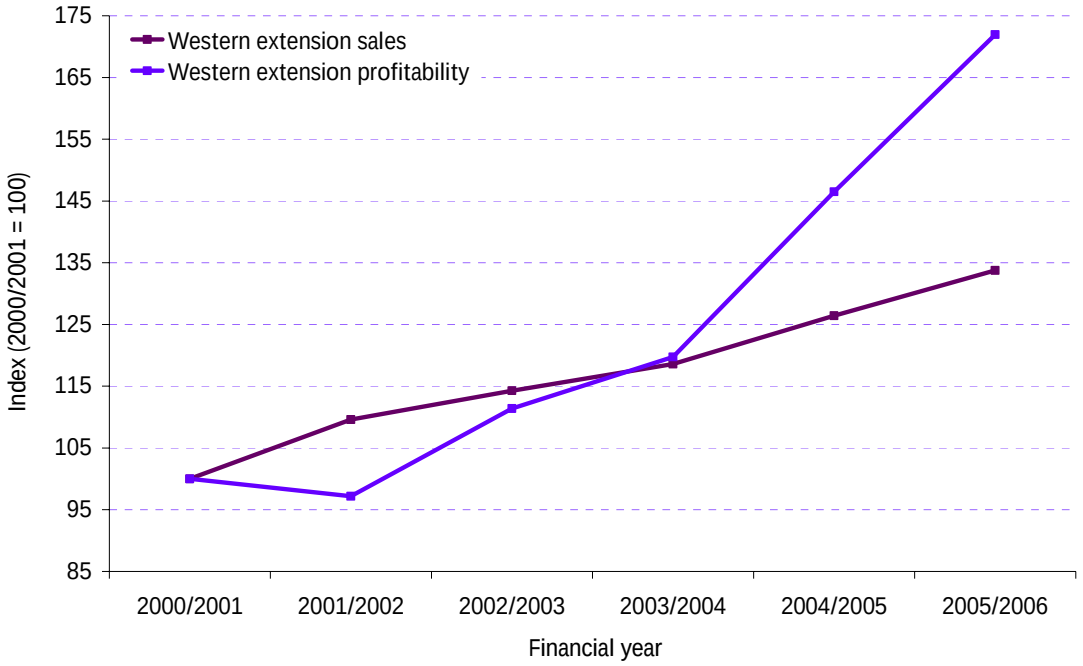
Source: Annual Business Inquiry, Office for National Statistics, January 2007.

Dun & Bradstreet

The Dun & Bradstreet analysis uses on a commercial database containing individual records for most businesses and workplaces in the UK. The database is generated from Companies House and Thomson Directories and is subject to continuous updating through telephone contact.

The Dun & Bradstreet analysis (Figure 12.4) shows that business performance in terms of turnover and profitability in the western extension has seen an upturn since financial year 2003/2004. This is in line with the general upturn in the London economy from 2003/2004. Profitability growth has been particularly strong since 2003/2004.

Figure 12.4 Western extension zone index of sales and profitability. 2000/2001 to 2005/2006.



Source: Dun & Bradstreet.

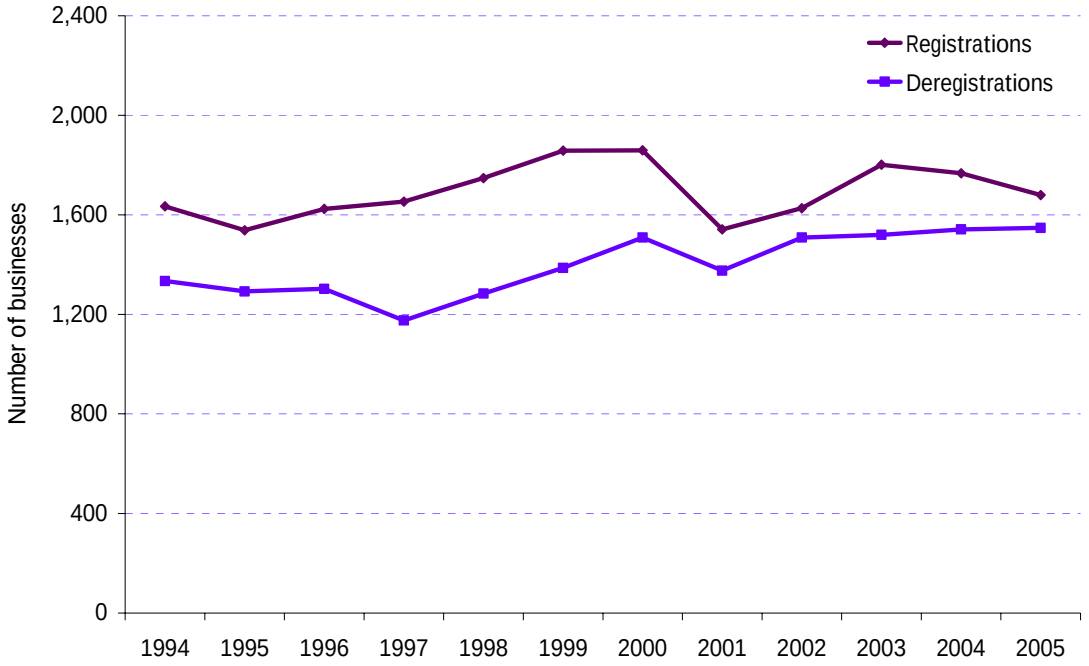
VAT registrations

The VAT registrations database contains records for over 1.8 million UK businesses registered for VAT. The analysis of VAT registrations data provides an indicator of turnover in the number of businesses. Smaller businesses with a turnover below the VAT threshold are not required to register for VAT, and are therefore not included as part of this analysis. Some businesses are also in sectors exempt from VAT, such as education and health. Data about these businesses is not available from VAT registration data.

There have recently been approximately 1,700 new VAT business registrations per year in the future western extension zone – equivalent in scale to about one quarter of the registrations in the central London charging zone per year. The number of VAT deregistrations in the western extension zone has shown a slight upward trend since the mid 1990s and was about 1,500 in 2005.

Figure 12.5 shows that in the future western extension, VAT registrations have outnumbered deregistration in all years since the mid-1990s. Although there is year-on-year variation, this gap has tended to close due to a steady rise in deregistrations over recent years.

Figure 12.5 Annual number of VAT registrations and deregistrations in the western extension zone.



Source: VAT Registration Data Analysis, 2006.

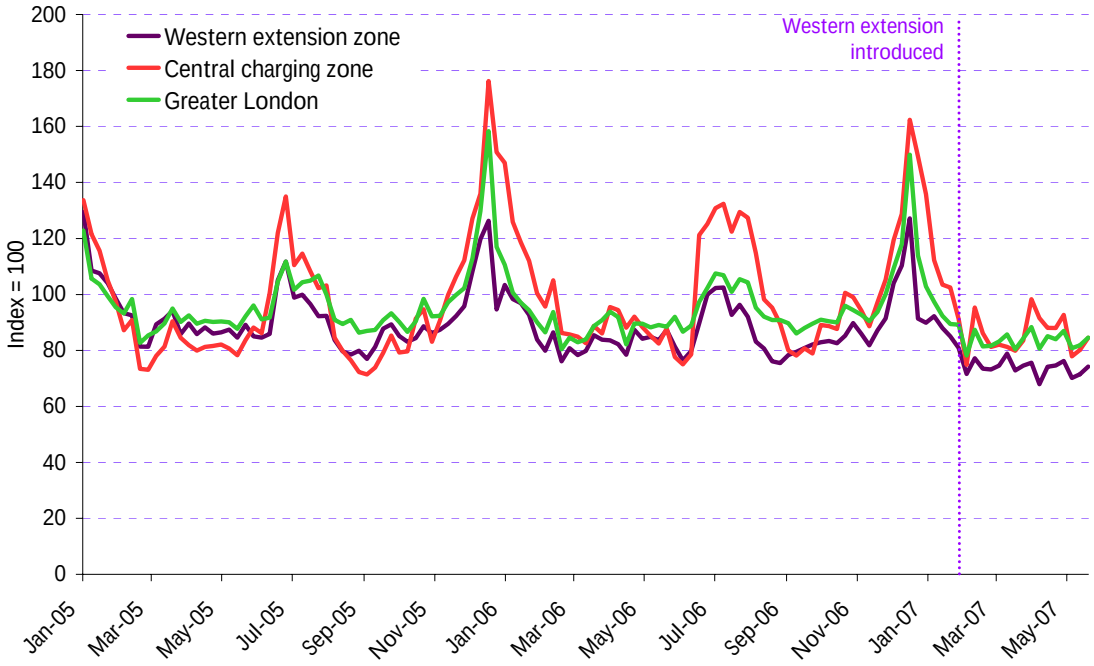
Of the approximately 14,500 VAT registered businesses in the area of the future western extension in 2005, financial and business services represented 51 percent. The next three largest sectors were public services, wholesale and retail, and hotels and restaurants sectors, representing 18 percent, 16 percent, and 7 percent of all business stock respectively. The largest sector in the western extension – financial and business services – has shown the biggest increase in net VAT registrations between 1999 and 2005, with average annual rate of growth of 2.7 percent.

12.5 Western extension zone retail sector

Retail traffic indicators measure the number of observed customers going into a representative sample of shops. This is known as 'footfall'. In the area of the western extension this is the only business indicator for which TfL currently has data for the period after the introduction of the extension scheme in February 2007. Figure 12.6 shows the weekday retail traffic indicator for the western extension zone, the central London charging zone and Greater London between January 2005 and May 2007.

The long-term trend in weekday retail footfall in the western extension zone has consistently been for index values to be slightly below those for the original central London charging zone and Greater London. This tendency has persisted in the 14 weeks of data that was available for the report since the introduction of western extension zone on 19 February 2007.

Figure 12.6 Weekday retail traffic (footfall) indicator, western extension zone, original central London charging zone and Greater London. 2005 to 2007.



Source: SPSL, 2007.

Analyses of the average difference in the footfall index between western extension and both the central charging zone and Greater London shows there no significant change in relative trends pre and post the introduction of the western extension scheme.

TfL Visitor Survey

Since 2004, TfL has undertaken a series of annual, on-street surveys with a random sample of retail consumers within the western extension zone. This survey is aimed at:

- gaining a better understanding of the relationship between the mode of travel and the wider daily shopping and dining trends in the western extension;
- assessing the behaviour of shoppers, diners and visitors to businesses within the western extension zone and the boundaries of this area prior to implementation of the extension.

The TfL Visitor Survey comprises three service-specific surveys which focus on the trends of shoppers, diners and business service users within and immediately around the western extension zone. In 2006, 7,159 people participated in this survey – 4,477 shoppers, 1,686 diners and 996 users of businesses and services within the western extension zone.

Those interviewed for the survey were individuals whose primary or secondary reason for being at the survey location was to shop, dine or use a service within the western extension zone or in boundary locations. Some example findings are reported below,

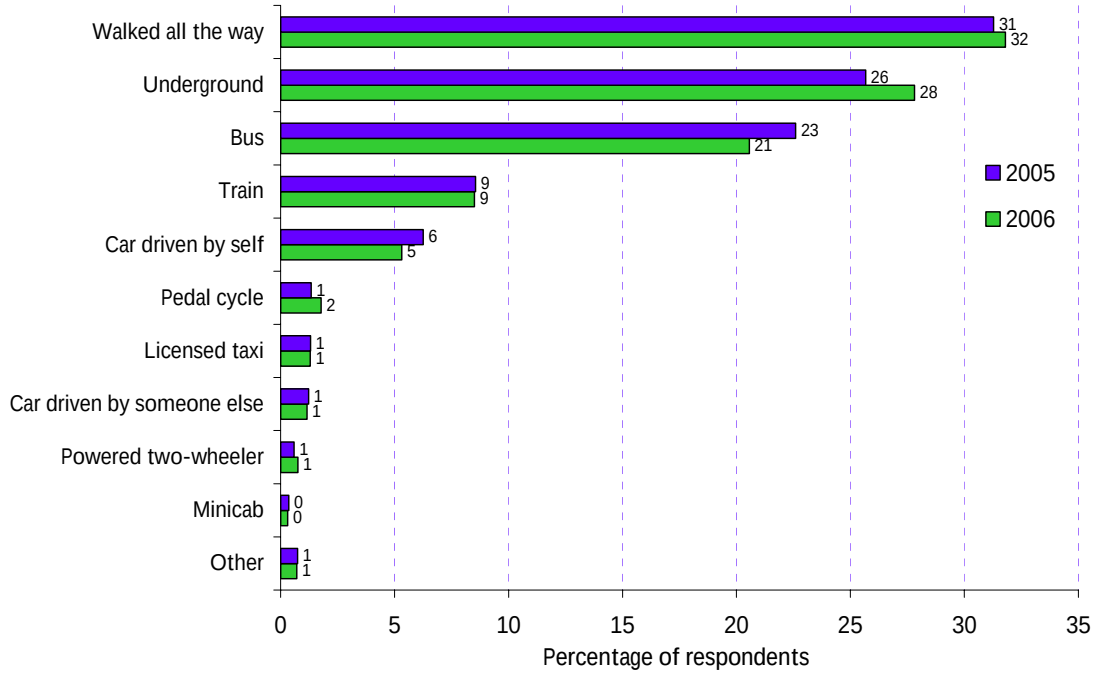
including the results of the most recent survey wave, undertaken between October and December 2006.

Shoppers

According to TfL surveys, local residents represent the largest proportion of shoppers in the western extension zone. This is unsurprising given the volume of residential properties within this area. Most shoppers were at the location to shop (39 percent) or because they worked in the area (21 percent). Tourists comprised 6 percent of all shoppers.

In 2006, the most popular transport modes for accessing the western extension for shopping were: walking all the way (32 percent) or travelling by Underground or bus (28 percent and 21 percent respectively), as shown in Figure 12.7.

Figure 12.7 Main mode of travel used to get to survey location.



Although 41 percent of shoppers to the western extension zone had access to a car or van that they could have used for their journey to the location, only 6 percent of shoppers travelled to the area by car. Only 1 percent of all car travellers were passengers in a car driven by someone else.

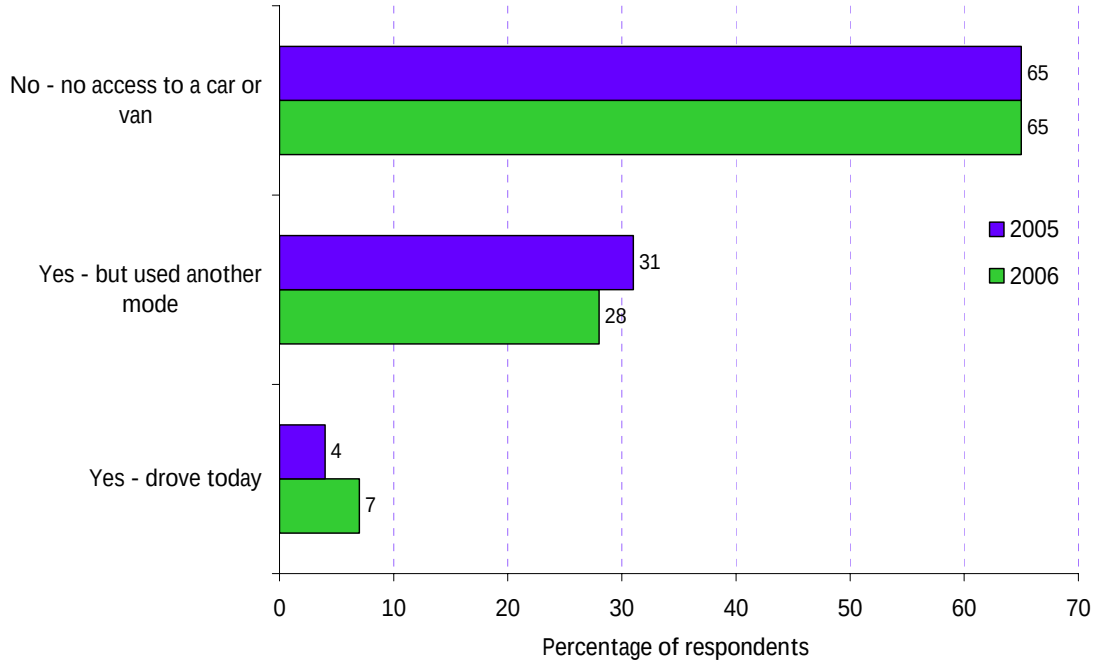
Diners

Only 5 percent of diners in the western extension zone said that they came to the area exclusively to eat out, suggesting that the large majority of diners combine a restaurant visit with journeys to the zone for other purposes. The three main reasons for being in the area were that the respondents lived locally (31 percent), worked locally (23 percent) or were shopping (13 percent).

In 2006, as in 2005, just over a third of diners in the western extension zone had access to a car or van that they could have used for their journey to the location.

However, although reflecting an increase on the previous year, only 7 percent of diners actually drove to the location, as shown in Figure 12.8.

Figure 12.8 Car availability: diners in the western extension zone, 2005 and 2006.



Western extension zone retail exit survey

In conjunction with central London retailers, TfL also commissioned a series of retail exit surveys within the western extension zone as an adjunct to the Visitor Survey. The aims of this survey were to examine shopper trends on a micro-scale, and also to collaborate with central London retailers in order to further develop a better understanding of the relationship between travel patterns, business operations and consumers.

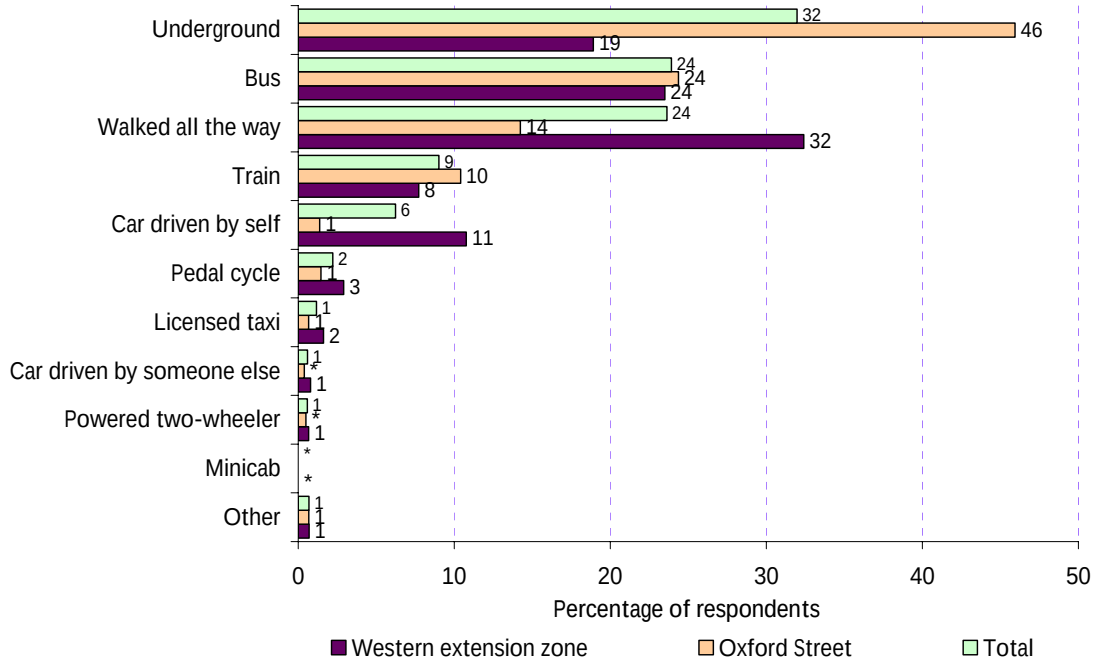
Surveys were conducted in Autumn 2006 outside the Boots and Peter Jones stores on King's Road, Chelsea and outside the Boots and John Lewis stores on Oxford Street as comparators. The exit surveys will be repeated in Autumn 2007 in order to capture any changes in behaviour that have taken place since the western extension zone was introduced.

Figure 12.9 shows the main findings from the initial survey that include:

- Almost half the shoppers in King's Road live locally: 48 percent of shoppers surveyed live inside the western extension zone.
- Just over half of the shoppers surveyed said that they shop at the location at weekends as well as weekdays.
- The main single mode of access of shoppers on King's Road was on foot, at 31 percent, with 52 percent of shoppers accessing King's Road using public transport modes and 12 percent by car.

- Shoppers that were residents of the western extension zone were far more likely to arrive on foot (51 percent).
- Car use was highest for those residents in the western extension zone (10 percent).

Figure 12.9 Main mode of travel used to get to survey location.



Note: * indicates values lower than 1 percent.

White City retail development

A large new retail development is currently under construction at White City, which is immediately adjacent to the boundary of the western extension zone. This is due to open in October 2008. It is expected that, once open, this retail development will compete with a number of other retail locations in London, most immediately those located inside the western extension zone.

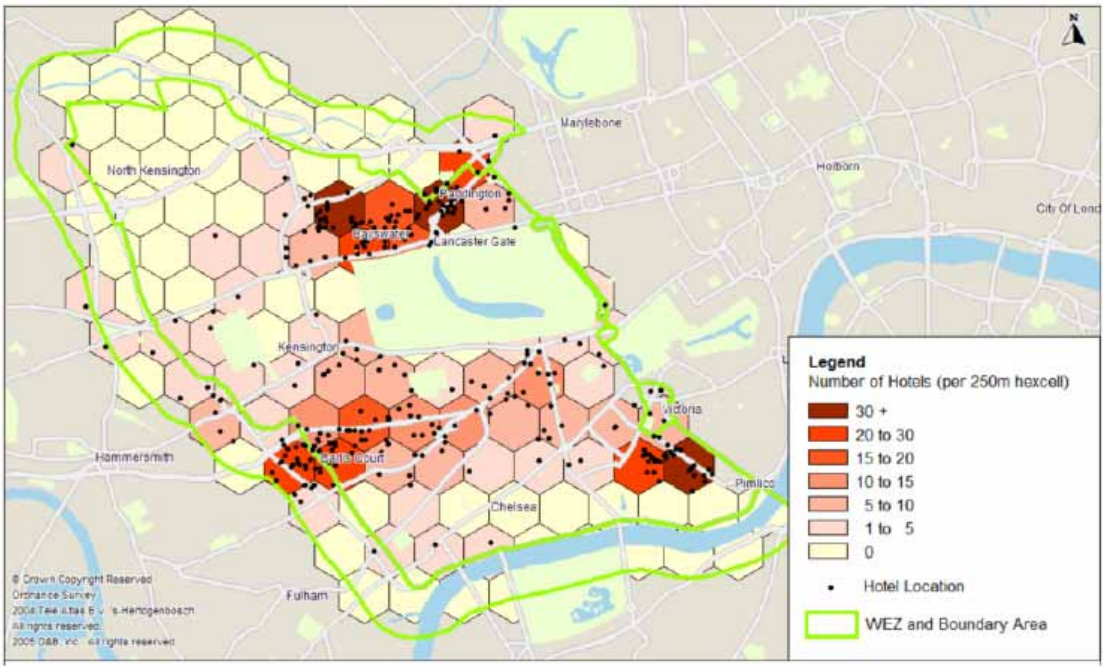
TfL will closely follow the progress of the White City development and incorporate assessments of the economic impacts of White City within the business and economic monitoring programme for the western extension scheme.

Western extension zone tourism survey

Tourism is a major factor within the western extension. The Royal Borough Kensington and Chelsea along with the City of Westminster are two of the top three most visited boroughs in London. According to 'Visit London' 14 percent of all visitors to Kensington and Chelsea are from overseas, compared to 9 percent in Westminster.

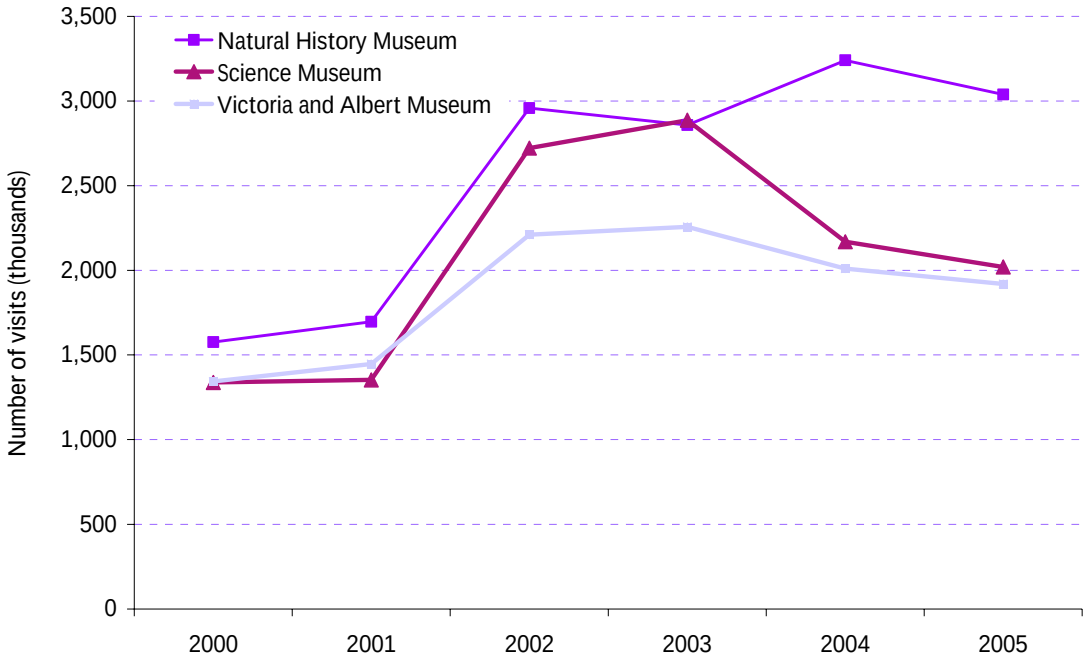
Figure 12.10 illustrates hotel densities in the western extension based on data from Dun & Bradstreet for 2006. There are over 400 hotels in the zone with a particularly high density around Earls Court, Victoria and Paddington.

Figure 12.10 Hotel density in the western extension zone.



Source: Dun & Bradstreet, 2006.

Figure 12.11 Annual change in number of visits to top museums in the western extension zone.



Source: Visit London, Visitor attraction trends, London Visitor Statistics, 2005/2006.

There are many visitor attractions in the western extension zone, with the Natural History Museum, Victoria and Albert Museum and Science Museum attracting large numbers of visitors each year. Some of London's largest attractions, retail outlets and park spaces are also located in the western extension zone.

The most popular museums in the western extension reported a steep rise in visitors after the museum entry charge was removed at the end of 2001. As shown in Figure 12.11, visitor numbers fell in 2005 due to heightened terrorism fears following the London bombings in July 2005.

12.6 Property markets

The analysis of commercial and residential property performance within the western extension zone builds on previous work undertaken within the central London zone to explore trends in sales volumes, property prices, rental value and investor sentiment in western extension zone property before and after the extension of the scheme.

As seen earlier is this section, the financial and business sector accounts for the largest proportions of business units within both the central London congestion charging zone and the western extension zone, creating a high demand for office space in both locations. However, the retail sector in the western extension zone is proportionally larger and more varied than that of the central zone, in terms of the tenant and property mix.

The residential property profiles of both locations also vary distinctly. Whilst the number of residential properties in the western extension zone is larger than that of the central London zone, it should be noted that both zones form a small part of Greater London and collectively account for only 5 percent of all Greater London residential property sales transactions.

Commercial property

The analysis of commercial property performance is based on the Investment Property Databank. This represents £116bn of commercial property in the UK. It includes properties that are valued monthly and quarterly and allows an in depth analysis of commercial property price trends.

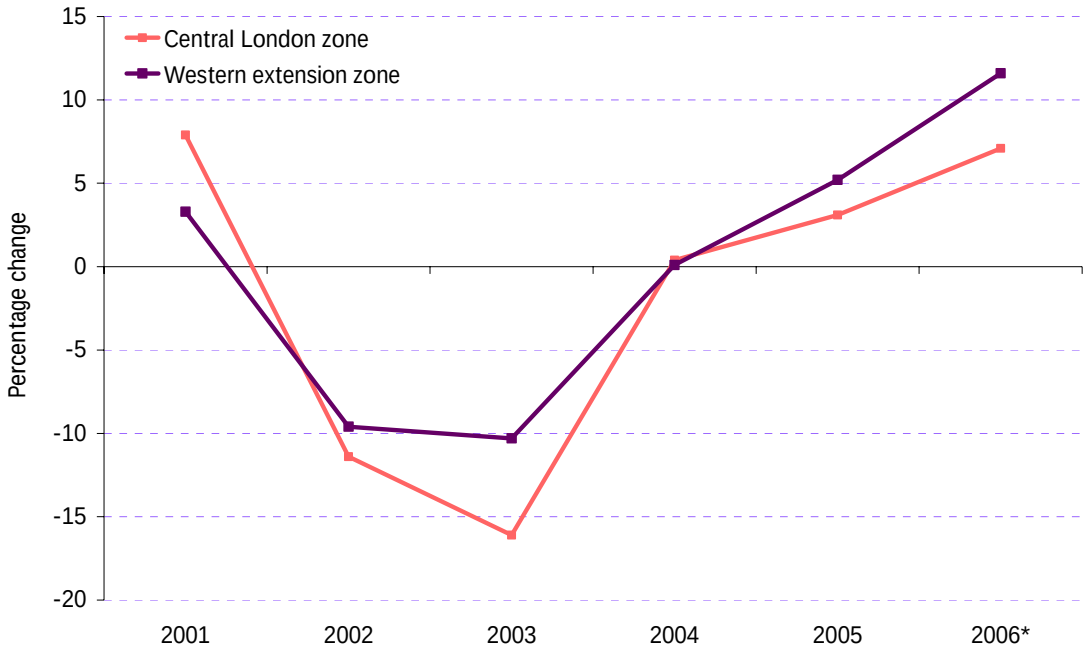
The performance of commercial properties within the western extension zone is assessed in terms of rental value and yield growth of retail and office properties. This is further assessed against the performance of commercial properties in Greater London as a comparator benchmark.

Office markets

According to the Investment Property Databank, rental value growth of office properties in the western extension zone has been stronger than that of the central charging zone in almost all of the last five years. Additionally, properties in the western extension zone have achieved higher return than properties in the central

charging zone, as shown in Figure 12.12.

Figure 12.12 Change in western extension zone office rental value growth, indexed to 2006.

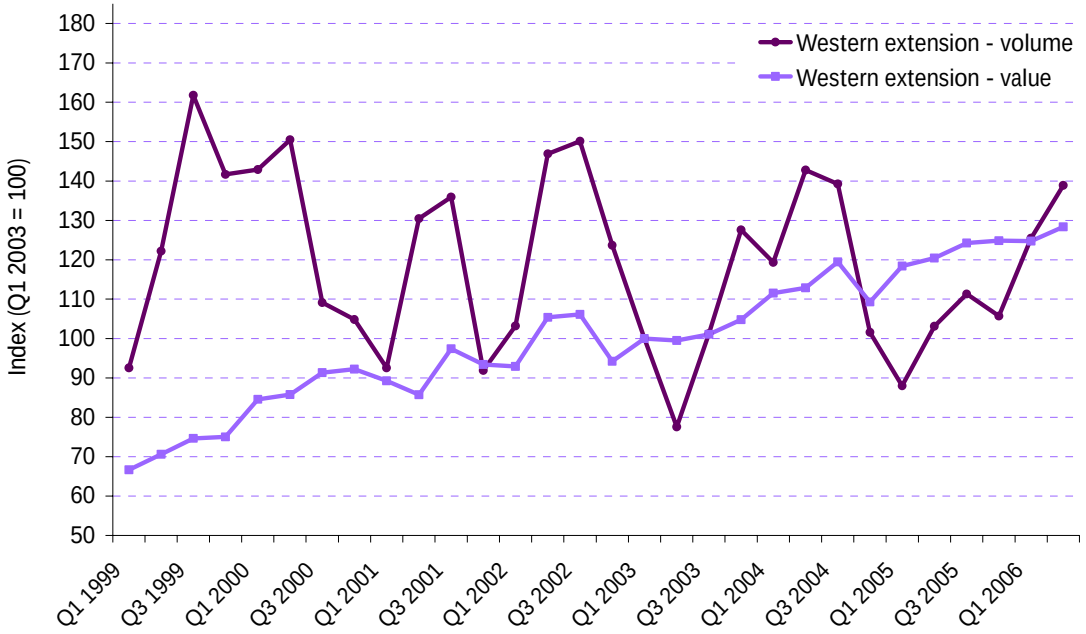


Note: * 9 months to September 2006.
Source: Investment Property Databank Ltd, 2006.

Residential property

Figure 12.13 shows that residential property sales volumes in the western extension have experienced intermittent peaks and troughs over the last seven years. Most recent data shows sales on an upward trend since early 2005, reflecting a general strengthening in the property market across London as a whole. By comparison, property values have generally been on an upward trend since the late 1990s, despite sporadic and substantial dips in sales volumes.

Figure 12.13 Change in sales volume and sales value index for all residential properties. 1999 to 2006.

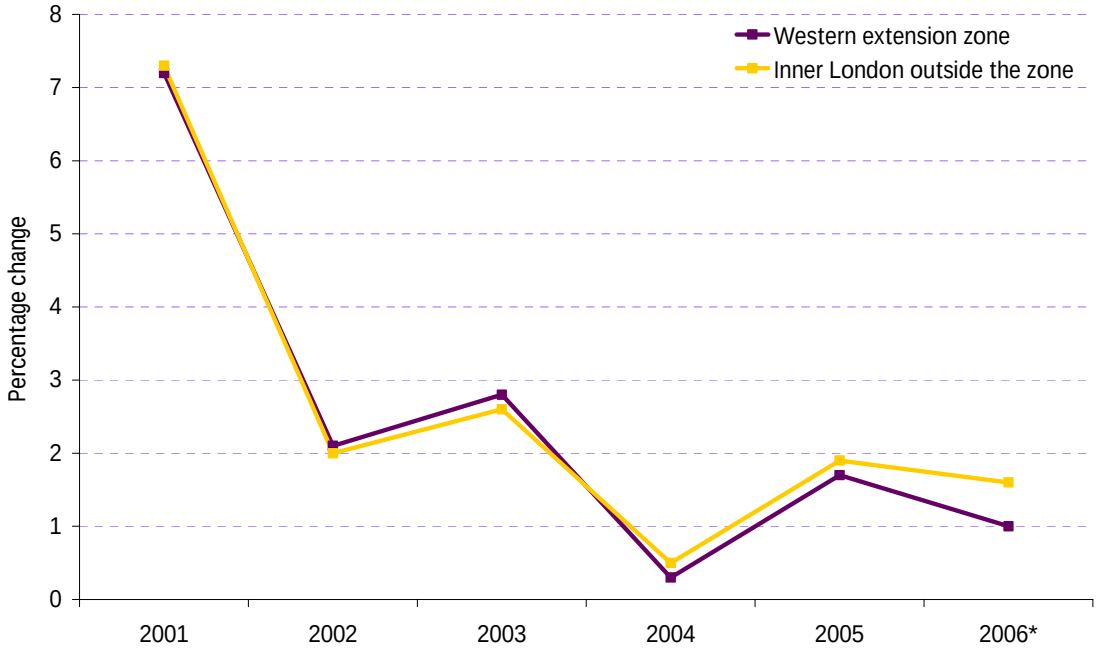


Source: HM Land Registry, 2006.

Retail property

According to the Investment Property Databank, the rental value growth of retail properties in the western extension has generally been in line with inner London rental value performance over the last five years, as seen in Figure 12.14.

Figure 12.14 Change in western extension zone retail rental value growth compared to the rest of inner London. 2001 to 2006.



Source: Investment Property Databank Ltd, 2006.

13. Western extension zone: social and behavioural impacts

13.1 Introduction

The social and behavioural impacts of congestion charging in central London can be defined as the effects that schemes have on the ways in which people and communities live, work, travel and relate to one another. The social impacts monitoring programme for the western extension draws and builds on experience of previous work in relation to the original central London charging scheme, as described in previous annual impacts monitoring reports.

This section describes the new research that has been developed for the western extension, and presents a selection of illustrative data describing behaviour and attitudes towards the scheme in late 2006 before implementation. Continuing studies following implementation will help TfL understand these effects, pinpoint possible areas of difficulty, and provide contextual data to assist with the understanding and interpretation of the aggregate travel changes observed elsewhere in the monitoring work.

13.2 Key limitations of the social and behavioural impacts work

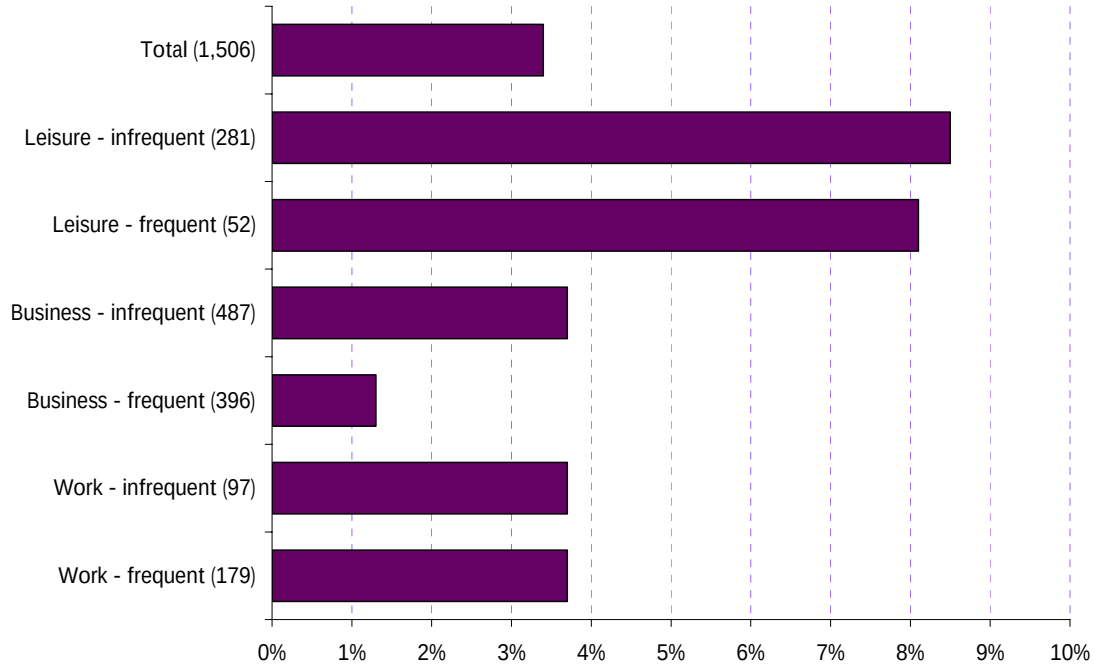
- Although every effort has been made to ensure that the social survey samples are representative of the population, it is likely that some groups are under – or over – represented. Care should be taken when considering findings relating to small or 'harder to reach' groups within the population.
- Furthermore, the results obtained are often based on the perceptions and attitudes of participants. These will be conditioned by a wide variety of factors and may not therefore correspond to instrumented or otherwise 'scientific' measurements of the same impacts observed elsewhere in the monitoring work.
- Provided that these basic limitations are understood, the data provide valuable contextual information that can assist with interpretation of the aggregate changes observed elsewhere.
- Social impacts surveys are not designed to quantify travel behaviour change. Purpose-designed travel surveys, such as Roadside Interview surveys, are required to address this aspect of behavioural change.

13.3 Key findings from the social impacts work in relation to the original central London scheme

- The majority of participants, broadly representing London residents, did not feel that they had been affected to any significant extent by the scheme. This logically reflected the fact that most London residents did not drive in the charging zone on a regular basis. In turn, this reflected the fact that car travellers typically accounted for considerably less than 10 percent of all travel to the zone. This is not to say that some people were not significantly and directly affected. Rather, that the large majority were not significantly or directly affected by the scheme.

- Respondents living inside the charging zone tended to recognise the benefits of the scheme, particularly the reduction in congestion and perceived improvements to general amenity, air quality, noise, traffic levels and public transport provision. On the other hand, some residents of the zone reported fewer visits by family members and friends and attributed this to charging.
- Transport issues that respondents felt most negatively about were largely unrelated to the scheme. Parking was a key concern: lack of spaces, 'excessive' traffic warden activity and rising charges.
- There was little change in reported aggregate car use by charging zone resident respondents, who received the 90 percent residents' discount.
- Respondents living outside the charging zone reported changes in travel by car to and from the central zone with a £5 charge that were generally in line with the aggregate travel effects observed in the volumetric traffic data. This provided important corroborative evidence for TfL's estimates of changed mode and purpose splits, and assessments of aggregate travel behaviour change.
- The majority of all respondents felt that the £5 charge was affordable. More respondents living within the zone reported finding the charge difficult to afford than respondents living in inner London, despite being in receipt of the 90 percent residents' discount. This appeared to reflect the frequency of actual charge payment, non-residents overall making fewer trips by car per person to the central London charging zone.
- In depth discussions with frequent users of the charging zone revealed that generally they felt that the scheme at £5 had been more successful than they had expected in reducing traffic congestion, and that their journeys had become more reliable.
- With the increase in the charge to £8, there was some intensification of its travel impacts, though they were difficult to assess at an individual level because of survey limitations, the continuing 'background' decline in car travel and the effects of the London bombings in July 2005, just as the increased charge was introduced. Figure 13.1 shows details from a survey of drivers, showing how the charge increase from £5 to £8 had a modest impact on reported travel, though this varied by journey purpose.

Figure 13.1 Proportion of all chargeable trips reported as no longer being made, corresponding to the increase in the charge from £5 to £8. Original central London zone 2005.



13.4 Social and behavioural impacts research programme for the western extension scheme

The social impacts of the western extension are being monitored by two primary surveys, carried out at regular intervals before and after the implementation of the scheme. These are:

The western extension zone users survey

This is a panel survey of 4,000 individuals (workers, residents and visitors) who travel into and within the western extension zone. It therefore seeks to observe change over time in a consistent group of individuals who are likely to be directly impacted by the extension scheme.

There are five planned survey waves, results from the first of which, characterising the period before the implementation of the extension, are summarised here. Four further waves during 2007 and 2008 will allow progressive impacts of the extension scheme to be tracked as they develop. All waves will, so far as is possible, be conducted with the same individuals.

Samples for this survey are optimised to give good resolution for small socio-demographic groups likely to be of particular interest that might otherwise be missed in a general sample. Provisions are in place for the western extension users survey to ensure consistent panel size and characteristics to deal with inevitable panel attrition as the survey progresses. All of the findings presented are weighted so as to be representative for the key quantities of interest.

The 'Londoners survey'

This survey aims to understand how London residents in general are affected by the western extension. As such, it provides a context for the western extension users survey (above). It employs a representative cross-sectional sample of 2,400 people living across Greater London, with a planned survey of six waves. Three were conducted during 2006 before implementation of the extension scheme, gathering data on anticipated impacts and adaptations, with three to follow implementation, gathering data on actual impacts.

Although the sample of individual participants will differ between survey waves, the sample is segmented and will be re-drawn so as to be consistently representative of the main socio-demographic groups, albeit at a fairly coarse level of aggregation.

This approach provides a 'top level' view of the impacts of the extension from the perspective of a 'typical Londoner', allowing the impacts of the extension to be placed in the context of Londoners in general, the large majority of whom will probably not be affected to any significant extent by the extension scheme. Crucially, it will also serve to highlight those socio-demographic segments that are more significantly affected, allowing further study.

The western extension supplementary surveys

This is a suite of small scale qualitative and quantitative surveys designed to measure the impacts of the extension scheme on key workers, shift workers, disabled people and carers who may potentially be affected more than others, and where some of these groups may be 'hard to reach' in adequate numbers through the main surveys described above. Importantly, these groups are likely to be impacted in different ways to others in the main surveys, requiring specific survey approaches to be used to elucidate these issues.

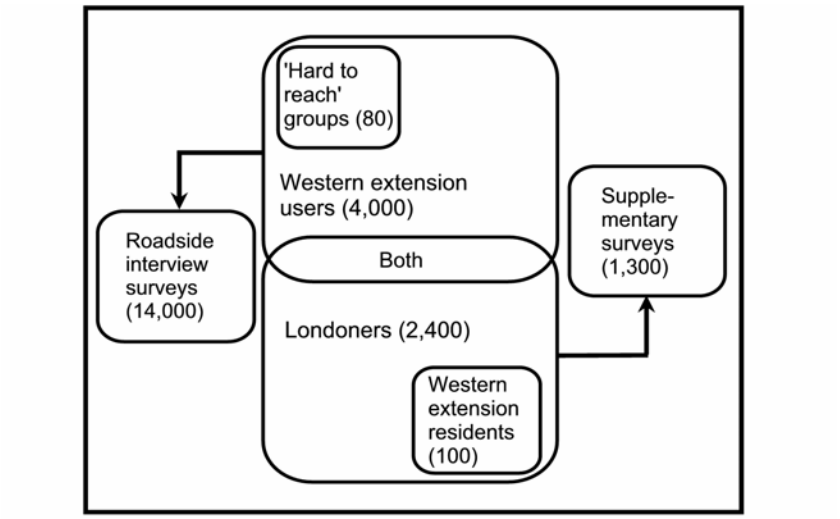
The western extension roadside interview surveys

To complement the above surveys, and to obtain a more robust quantitative estimate of travel behaviour change, a large programme of roadside interview surveys has been put in place. These surveys interview drivers at the roadside whilst they are driving in the extension zone, thereby providing details of actual trips being made. By carrying out these surveys both before and after the extension zone is implemented, and relating them to observed traffic volumes, it should be possible to obtain a more robust quantification of travel behaviour change than was possible in relation to the original central London zone.

Summary of the research programme

Figure 13.2 is a schematic representation of the main components of the social and behavioural impacts research programme for the western extension, showing the relationships between the various components described above. The western extension surveys will also address the original central London zone and any new, possibly consequential, impacts of the extension scheme on the original zone.

Figure 13.2 Main components of the social and behavioural impacts research programme for the western extension (showing approximate sample sizes of individuals).



Reflecting these surveys, the following convention is adopted for the remainder of this section:

- Respondents to the western extension users survey, which are representative of those who travel to/from or within the western extension zone, are referred to as '*western extension users'*.
- Respondents to the Londoners survey, which is representative of London residents, are referred to as '*Londoners*'.
- The following sections look at the some key themes in relation to the western extension and existing central London charging zone, using either the Londoners survey or the western extension users survey as appropriate.

13.5 Perceptions of congestion and attitudes towards the western extension scheme

This section looks at how *Londoners* and *western extension users* regard levels of congestion in and around central London.

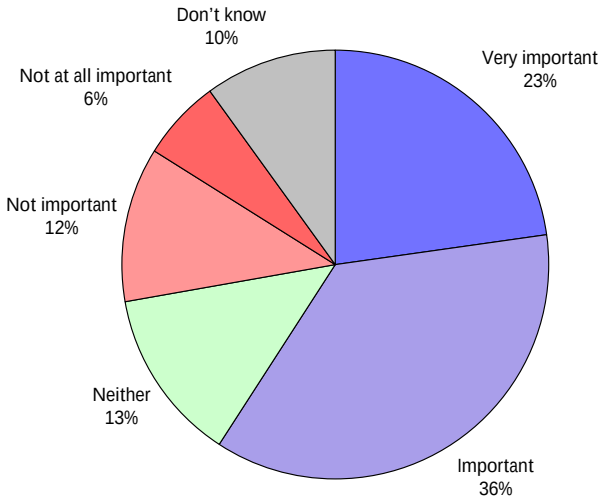
Existing levels of congestion

Around sixty percent of both *Londoners* and w*estern extension users* thought it was important to tackle traffic congestion in the area of the proposed western extension zone. However, respondents to both surveys differed considerably in their perceptions of relative congestion in the extension zone, the original central London zone and their own local area. Typically:

- Existing levels of congestion in the extension zone were viewed as being broadly comparable to those currently prevailing in the original central zone.
- Residents of the extension zone tended to consider levels of congestion in this area as being less severe than those who travelled into the area from elsewhere.

- Similarly, extension zone residents were relatively less likely to consider that tackling congestion within the zone was important, compared to residents of other parts of London.

Figure 13.3 Importance of tackling congestion in the western extension zone. Londoners Survey, January-February 2007.



Base: all respondents (2,401)

The sections below consider respondents' perceptions of recent congestion trends in central London. These findings make an interesting comparison with the measured congestion trends considered in Sections 3 and 10 of the report.

Congestion in the original central London zone

Comparing levels of traffic congestion in early 2007 with one year ago, 29 percent of *Londoners* felt that congestion had improved in the original central London zone, and 12 percent of *Londoners* thought that congestion had got worse over the preceding 12 months. However, only a small proportion of Londoners survey respondents would have driven into the original charging zone over the course of the year. When frequency of driving to central London is taken into account, the proportion of respondents who consider that congestion had got worse doubles, to 20 percent. However, this is still very much a minority of *Londoners,* and is not necessarily representative of the drivers present in the original central zone on a typical charging day.

Congestion in the western extension zone

About half (53 percent) of *Londoners* did not volunteer an opinion about traffic congestion in the western extension zone over the previous year, reflecting the large proportion of Londoners who do not drive in the extension zone with anything other than a very minimal frequency.

Of the remaining sample of 47 percent of *Londoners* who volunteered an opinion, two thirds felt that there had been no change in congestion levels in the western

extension zone over the previous 12 months. One quarter felt that congestion here had got worse, while the remaining one tenth felt that it had improved.

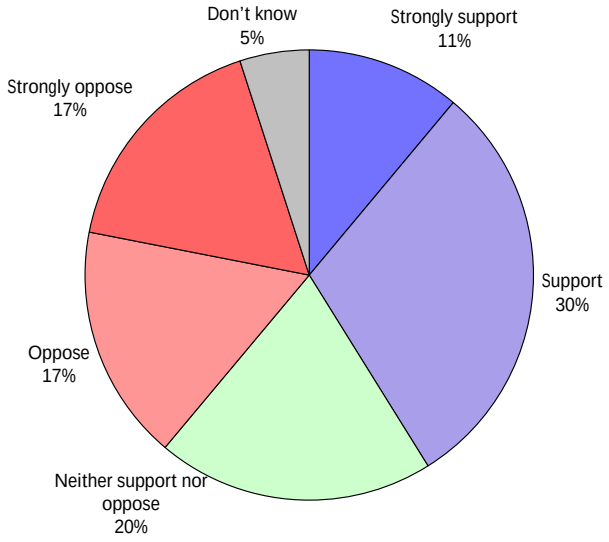
Londoners were also asked their opinion about the levels of congestion in their own local area, which covered the full diversity of residential areas in London. Here, about one third (32 percent) felt that traffic congestion in their local area had got worse over last year, whilst only 7 percent thought that it had improved.

Support for the western extension zone

Around 41 percent of *Londoners* supported the introduction of congestion charging within the extension zone, and around 35 percent opposed it (Figure 13.4). As frequency of travel into the western extension zone by car or van increases, the proportion of respondents who strongly opposed the introduction of the extension scheme also increases. In contrast, 42 percent of respondents who never drove into the western extension zone were supportive of the extension to the charging zone.

Western extension users were fairly evenly divided in their support of the western extension, with 47 percent of the *western extension users* supporting it, and 41 percent opposing it. Resident/worker respondents to this survey were slightly more in favour of the proposal (54 percent), while visitors were slightly more opposed to it (49 percent). 'Hard to reach' respondents were similarly divided, with 39 percent supporting the proposal and 37 percent opposing it.

Figure 13.4 Support for the western extension zone. Londoners Survey, January-February 2007.



Base: All respondents (2,401)

13.6 Travel behaviour

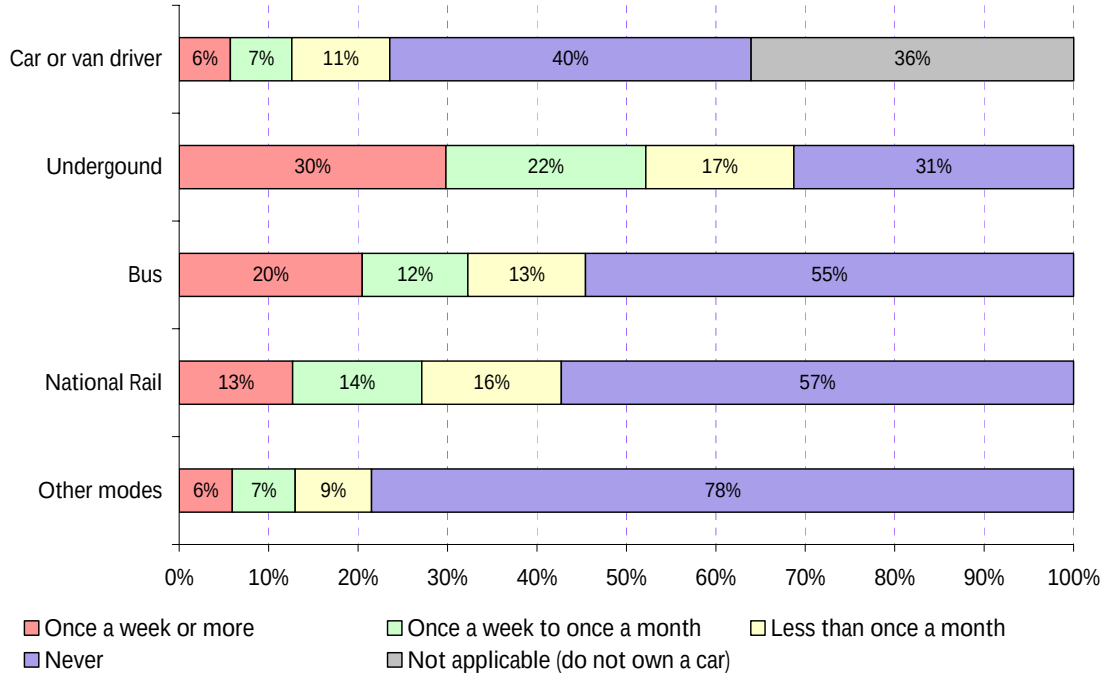
The following sections describe broad travel behaviour patterns by respondents to the two principal social impacts surveys. Although the numbers involved cannot be taken as precisely quantifying these aspects, they are indicative in a broad sense and helpful in understanding existing behaviour patterns that will condition both attitudes and responses to the western extension scheme.

Frequency of travel to, from or within the original central London and western extension zones by mode

Figures 13.5 and 13.6, taken from the Londoners survey, show the frequency of travel by mode, to both the original central London congestion charging zone (charged in 2006) and the western extension zone (uncharged in 2006) during charging hours.

Of those who travel to the original central London zone frequently (more than once a week), two-thirds do so by public transport. Only 6 percent do so by car or van. Bearing in mind that this is a survey of Londoners, large proportions of people do not travel on a frequent basis to the original charging zone. So, only one-quarter of *Londoners* travel to the original charging zone by car over the course of a year, compared to just over one-half by bus and three-quarters by Underground.

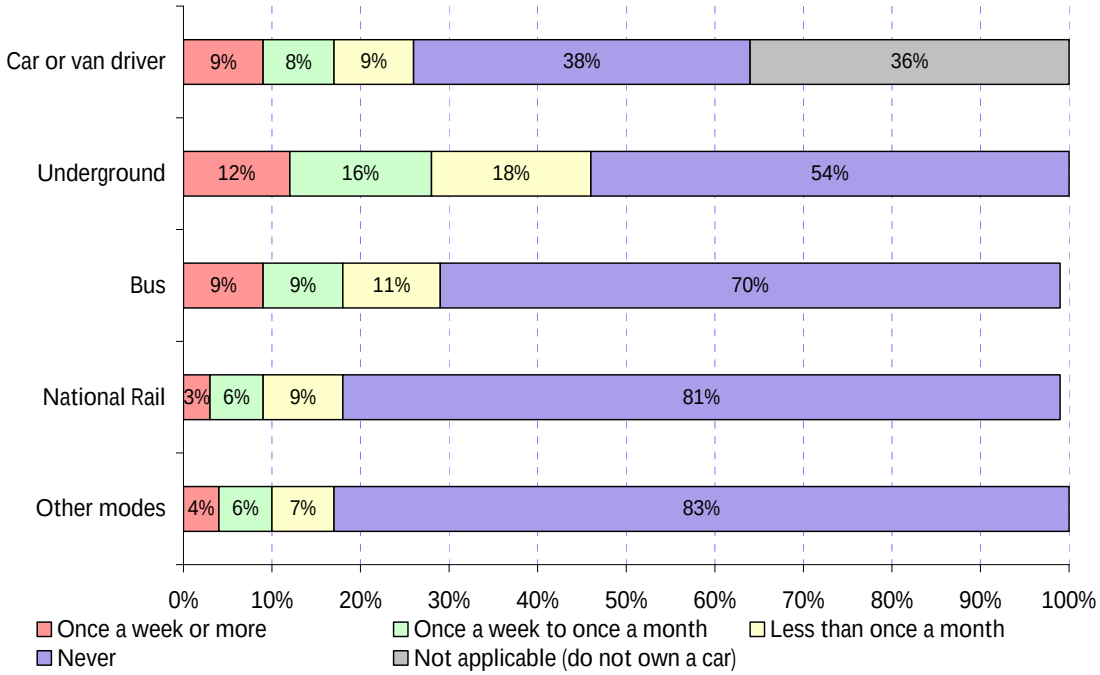
Figure 13.5 Frequency of Londoners' travel into the original central London congestion charging zone during current charging hours (07.00-18.30). Londoners Survey, January-February 2007.



*Base: all respondents (2,401)

The pattern is similar in respect of *Londoners'* travel to the western extension zone. Here, the overall frequency of travel is lower, as might be expected in comparison to the central zone. Around one-quarter of Londoners made at least one car or van trip to the extension zone over the previous year, with only 8 percent making car or van trips once a week or more. Within the overall picture of reduced trip numbers, the frequencies for individual modes reflect the different possibilities for trips within London in the extension zone compared to the original central London zone (Figure 13.6).

Figure 13.6 Frequency of Londoner's travel into the western extension zone during future charging hours (07.00-18.00), Londoners Survey, January-February 2007.



Base: all respondents (2,401)

Importantly, therefore, changes to travel arrangements in central London will only directly or significantly affect a relatively small proportion of Londoners, and only a sub-set of these who are frequent car or van drivers to the zones would be affected on a regular basis by either the original or extended congestion charging zones.

Travel to, from or within the western extension zone by mode and user type

Western extension users are more likely to use the bus for travel to, from or within the extension zone than any other mode of transport (Table 13.1), although the proportion of travel by car or van is higher than for *Londoners* in general, accounting for 19 percent of all trips. This is a reasonable reflection of the greater inclusion of western extension residents in this survey, the plentiful availability of bus services and comparatively limited National Rail facilities.

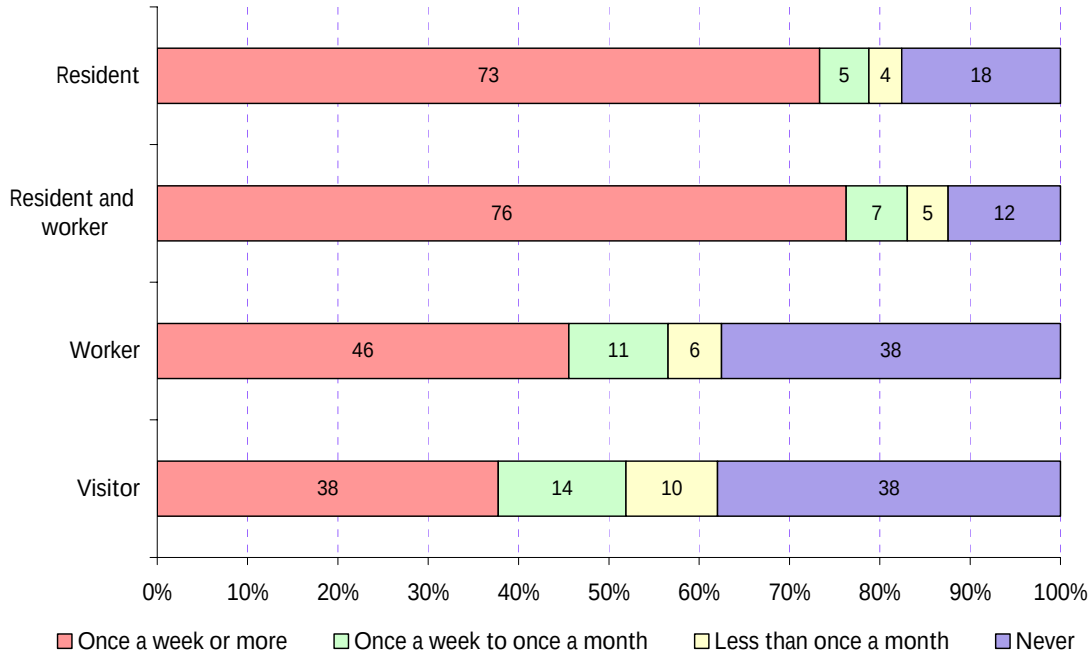
Table 13.1 Frequency of travel in or into the western extension zone during future charging hours (07.00-18.00) by mode. Western extension users survey, Wave 1, column percentages.

	Bus	Car or van driver*	Underground	Cycle/ motorcycle
Once a week or more	57%	56%	52%	13%
Once a week to once a month	11%	10%	14%	2%
Less than once a month	5%	6%	6%	1%
Never	27%	28%	28%	85%
Total (count)	4,105	2,032*	4,105	4,105
Percentage of the total trips made by these modes	38%	19%	35%	9%

* Base: those who drive (approximately 50 percent of respondents).

Of those western extension users survey respondents who drove in the western extension zone on at least one occasion per year, resident and resident/worker respondents tended to drive in the western extension zone during future charging hours more frequently than did other western extension zone users. About three quarters (76 percent) of resident/worker drivers drove in the area at least once a week, with 43 percent doing so every weekday. For resident drivers, 73 percent drove in the area at least once a week, with 33 percent saying they did so every weekday. Figure 13.7 shows the frequency of driving in the western extension zone during charging hours by western extension user type, taking as a base all those respondents who drove at least once in the extension zone.

Figure 13.7 Frequency of driving in or into the western extension zone during future charging hours (07.00-18.00). Western extension users survey Wave 1, respondents who drive at least once a year.



Base: those who drive 2,001
Residents: 475 Workers: 680 Resident/workers: 377 Visitors: 470

Mode and purpose shares for trips to the western extension zone differ between survey respondent groups. Tables 13.2 and 13.3 relate to the primary reasons for travel given by respondents. Therefore, they do not reflect actual trip numbers, but the primary motivation for all people who make trips, irrespective of either the purpose or frequency. Therefore, a once-yearly shopping trip will have the same 'weight' in these tables as a daily commuting trip.

Bearing this in mind, of *Londoners* who make at least one shopping trip to the extension zone, for example, almost one-fifth will have travelled by car, one quarter by Underground and one-third by bus (Table 13.2).

Table 13.2 Primary reasons for respondents travelling to, from or within the western extension zone during future charging hours (07.00-18.00). Londoners Survey, January-February 2007, column percentages.

Reason for travelling	Mode of travel			
	Underground	Bus	Car	All modes
Shopping	24%	30%	18%	24%
Work commuting	19%	17%	20%	18%
Entertainment (eg cinema, theatre)	10%	10%	6%	9%
Meeting friends/relatives	18%	18%	23%	19%
Other	30%	26%	34%	30%
Sample base	1,041	657	561	2,260
Percentage of trips	46%	29%	25%	100%

Similarly, as shown in Table 13.3, 42 percent of *western extension users* travelled primarily for commuting purposes. Of these, and for most other trip purposes, the mode shares are approximately equal, indicating that *western extension users* have considerable flexibility in the modes available to them for any given trip purpose.

Table 13.3 Mode of travel to the western extension during future charging hours (07.00-18.00) by reason. Western extension users survey Wave 1, column percentages.

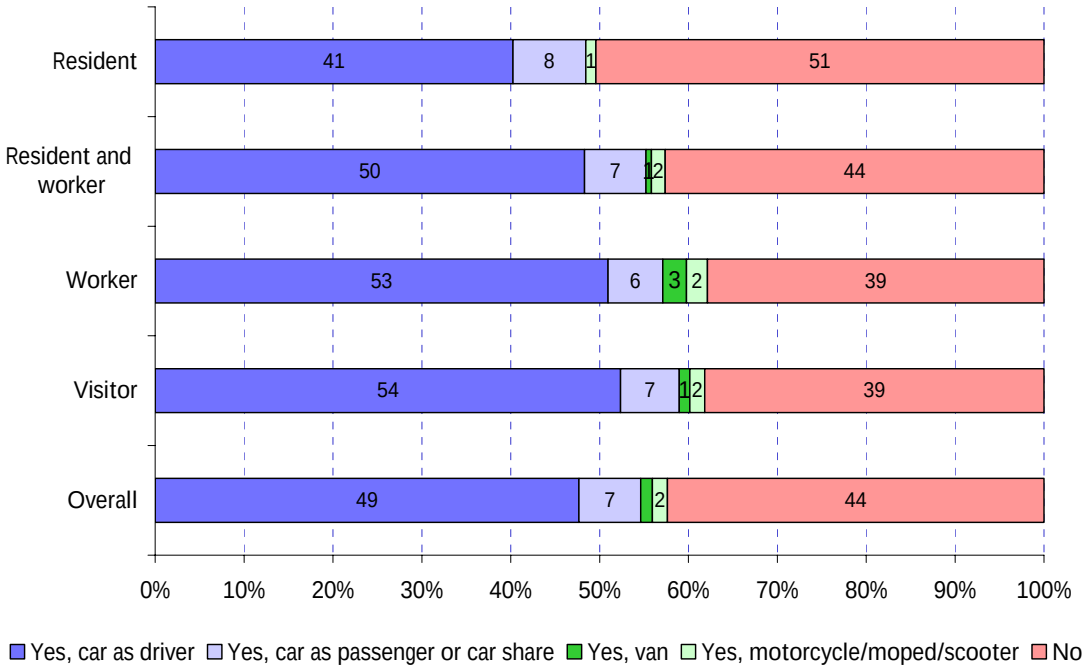
Reason for travelling	Mode of travel				
	Underground	Bus	Car	Other	All modes
Shopping	12%	20%	16%	8%	16%
Work commuting	45%	39%	39%	48%	42%
Entertainment (eg cinema, theatre)	8%	8%	4%	9%	8%
Meeting friends/relatives	13%	11%	12%	10%	12%
Other	22%	20%	30%	25%	23%
Sample base	2,878	2,893	1,462	622	7,819
Percentage of trips	37%	37%	19%	8%	100%

Access to cars/vans, parking and congestion charging payments

- 63 percent of *Londoners* stated they had access to a car for their own use, whilst one percent had access to a van. These proportions are slightly lower than the 2001 Census average.

- In addition, residents within the western extension zone are more likely to have access to a car or van than people living within the original central London zone (53 percent compared to 40 percent).
- More than half (58 percent) of the *western extension zone users* said that they had access to a car, van or powered two-wheeler for their own use (Figure 13.8). About half (49 percent) said they have access to a car while 44 percent said they had access to none of these.

Figure 13.8 Access to car, van or powered two-wheeler for personal use. Western extension users survey Wave 1.



Base: (4,021) Residents: (1,158) Workers: (1,255) Resident/workers: (746) Visitors: (862).

- Residents in the western extension zone and the original central London zone are less likely to have access to off-street parking (53 percent and 38 percent respectively), compared to Londoners survey respondents living in other areas of London (66 percent).
- Amongst *Londoners* who frequently drive (once or more per week) in the western extension zone, nearly two thirds (65 percent) personally paid for parking in the western extension zone. Of those *western extension users* who said they drove in the western extension zone during charging hours, 43 percent said they personally paid for parking in the western extension zone.

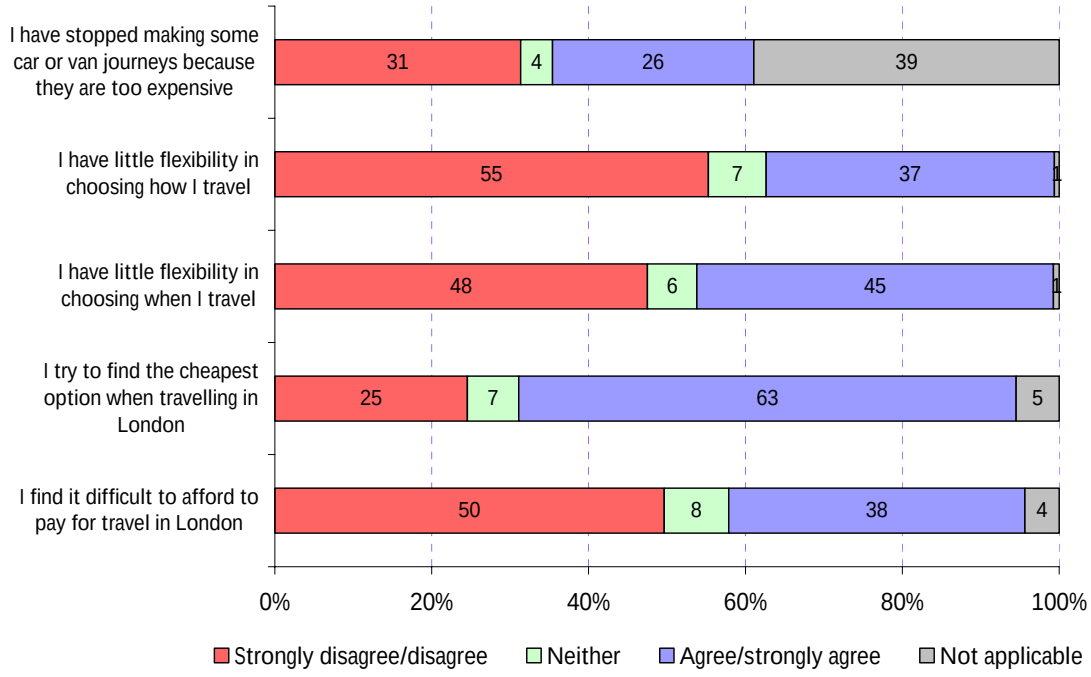
Affordability and flexibility of travel in London

- Responses from both surveys in this area are generally in line with what might be expected. Around 63 percent of the *western extension users* and 67 percent of *Londoners* agreed that they try to find the cheapest option when travelling in London, and 38 percent and 49 percent of the respondents respectively, agreed that they find it difficult to afford to pay for travel in London.

- Affordability was found to correlate with household income.
- Many respondents thought that they have little flexibility in terms of choosing how they travel, with 37 percent of *western extension users* and 40 percent of *Londoners* agreeing with this statement. They were more evenly split with regard to flexibility of time of travel, with 45 percent agreeing that there was little flexibility and 47 percent disagreeing with this statement.
- *Londoners* whose main purpose of travel is commuting (48 percent) or travelling for business (54 percent) are less likely to be flexible in their mode of travel than those travelling for other purposes (35 percent). Additionally nearly half (46 percent) of people that work full time are inflexible about their mode of travel.
- People who travel frequently (once or more per week) into the original central London zone by car during charging hours are more likely to have little flexibility in their choice of travel time or travel mode.

Figure 13.9 shows the proportions of *western extension users* agreeing with a selection of statements about affordability and flexibility of travel in London.

Figure 13.9 Level of agreement with statements about affordability and flexibility of travel in London. Western extension users survey Wave 1.



Base: 4,021

Projected changes in travel behaviour as a result of the western extension zone

Londoners were asked the extent to which they expect their travel behaviour to change in future following the introduction of the western extension scheme.

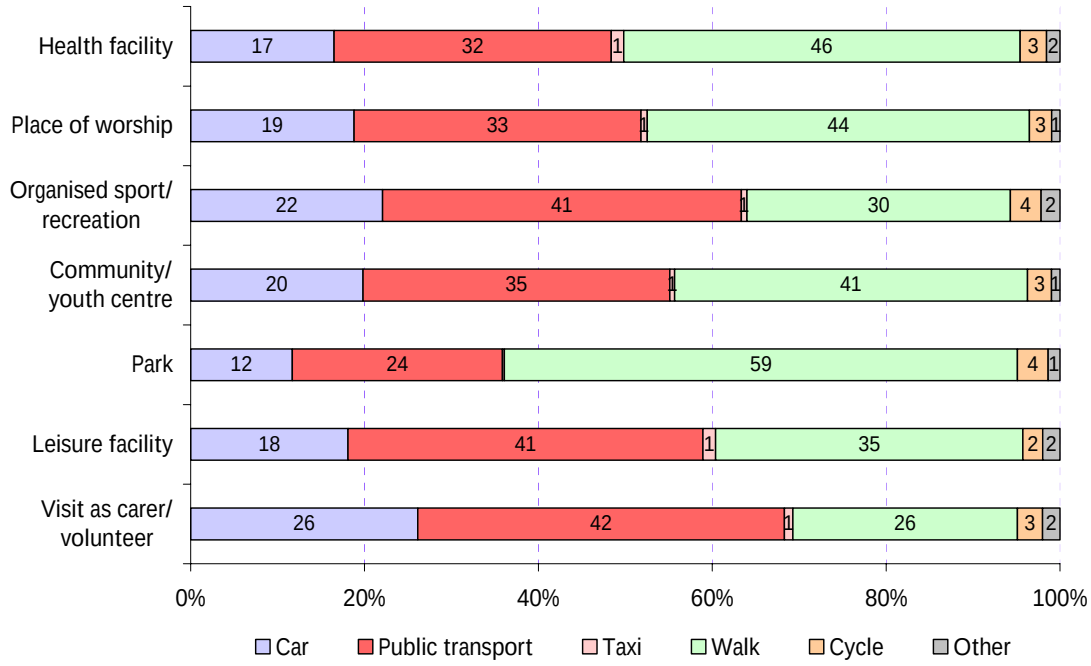
- Approximately three quarters (72 percent) of respondents felt there would be no change in the number of car journeys they made into western extension zone.

- Around 18 percent stated they would make fewer journeys following the introduction of the extension scheme.
- Ten percent of people were not sure of how their journeys would change, and less than 1 percent said they would make more journeys.

13.7 Access to facilities

Western extension users were asked for their normal mode of transport when using local services and facilities (Figure 13.10). Walk and public transport were the most commonly used modes for all journey types, with car accounting for typically less than one fifth of these trips. The highest proportion of car use (one quarter of trips by car) was for trips involving visits as a carer or volunteer.

Figure 13.10 Normal mode of transport to access local services or facilities. Western extension users survey Wave 1. Proportions relate to those who undertook each activity only.



Health facility: 2,092
Place of worship: 802
Organised sport/recreation: 1,219
Community/youth centre: 360
Park: 2,980
Leisure facilities: 2,950
Visit as carer/volunteer: 462

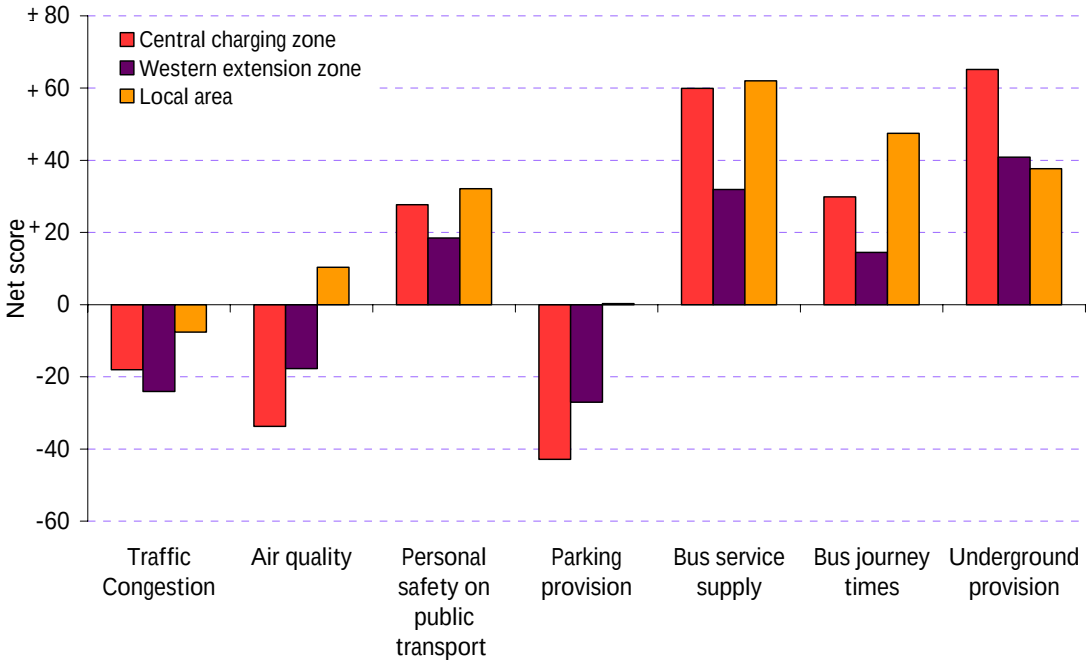
Western extension users were asked whether they expected the frequency of their trips to local services and facilities to change because of the introduction of the extension zone. The majority (more than 80 percent for each trip purpose) said they did not expect the frequency of these trips to change, but a small proportion of respondents said that they expected to make fewer trips as a direct result of the introduction of the extension scheme.

13.8 Impact of the western extension scheme on local services and the local environment

This section discusses the comparative perceptions of transport provision and local amenity in London, looking at the western extension zone, the original central London zone, and respondents' own local area of residence (all Londoners survey respondents). This includes perceptions of the provision of bus and Underground services, safety on public transport, traffic congestion and air quality. Figure 13.11 shows net scores for a range of transport and environmental attributes.

The original central London zone is perceived more favourably compared to the western extension zone for the majority of attributes, with the exception of air quality and parking provision.

Figure 13.11 Ratings of aspects of service provision and the environment. Londoners Survey January-February 2007. Net scores, % negative responses taken from % positive responses.



13.9 Western extension supplementary surveys

This is a suite of small-scale qualitative and quantitative surveys designed to measure the impacts of the western extension scheme on groups whose travel behaviour patterns and needs differ from that of the rest of the population. The coverage includes: shift workers; groups on whom the impacts have particular public policy significance, such as key workers; and groups who may find it difficult to participate in a large scale social survey, particularly those that may be disproportionately affected, such as disabled people and carers.

Prevalence of shift work and key workers

- Overall, 15 percent of *Londoners,* or 22 percent of *Londoners* respondents in employment, stated that they did some shift work, with 10 percent of the total respondent population working shifts all or most of the time, and 5 percent working shifts occasionally.
- One-third of workers within the western extension zone worked shifts at least occasionally; one-sixth worked shifts all the time. Over a quarter of workers in the original London congestion charging zone worked shifts at least occasionally, and 24 percent of people who worked outside the extended charging zones worked shifts some of the time.
- Twelve percent of Londoners survey respondents worked in occupations classified as 'key' (17 percent of all employed people), with the large majority of these either NHS clinical staff or teachers.
- Over one-third of people in key worker positions worked shifts at least occasionally, with over one-quarter 'always' working shifts. This compares to 22 percent of non-key workers who 'sometimes' work shifts.
- Eleven percent of key workers regularly travelled into the original central London zone as part of their job at the time of the survey. However, the majority of key workers interviewed who travelled into the original charging zone did not use a vehicle that was exempt from the congestion charge, and most pay the charge themselves with no employer reimbursement.

The key workers survey and shift workers surveys

For the key workers survey, 1,094 key workers employed in the original central London zone and the western extension zone were interviewed during Summer and Autumn 2006. These surveys covered seven different organisation types and the content focused on the implications for the working lives of those involved.

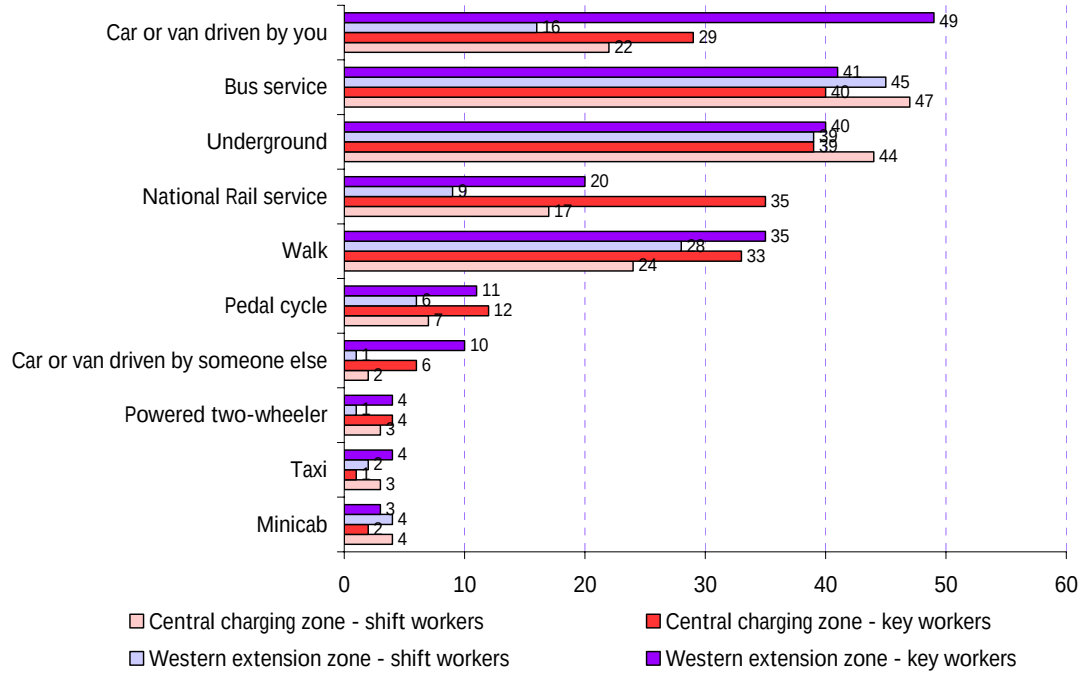
For shift workers, 127 people employed by 86 organisations in the original central London zone and 124 people employed by 87 organisations in the western extension zone were interviewed during Autumn 2006. These groups will be revisited following introduction of the extension, during Summer and Autumn 2007.

Travel to work patterns of key and shift workers

Figure 13.12 shows the mode share patterns for travel to work of the different groups of key and shift workers in the supplementary surveys.

Bus and Underground are the most frequently used modes overall, with proportions being relatively consistent across respondent categories. Car (either as driver or passenger) is typically used by just under one-third of these workers. Notably, however, this proportion is greater than half for key workers in the western extension zone. Around one-third of these workers typically walk to work, and less than one in ten take a taxi or minicab.

Figure 13.12 Mode of transport to and from work. Key worker survey and shift workers survey.



* Sample sizes: Central charging zone key workers = 526, Central charging zone shift workers = 127, Western extension zone key workers = 568, Western extension zone shift workers =124.

Cost of travel in London

- Shift and key workers view the cost of travel in London as a significant issue for them; about half of key and shift workers (53 percent) agree that they find it difficult to afford travel costs. They try to minimise their travel costs, with 67 percent key workers and 62 percent shift workers trying to find the cheapest option when travelling in London.
- Around half view public transport as the easiest way to travel around London. Those currently using less expensive forms of transport to get to work such as buses, walking or cycling are more likely to look for the cheapest travel options than those who use a car or rail.

Key and shift workers attitudes towards congestion and congestion charging

- Traffic congestion is considered to be a problem in the original London congestion charging zone by a majority of the key and shift workers who are based there. Few believe however that the original central London congestion charging scheme has had much impact on their own journey times.
- Around half of shift and key workers who work in the western extension zone consider local traffic congestion to be either a 'fairly big' or 'very big' problem, somewhat lower than the proportion who currently hold the same view about the original zone.
- Traffic congestion and the congestion charge are the most frequent reasons given for not driving or considering driving into the central London congestion charging zone.

- The introduction of the original central London congestion charging scheme has not had a significant impact on how key and shift workers based there travel to work. Fewer than one in 20 shift workers and less than one in 10 key workers claim they have changed the mode of travel they use to commute to work following the introduction of the original scheme.
- Around three in five shift workers currently working in the original central London zone have changed their place of work since the scheme was introduced, compared with just over a third of key workers. Although this demonstrates the high rate of 'background' change to the central London workforce, for reasons unrelated to congestion charging, 11 percent of key workers and 3 percent of shift workers, who have changed their place of work, claim that the original congestion charging scheme had been an important factor in their changed workplace location.
- However, one in two shift workers and one in five key workers in the original London congestion charging zone have started working in the zone since the original scheme was introduced.

The western extension zone

- Key and shift workers employed in the western extension do not feel that the extension scheme will impact significantly on how easy it is to travel in the area, perhaps reflecting a tendency to travel predominantly outside charging hours.
- Nine percent of key workers and 5 percent of shift workers based in the extension zone plan to change how they get to work once charging is introduced.
- Key workers who currently use a car to get to work are most likely to say that they will change their travel method; one in six western extension zone key workers who drive every day plan to change how they travel to work.
- Around three times as many western extension zone key workers believe their daily commute to the newly extended zone will take them more (29 percent) rather than less (11 percent) time.

People with travel-related disabilities and carers

In-depth interviews lasting around one hour each were carried out with 61 disabled people and carers resident in the original central London charging zone and the western extension zone. The interviews explored the attitudes and experiences of disabled people and carers towards travel in London, and the impact of this travel experience on their quality of life. This is a piece of qualitative research, and, as such, aims to provide an understanding of the breadth of experience, rather than a quantification of how prevalent such experiences may be.

People with disabilities are not a homogeneous group, and their transport needs and views of the scheme are not the same. Respondents to the survey reflect a diverse population in terms of age, type of disability and working status. Some of the respondents qualified for a Blue Badge, allowing them free parking and a 100 percent discount on the congestion charge.

Experience of travel by public transport

In many ways, the experiences and attitudes of disabled people mirror those of the wider population. However, travelling by public transport can be particularly problematic for disabled people for a number of reasons, including accessibility of services such as stations; not being able to find a seat; and a shortage of announcements or visual displays on buses and some Underground lines. Many of the survey respondents expressed concerns about 'softer' aspects of the way in which services were delivered by staff. Respondents found great reassurance when a member of staff was friendly and helpful; conversely, bad experiences with rude or unhelpful staff members could deter respondents from travelling on public transport again.

Some respondents did identify that there had been improvements in public transport provision since the introduction of congestion charging, although others had found that increased overcrowding exacerbated the problems they already experienced. Some had found that taxi companies had increased their fares to cover the congestion charge (although licensed taxis are exempt from the charge), whilst others felt that reduced journey times had reduced costs.

Experience of travel by car

For many respondents, travelling by car, either as a driver or passenger, was the best option in London – some said that they would be housebound without it. The perceived benefits of travelling by car were the 'door-to-door service' and independence available. For those who did not travel by car, the main reasons cited were cost or that their disability prevented them from driving.

Impact of the central London congestion charging scheme

In general, respondents felt that they had all the information they needed about the operation of the congestion charging scheme, and were happy that they knew how to access further information if required. Most of the disabled people interviewed said that the central London congestion charging scheme has not had a noticeable impact on their travel arrangements as they either do not use a car or, if travelling by car, are exempt from paying the charge through the Blue Badge scheme.

Some respondents resident in the central London zone have found that their friends and family are less likely to visit them during charging hours, especially where people may previously have made short, casual visits. It is felt that such visits have been made more difficult in terms of both the cost and the inconvenience of paying the charge. The cost and difficulty of parking was also mentioned as a factor.

Many respondents explained how they feel anxious about asking people to visit or help them as the charge makes them feel that they are imposing on people. One respondent mentioned that he feels so guilty about his visitors having to pay the charge that he offers to pay it, which can cause embarrassment. For some, this concern could be alleviated if they were aware that they can register other people's cars on a Blue Badge.

There were also many for whom visits have not been greatly affected as their visitors are able to come in by public transport or only tend to visit in the evenings or at weekends anyway.

Anticipated impact of the western extension to the charging zone

The anticipated impact of the western extension reflects the experience of the central London scheme. Most disabled residents of the western extension area do not expect their travel to be affected as they are either exempt from the charge or do not drive.

The main concern raised was that friends and family will visit less often and that disabled people will feel guilty about asking people to visit or help if they know they will be charged to do so. One respondent expressed concerns that she would find it more difficult to recruit carers when the extension comes into affect.

Those interviewed made a range of suggestions about how the congestion charging scheme, and transport provision in general, could be improved to help disabled people and carers.

13.10 The western extension roadside interview surveys

Roadside interviews are a standard transport survey technique in which a controlled sample of drivers are stopped at the roadside and invited to complete a short questionnaire. The questionnaire covers key information including: trip origin, destination, main and secondary trip purpose, congestion charging payment options and follow-on trips. In addition, basic socio-demographic and contextual information (vehicle type, time of day, vehicle occupancy) are observed by the roadside surveyors. Drivers who volunteer contact details can be re-contacted at a later stage and invited to participate in a follow-on survey designed to probe one or more aspects of travel behaviour (eg responses to the extension scheme) in greater depth than is possible at the roadside.

Because the survey sample relates to traffic counts collected elsewhere in the monitoring work, and the statistical properties of the achieved sample are therefore known, it is possible to analyse and treat survey responses so as to be representative, of travel to, from and within the extension zone.

To this end approximately 35 sites, involving approximately 14,000 respondents and giving a large and representative sample of observed travel to the western extension zone, were surveyed in Autumn 2006, and will be surveyed again in 2007. The principal objective of this work is to obtain comparative outputs describing the characteristics of travellers who were both observed in the zone on a representative day (before and after implementation) and whose relationship to the total body of travellers is known. By comparing data obtained after the implementation of the extension with that obtained before, observed change across a dozen or so key ‘dimensions’ should be quantifiable. These dimensions include:

- Before and after implementation of the western extension zone.
- Survey location, vehicle type, occupancy and time of day.

- Origin, destination and basic trip routeing.
- Primary and secondary trip purpose and trip chaining (eg daily frequency).
- Congestion charging payment details and exemption or discount status.
- Home and work location.
- Industry sector (for work-related trips only).

13.11 Summary of key points

A programme of social research has been put in place to explore the impacts of the western extension, building on the experience and lessons learned with the social impacts work for the original central London congestion charging scheme. The research focuses on aspects of the daily lives and behaviour of Londoners and those most likely to be significantly affected by the extension scheme. The work uses two core surveys undertaken at intervals before and after implementation of the extension, together with a number of supplementary surveys. The two core surveys are supported by a number of supplementary surveys designed to probe impacts on specific groups in more depth than is possible through the core surveys.

There is particular focus on the more robust quantification of travel behaviour change through a large-scale programme of roadside interview surveys in and around the western extension.

Survey waves undertaken before the introduction of the extension scheme provide interpretative material, allowing developments following implementation on travel behaviour patterns, as well as the impacts on peoples' daily lives, to be understood.

Part 3:

Western extension zone: the first three months

14. Western extension zone: the first three months

14.1 Introduction

The western extension to the central London congestion charging scheme was introduced on Monday 19 February 2007, following two years of planning, consultation and preparation by TfL, its consultants and service providers. From the outset all major features of the extended scheme operated well, with no major problems or difficulties reported. This has continued to be the case.

This section presents a synopsis of TfL's early experiences with the extended scheme. It firstly looks at some key measures reflecting the operational aspects of the extension. It then proceeds to give an overview of traffic changes over the period to early June 2007, reflecting approximately three months' operation. Finally, initial findings from TfL's first comprehensive surveys of congestion in the extension zone are described.

14.2 Three months on: a summary

- From the outset all major operational and traffic management aspects of the extended scheme functioned well, reflecting thorough preparation by TfL and its contractors. This has continued to be the case.
- Key indicators reflecting scheme operation, such as the residents' discount registration process, the number of charges paid, call centre performance and enforcement activity are all closely aligned with TfL's expectations, with no adverse trends of note.
- Traffic entering the extension zone is down by between 10 and 15 percent against comparable pre-extension data. This is in accord with TfL's expectation.
- Traffic on the free passage route between the existing and extension zones is effectively unchanged in aggregate volume terms. This is in line with TfL's expectation.
- Traffic on the remainder of the western extension boundary route has increased in aggregate by up to 5 percent, although this varies by location and week. In general, this is in line with TfL's expectation and, due to planned traffic management around the boundary, there is no evidence of traffic operational problems on this key route.
- There is some evidence from more recent counts that traffic entering the original central zone has increased, by up to 4 percent. This may in part reflect increased discounted trips to and from the original central zone from western extension residents, but the same trend is not yet apparent for traffic circulating within the central zone. TfL's expectation was for increases here of about 2 percent.
- The first comprehensive survey of congestion in the western extension zone gives a representative reduction of 20-25 percent over equivalent conditions before implementation, compared to TfL's expectation of reductions in the range 17 to 24 percent, based on a night-time (uncongested) travel rate of 1.8 minutes per kilometre. Equivalent data for the original central zone does not yet reveal any

measurable 'consequential' congestion impacts, although the picture here is complicated by wider trends affecting congestion in central London.

- Although much of these indicators are preliminary and must therefore necessarily be treated with due caution, the initial feedback is encouraging, with most early indicators broadly in line with TfL's range of prior expectations.

14.3 Operation and enforcement of the extension scheme

The western extension was an enlargement to the existing central London zone. Therefore, all developments to the operation of the scheme outlined below are based on the increased volume of chargepayer activity for the enlarged (combined) zone rather than the western extension area alone.

Developments during 2006 for the original central London zone, reflecting steady-state operation of the original scheme, are considered in Section 7 of this report.

Resident discounts

The first date by which residents of the extension zone and associated 'buffer areas' could apply for the 90 percent residents discount was 9 October 2006. There were several reasons why TfL encouraged early registration:

- previous experience with the original central London scheme, where residents left it very late to register;
- to reduce the impact on TfL's main service provider, Capita, having to process large volumes of applications in a short space of time (thereby minimising risk of errors being made);
- to reduce the risk of Penalty Charge Notices being issued to residents due to processing errors or delays in receiving applications.

Two incentives were offered to encourage early registration:

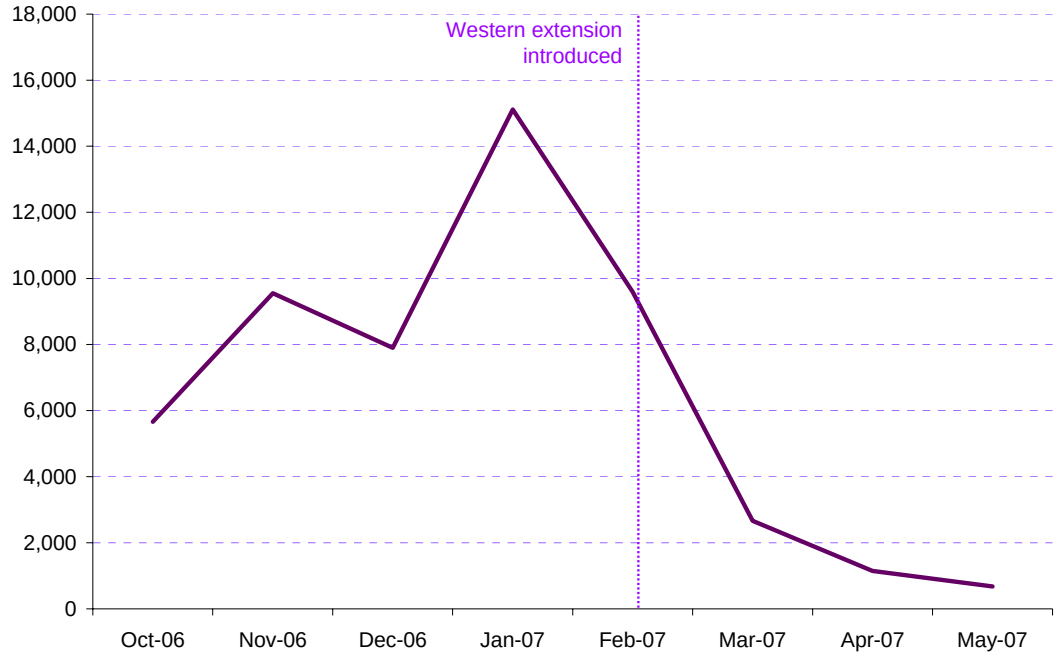
- the ability to pay the charge at the discounted 90 percent rate and have use of the central London congestion charging zone from the date of successful registration;
- the £10 registration fee was waived for all successful applications received before 19 February 2007.

A multi-media approach was used to inform extension zone residents of this opportunity, involving the direct mailing of leaflets, local press, radio, posters on bus shelters and road shows in the extension area. Road shows from October 2006 through to March 2007 answered residents' queries and provided key information about how the scheme operated.

In early October 2006 residents were sent an information leaflet with an application form and reply paid envelope. The information leaflet explained how the discount worked, as well as other key pieces of information, eg how to pay the charge and the change to the hours of operation of the extended scheme. Follow up activity took place at the end of November, targeting residents who had still not registered for the discount.

Various enhancements to the discount application process led to a decrease in the volume of rejected applications from that previously experienced with the central zone scheme. A total of 52,400 western extension zone residents discount applications were successfully approved in the run up to the implementation of the extension which, due to the successful public information campaign, was slightly ahead of TfL's projections (Figure 14.1).

Figure 14.1 Approved residents discount applications (western extension eligible residents only).



Other discounts

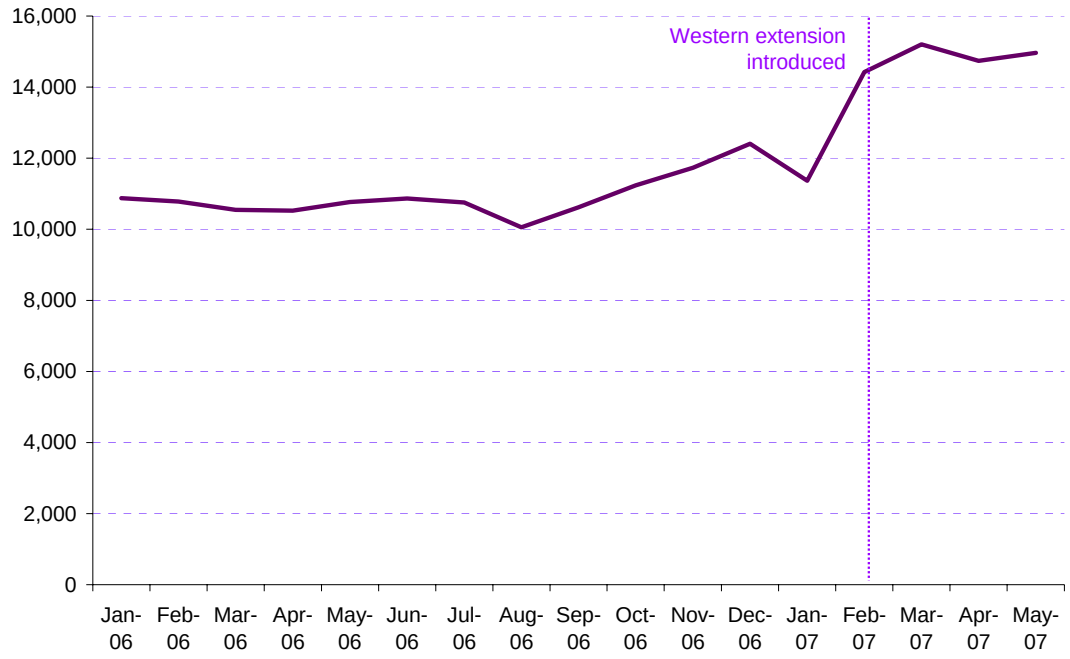
Alternative fuel discount applications increased throughout 2006 and early 2007. However, since the alternative fuel discount is offered to all chargepayers regardless of their place of residence, the extension did not have a great impact on the aggregate number of applications received. The total number of active alternative fuel discounts in May 2007 was about 13,700.

Blue Badge discount applications, which allow a 100 percent discount, increased slightly in the run up to the introduction of the western extension. The total number of active Blue Badge accounts in May 2007 was around 113,700.

Quality of service

Calls received to the call centre peaked at about 24,000 on implementation day – 19 February 2007. However they quickly reduced to forecasted volumes from 20 February onwards. An average of 15,000 calls are typically received each charging day (Figure 14.2), which is 33 percent higher than the average volumes prior to the introduction of the western extension, in line with TfL's expectations.

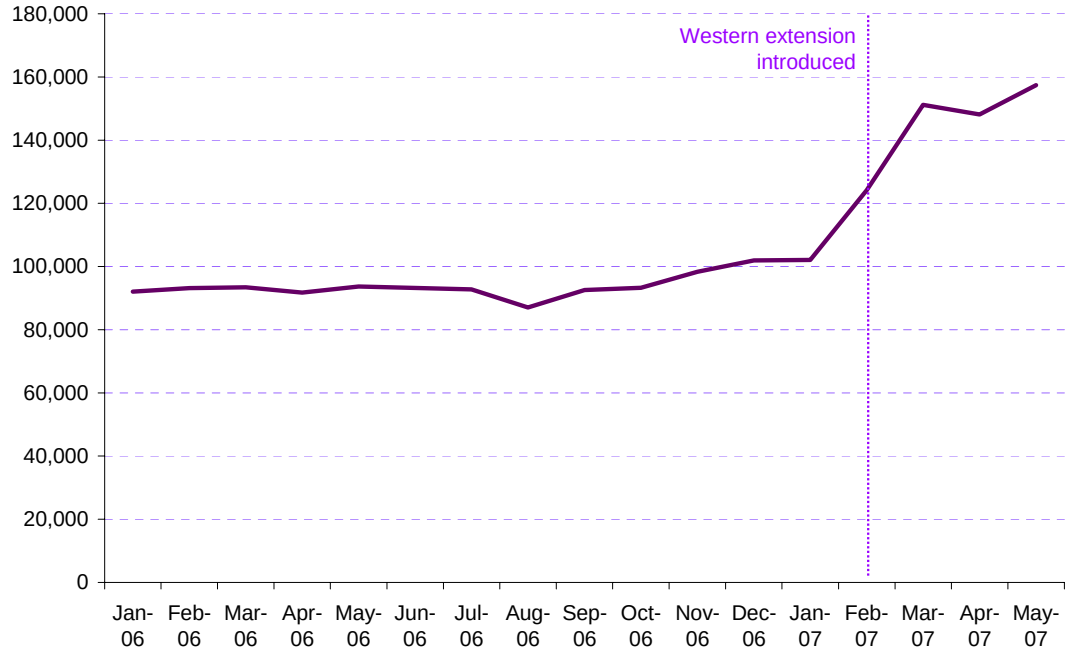
Figure 14.2 Average number of calls received at the congestion charging call centre per day.



Largely as a result of the additional call centre staff recruited to cope with the higher number of calls due to the western extension, average queuing time remained low – at around 4 seconds. This was well within contractual and operational targets.

Charge payments

Figure 14.3 Average daily valid charges including residents' and fleet vehicles. January 2006-May 2007.



Charge payments, including residents and fleet, have typically increased by 53,000 per charging day since 19 February 2007 (Figure 14.3). Average valid charges per charging day are now around 150,000. This is 55 percent higher than pre-western extension average figures.

Enforcement and compliance

The process for enforcing the western extension scheme is exactly the same as that for the central London charging zone, which is described in more detail in Section 7.

It is still too early in the enforcement process to fully understand the impact of the extension to the zone in terms of compliance, Penalty Charge Notice volumes, overall payment, representation or appeals rates.

Image capture

A new service provider – Siemens – was appointed by TfL following a competitive tender process to provide the cameras for enforcing the extension zone. The Siemens contract commenced in September 2005 and a Supplemental Agreement was negotiated with Capita, TfL's main service provider, to manage the Penalty Charge Notice issue process and build the interfaces required with Siemens to collate images from this new enforcement infrastructure.

The new technology delivered by Siemens resulted in a move away from an analogue system. Here, the cameras on street are individually linked by hard fibre communications to automatic number plate reading systems in a central hub (as in the original central zone scheme). The new configuration used self-contained camera and automatic number plate reading units at the roadside. These were connected to a single 'in-station' by digital broadband.

This brings many advantages including:

- lower communication costs;
- fewer roadworks required in laying hard fibre communications;
- greater resilience in communications (eg less risk of road works cutting through fixed cables);
- 'disaster recovery' link to all cameras, and no need to buy duplicate automatic number plate reading systems;
- greater flexibility of location and reduced floor space required in data centres.

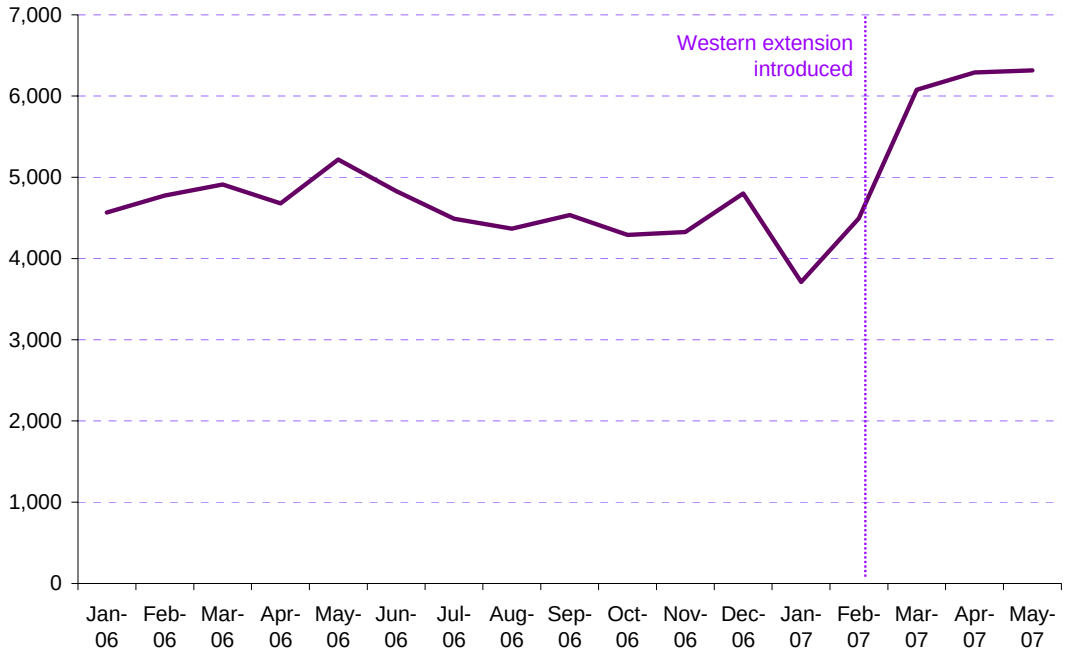
There are a total of 667 individual cameras at 137 locations covering every entry and exit point to and from the western extension zone, as well as at selected locations within the extended zone itself. These are additional to the similar number of cameras used for enforcing the original central zone scheme. Under their contract with TfL, Siemens collate all images from the system, with only the necessary images ('contravention candidates') being passed to Capita throughout the day. Once received, the Siemens images are combined with all Capita captured images gathered from the original central zone and are then processed in accordance with existing procedures.

Figure 14.4 Western extension automatic numberplate reading enforcement camera site.

Penalty Charge Notices

Over the three months since the introduction of the western extension, the average number of Penalty Charge Notices issued per charging day has risen to about 6,000 (Figure 14.5). This is up to 2,000 higher than prior to the western extension average, but is again broadly in line with TfL's expectations.

Figure 14.5 Penalty Charge Notices issued.



It is still too early to give a clear indication of the increased number of representations in respect of Penalty Charge Notices issued following the

implementation of the extension. However early observations are that the number of representations received have increased by 15 to 20 percent per charging day. Despite the increase in volumes, Capita's enforcement operation has managed to maintain the stringent quality levels and response times for consideration of representations that the contract with TfL demands.

There has been no apparent change in the behaviour of those who receive Penalty Charge Notices for non-payment of the charge since the introduction of the western extension. Early indications are that the overall payment rate for Penalty Charge Notices issued will remain above the established level of 70+ percent.

14.4 Early indications of the traffic impacts of the western extension

Changes to traffic levels and traffic characteristics are the most immediate reflection of scheme impacts. Unlike longer-term impacts on, for example, the local economy, a fairly immediate traffic response can be expected. Using automatic traffic counters, cameras and other methods, it was possible to measure and compare traffic levels during the very early days of the scheme. Indeed, initial feedback on traffic changes in the morning peak period was available to TfL by around midday on the scheme implementation day itself, and was important in building confidence in the early functioning of the scheme.

Available data and key limitations

Traffic monitoring during the early months of the extended scheme was specified as a short-term overlay on the longer-term traffic monitoring work described in Section 9 of this report. It primarily utilised permanent automatic traffic counters that had been placed at strategic points in and around the extension zone. About 50 of these were available, organised so as to provide a number of traffic volume indicators across key cordons and screenlines that corresponded to those for which traffic change forecasts had been made by TfL.

Counters were installed progressively during 2006, providing a baseline describing traffic conditions before implementation against which emerging data in the early months of the extension could be compared. An important limitation in this regard is seasonal variation in traffic levels. This complicates any assessment of change over, for example, the Winter/Spring period of interest, as average traffic volumes would normally increase, from below the annual average in January to above the annual average in Spring. Furthermore, comparison against traffic levels in 2006 necessarily has to assume that these levels were typical, which may not necessarily have been the case.

A further limitation is that counters could only be placed at a sample of sites, these in practice being the more major roads. Whilst thereby capturing a large proportion of the traffic of interest, there is the possibility of sample bias, meaning that the initial indicators of change may not be entirely representative of conditions on all roads, particularly the more minor roads. In particular, reduced congestion on these major roads may lead drivers who had previously used more minor roads to divert in preference, potentially causing automatic counter based indicators to under-estimate the degree of overall change.

Supporting information on traffic changes and initial indications of changes to average network speeds and congestion were available from a set of automatic number plate reading cameras located in and around the extension zone. Again, however, these were not available until very close to the implementation date. Whilst they were useful in providing early feedback on a day-by-day basis, the limited available 'before' data do not allow definitive conclusions on the traffic speeds or congestion impacts of the scheme from this source.

More recently, results have become available from the first of the bi-monthly moving car observer surveys following the implementation of the extension zone, as described in Section 10. Whilst not yet necessarily representing settled or longer-term conditions, these first results are commensurate with the traffic changes observed so far and are encouraging.

The following further indications of early scheme impacts were also available:

- Comprehensive indicators of traffic changes in the central zone, which may have arisen in response to the extension, from approximately 50 automatic traffic counters installed in association with the initial central zone scheme.
- Various short-term manual traffic counts, bus passenger occupancy counts and information from urban traffic control systems – each providing specific early feedback on aspects of scheme operation and impacts.

Continuing feedback from automatic traffic counters in particular is now building into a good indication of the early traffic impacts of the extended scheme. In general, the emerging impacts accord very closely with TfL's projections. These are summarised below in terms of the main strategic traffic indicators associated with the extension.

14.5 Traffic entering and leaving the western extension zone

TfL expected that the settled volumes of traffic entering the extension zone, in terms of vehicles with four or more wheels during charging hours (revised to be 07.00 to 18.00 on working weekdays), would reduce by between 13 and 17 percent against what would have been expected in the absence of the extension. In practice, this can be taken to be average conditions in the year or two before implementation. An assessment of settled conditions with the extension in operation would ideally need data from one or two years of operation, as longer-term traffic impacts may not emerge for several years. Short-term automatic counter based comparisons nevertheless provide a good early indication of these impacts, bearing the above limitations in mind.

The automatic traffic counters contributing to this indicator were installed in two phases. The first set, covering the part of the extension zone boundary largely in the City of Westminster, were fully installed from February 2006. The remainder, mainly covering that part of the boundary in the Royal Borough of Kensington and Chelsea, were not fully available until late October 2006.

Figure 14.6 shows the available time-series for the 12 sites located largely in the City of Westminster (but including three major road sites in the Royal Borough of Kensington and Chelsea). Figure 14.7 shows the available time series for the

complete set (21 sites). Data are in terms of weekly average daily charging hours flows across a sample of inbound roads, with the counters being located immediately inside the boundary of the extension zone.

Both indicators show a similar and quite clear picture. Volumes of traffic entering the extension zone in the early part of 2007 following the introduction of the scheme are significantly below those seen during 2006.

The percentage change varies from week to week. The poor weather in January and early February 2007, the half-term school holiday during February, and the different timing of Easter in each year and the reliance on data for Autumn 2006 (which may not have been entirely representative of conditions before implementation) are complicating factors. Furthermore, there is some suggestion of relative increases in traffic over the most recent weeks, from the indicator based on 12 sites. This has been traced to atypical flows on several monitored roads, reflecting temporary roadworks in the Ladbroke Grove area, and is not therefore likely to be an enduring feature of these counts.

Based on these data, TfL's best estimate would be that traffic entering the extension zone is typically between 10 and 15 percent lower than would otherwise be expected. This is in line with TfL's range of expectation.

Figure 14.6 Average daily charging hours flow by week across 12 representative major roads entering the western extension. Vehicles with four or more wheels.

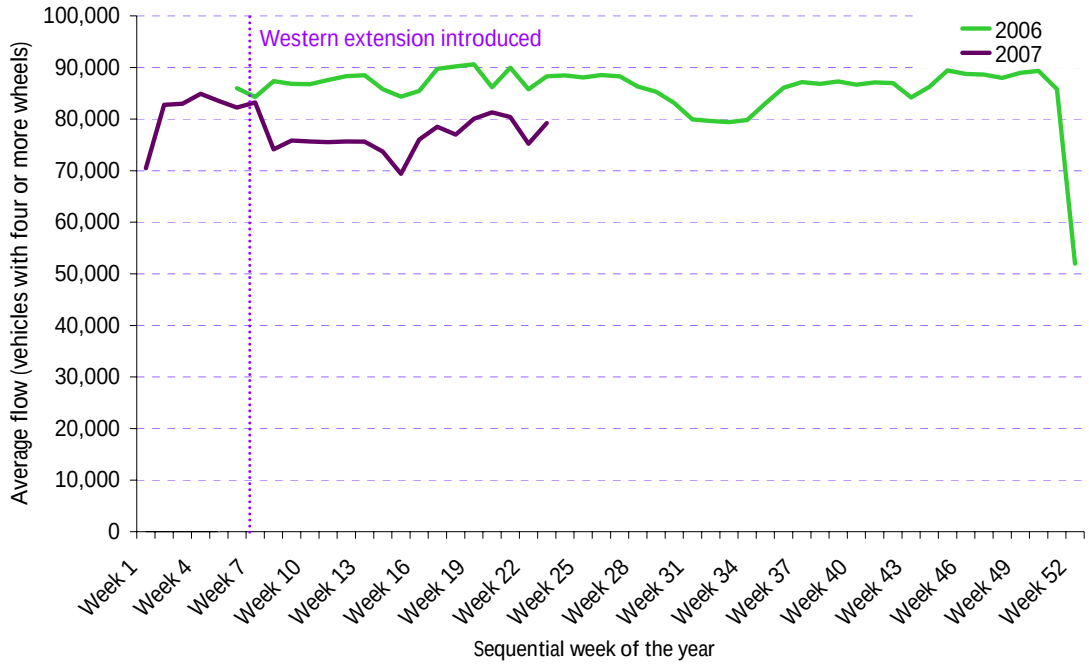
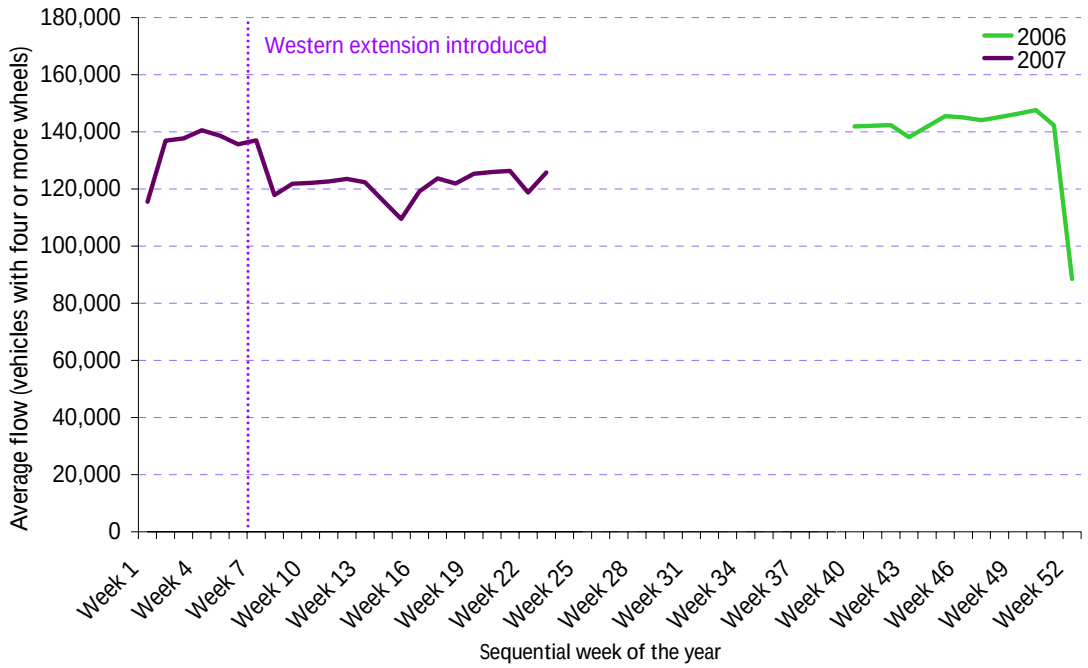


Figure 14.7 Average daily charging hours flow by week across 21 representative major roads entering the western extension. Vehicles with four or more wheels.



A comparable picture is seen for traffic leaving the extension zone, this being monitored by an equivalent set of automatic counters on key exit points from the zone (Figures 14.8 and 14.9). Here however, the indicated percentage changes are – as expected – consistently less than those for inbound traffic, typically lying in the range 8 to 12 percent.

Figure 14.8 Average daily charging hours flow by week across 12 representative major roads leaving the western extension zone. Vehicles with four or more wheels.

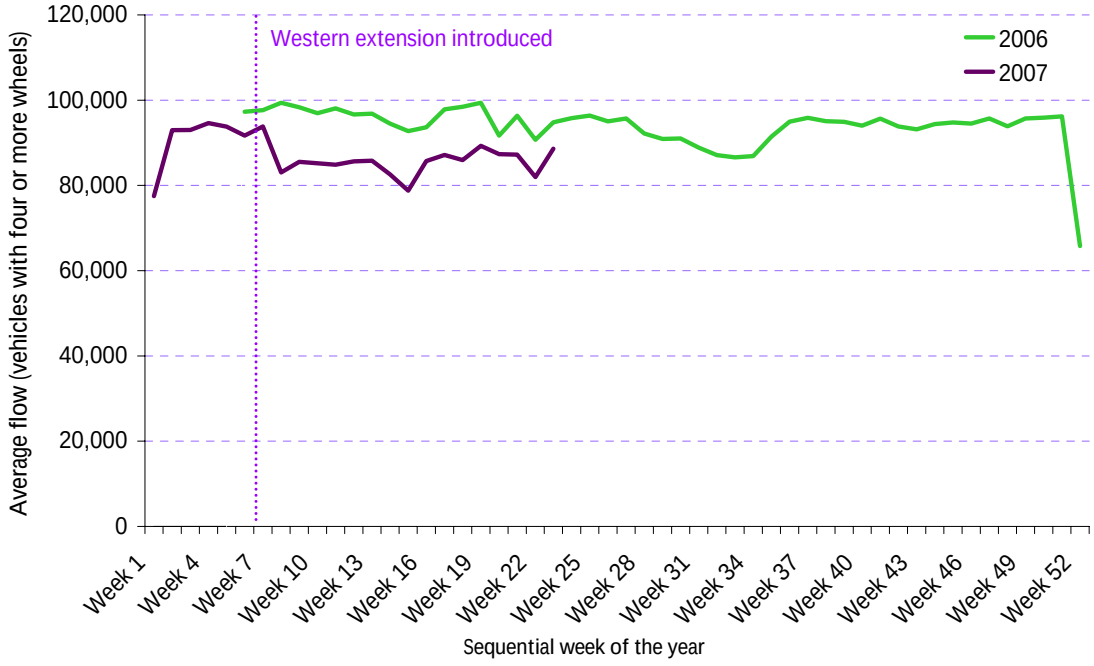
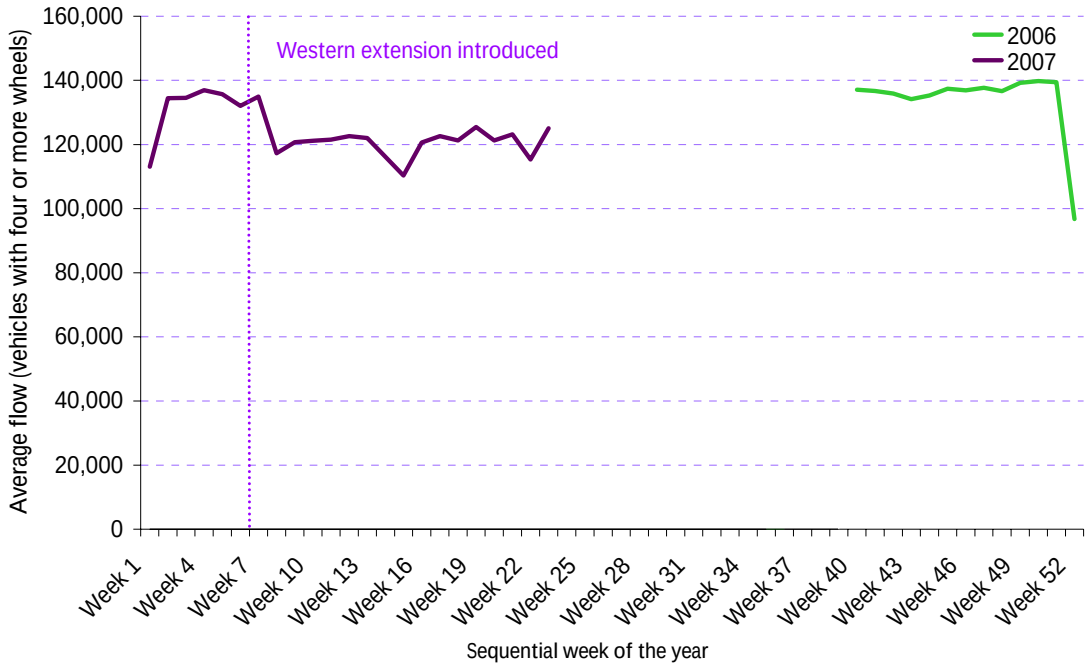


Figure 14.9 Average daily charging hours flow by week flow across 20 representative major roads exiting the western extension. Vehicles with four or more wheels.

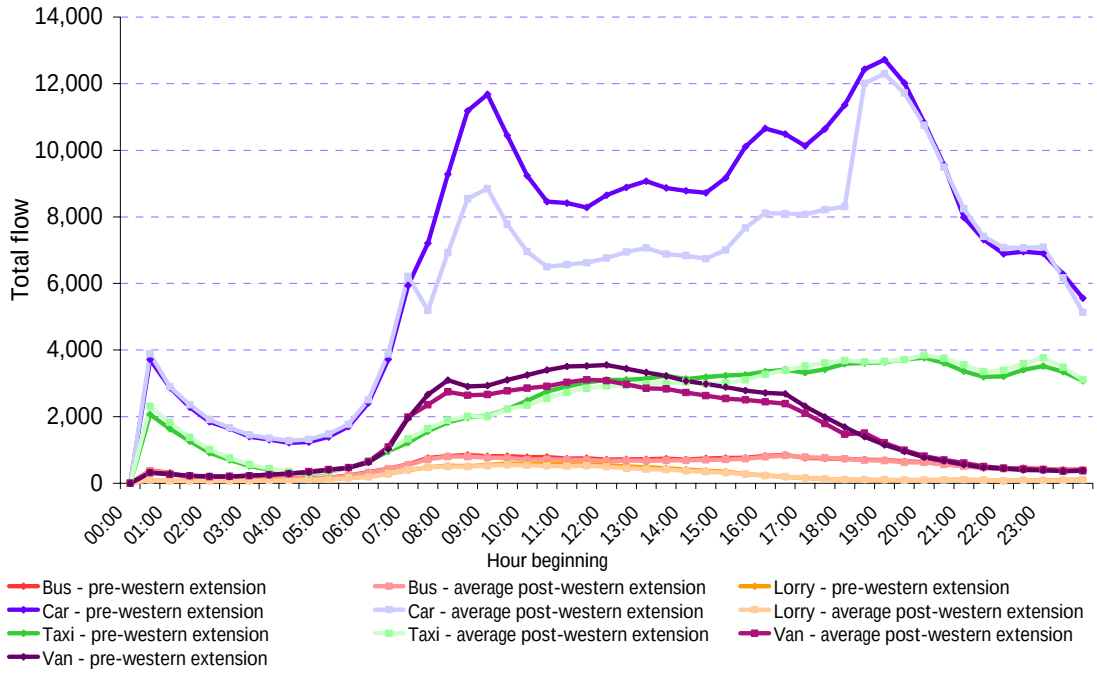


A further indicator of traffic was available over the immediate implementation period, using data from automatic number plate reading cameras enforcing the extension zone. These give a theoretical 100 percent coverage of all roads leading into and out of the extension zone and allow classification of vehicles into the main body types. However, they are subject to various estimation errors, particularly the successful capture rate of the cameras. This means that the indicator is more reliable as a measure of change as opposed to an estimate of the absolute numbers or relative proportions of vehicles involved.

Figure 14.10 shows daily profiles of traffic, in terms of the combined number of vehicles by type entering and leaving the extension zone by time of day. Results covering the first four weeks after the implementation (only) are averaged and compared with limited available data for the weeks immediately before the implementation of the extension.

The overall picture is very similar to the automatic count data described above, with substantial and consistent reductions in the number of vehicles passing into or out of the extension zone during charging hours. The short-term indicator of total traffic change (inbound and outbound movements combined during charging hours) from this source is 17 percent, which is somewhat higher than indicated by automatic traffic count data. This may be a manifestation of the 'major road bias' inherent in the sampling of sites for automatic traffic counters described above. Against this, however, is the fact that this indicator compares post-extension conditions against late January and early February 2007, when traffic flows would have been expected to have been comparatively low due to normal seasonal variation (ie this indicator is liable to slightly over-state the degree of change).

Figure 14.10 Daily profiles of traffic entering and leaving the western extension zone (combined) by main vehicle type. ANPR camera data, weeks across the western extension scheme implementation period.



Further features of interest from Figure 14.10 are that:

- The impacts of the extension are largely confined to charging hours. There are few significant changes to traffic outside charging hours.
- As would be expected, the vehicle type showing the biggest percentage change is cars (in terms of body type, so therefore including licensed minicabs). These reduced by 23 percent during charging hours.
- Of the other main vehicle types, vans reduced by 12 percent and heavier good vehicles by 7 percent during charging hours, these being roughly in line with TfL's expectations.
- Interestingly, the number of licensed taxis observed decreased by 4 percent, and the number of buses/coaches decreased by 5 percent during charging hours. These are contrary to TfL's expectation of small increases to taxis and London buses.

In summary therefore:

- As with the original central zone in 2003, the impact on traffic entering and leaving the extension zone was both immediate and substantial.
- The scale of the traffic reductions for traffic entering the extension zone across different periods and indicators typically and consistently lie in the range 10-15 percent, which compares with TfL's projections of 13 to 17 percent.
- Taking seasonal factors into account and allowing for some degree of 'bounce-back' from traffic levels in the very early weeks following implementation, the initial impacts have been consistently maintained. However, a longer-run of data is necessary to confirm these effects, and also to allow a comprehensive set of

year-on-year comparisons. These will arise in due course from the work described in Section 9 of this report.

14.6 Traffic circulating within the western extension zone

TfL expected that traffic circulating within the extended zone (vehicles with four or more wheels, charging hours) would reduce by between 10 and 14 percent as a result of the scheme. TfL did not implement a comprehensive sample of automatic counters covering roads inside the zone, but two partial indicators are available. The first is a small number of sites (eight) covering links of specific interest in that part of the extension zone within the City of Westminster. The second is a sub-set of sites (four) on the main east-west screenline running through the eastern half of the extension zone (see Section 9). Although these indicators do not provide either a representative or very precise indicator of change across the whole of the extension zone, the early trends are nevertheless of interest.

The sites within Westminster are in the eastern third of the extension zone, and might consequently be expected to understate the degree of change in relation to that experienced across the whole of the extension zone. This would arise from the proximity to the original charging zone (a very significant traffic generator), together with the factors acting in favour of inter-zonal travel created by the inter-available resident's discount and the absence of an additional charge for drivers who had already paid to enter the central zone, compared to those who had not.

Traffic at these sites has been consistently around 10 percent less following the extension, compared with equivalent weeks in 2006.

The equivalent comparison at the four internal east-west screenline sites is somewhat erratic, as would be expected from the small number of sites involved. Indicated reductions in the range of 5 to 15 percent against comparable weeks in 2006 are typical, varying considerably from week to week.

These two indicators are therefore suggesting sustained decreases in circulating traffic (vehicles with four or more wheels) of around 10 percent, comparable to that suggested by the indicator for traffic leaving the extension zone (see Section 14.5), and in accord with the lower end of TfL's range of expectation.

14.7 Traffic on the boundary route

TfL expected small overall increases in total traffic on the boundary route around the outside of the extension zone. These would arise from drivers making 'through' trips, opting to divert around the boundary of the extension zone, in order to avoid paying the charge. This effect would be counterbalanced by reductions in trips that had previously crossed or travelled along a portion of the boundary route on their way to and from the extension zone creating, in effect, capacity for these 'diverted' trips. Furthermore, increased investment and emphasis on effective traffic management on this route would mean that the overall effects on traffic conditions could be expected to be broadly neutral.

For monitoring purposes the boundary route can be considered in two parts. The first of these is the free passage route, running between the existing and extended zone from Edgware Road to Vauxhall Bridge. This section would potentially be a particular focus for diverted trips, as well as reflecting interactions between the existing and extended zones, although TfL's expectation was for effectively no change to traffic on this route overall. The second is the 'western boundary', comprising the remainder of the boundary route around the outside of the extended zone. TfL's expectation here was for increases of up to 4 percent overall.

Free passage route

The free passage route consists of six key roads: Edgware Road, Park Lane, Grosvenor Place, Grosvenor Gardens, Bressenden Place and Vauxhall Bridge Road. Bi-directional automatic counters were placed on all six of these roads, providing a robust picture of traffic changes on this route. This indicator was available from the start of 2006.

The picture so far (Figure 14.11) is one of remarkable and consistent stability in traffic levels. Weekly average flows rarely deviate from the annual average by more than plus/minus 5 percent, and have barely changed in response to the implementation of the extension. Average flows in the weeks immediately preceding the extension in 2007 were slightly depressed in comparison with equivalent weeks in 2006, perhaps reflecting poor weather on certain days.

Levels of traffic for weeks following the introduction of the extension have been comparable to, or slightly below, equivalent weeks during 2006, in line with TfL's expectation of no effective change – a highly satisfactory result. Feedback on the operational performance of this route confirms that no significant operational problems have arisen from the implementation of the extended scheme.

Figure 14.11 Average daily charging hours flow by week across 6 representative bi-directional roads on the free passage route. Vehicles with four or more wheels.

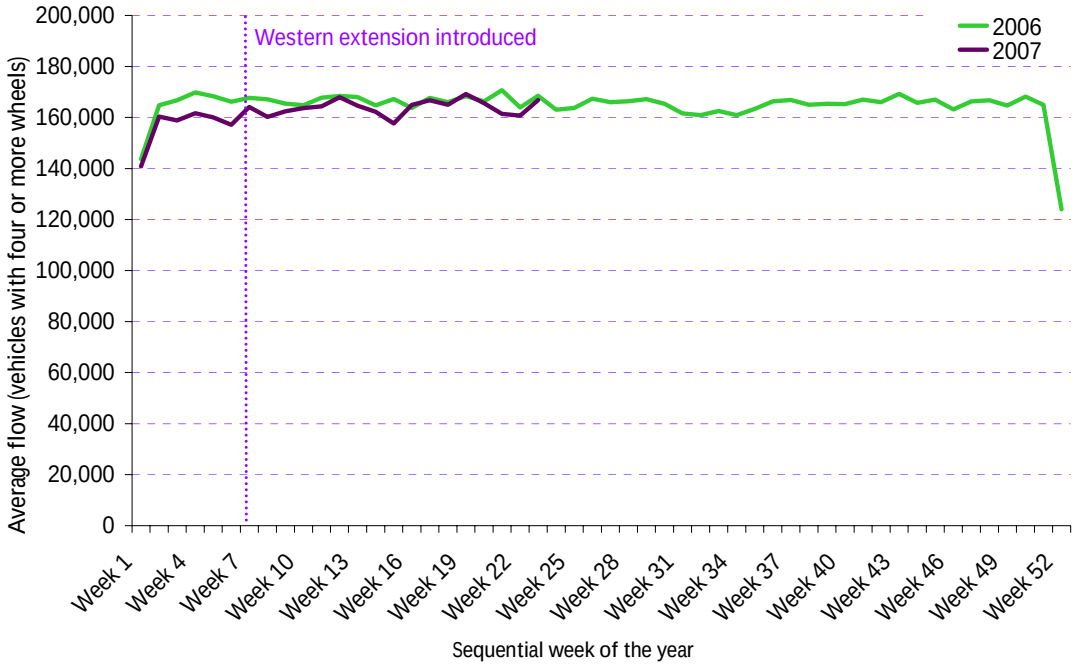
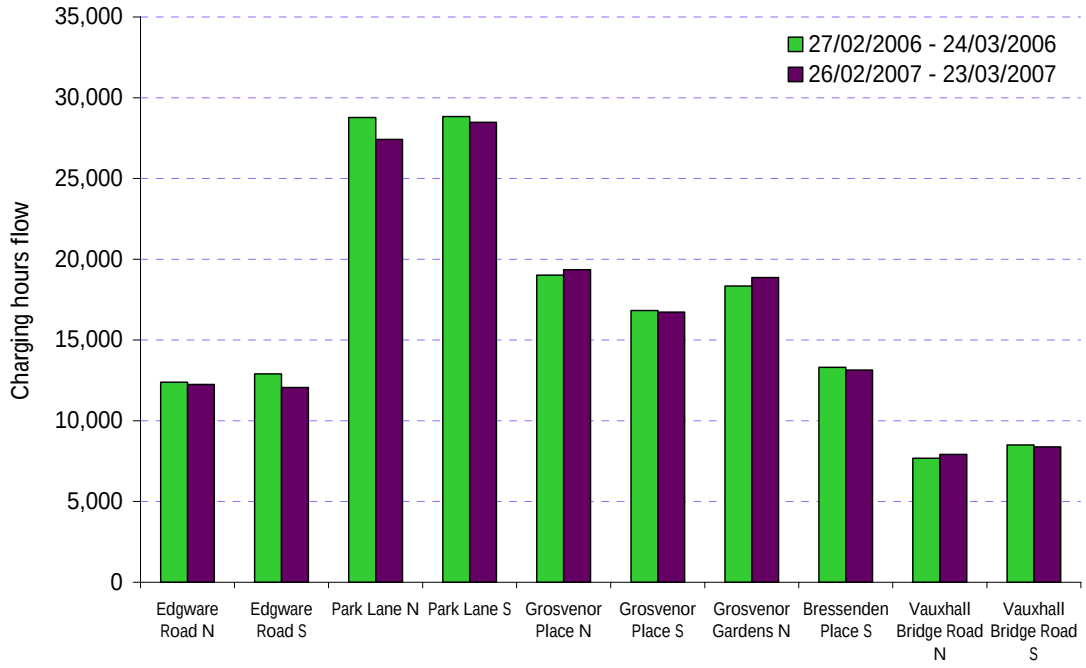


Figure 14.12 shows equivalent data at the individual site level. It compares average charging hours flow for the four (equivalent) weeks between late February and late March in both 2006 and 2007, ie the period between the February half term and Easter holidays. Flows during both periods at all sites are generally very similar, confirming that the apparent stability of total traffic is consistent across the whole of the free passage route, and that similar aggregate flows do not disguise any significant deviations at the individual site level.

Figure 14.12 Average directional charging hours flow across individual free passage route links. Post extension 2007 compared with equivalent weeks in 2006. Vehicles with four or more wheels.



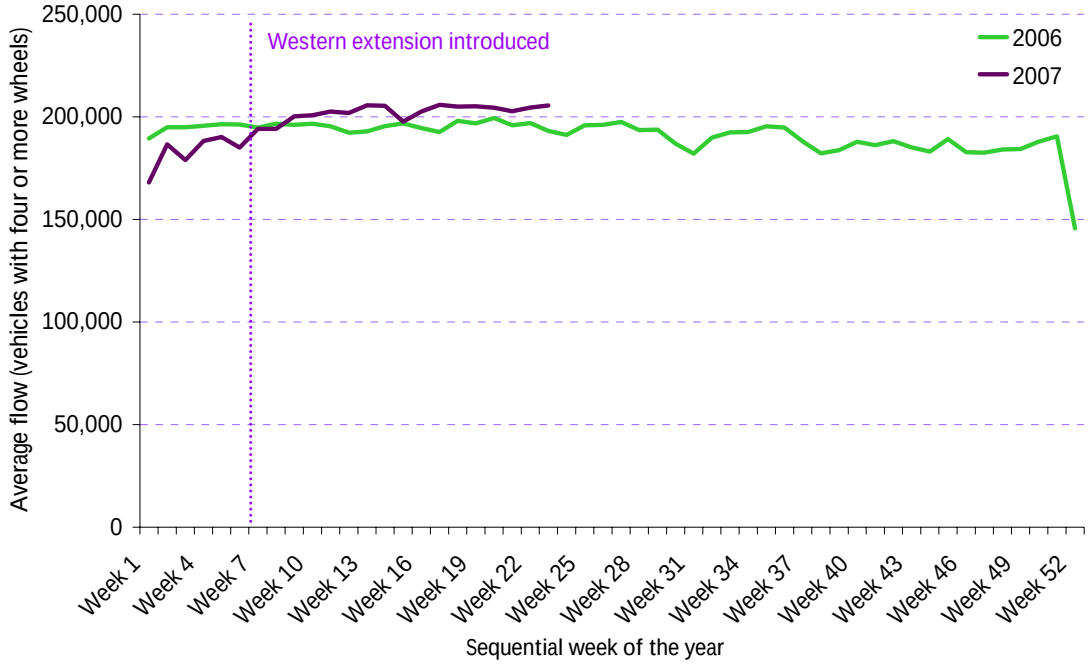
Western boundary

Eleven automatic counters were placed on roads comprising the remainder of the western extension zone boundary route, covering all key roads. These were also available from the start of 2006. TfL expected small increases in traffic on this route, of up to about 4 percent overall.

Figure 14.13 shows the available time series, and it is again characterised by generally stable traffic levels overall. It is thought that roadworks affected traffic on this route towards the end of 2006, resulting in lower traffic levels than might otherwise have been expected at this time, as October and November tend to see traffic levels that are higher than the annual average in London. Furthermore, poor weather in late January and early February may have contributed to traffic levels in early 2007 being lower than those of early 2006.

The weeks following implementation of the extension saw general rises in traffic, of up to 6 percent against equivalent weeks in 2006. Typically, however, aggregate rises are of the order of 4 percent or less, and therefore accord very closely with TfL's expectation.

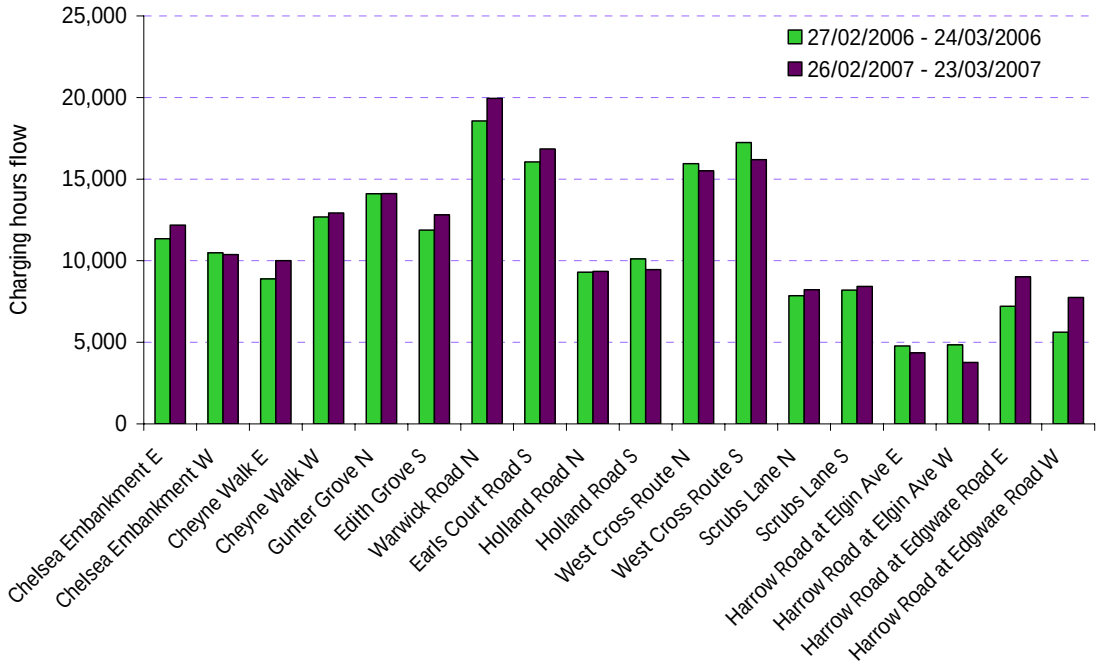
Figure 14.13 Average daily charging hours flow by week across 11 representative bi-directional links on the western boundary of the western extension. Vehicles with four or more wheels.



At the individual site level, the picture is more variable but the overall impression is one of consistent small increases in traffic across most sites, rather than disproportionate changes at only a few. Figure 14.14 shows the results from individual automatic traffic counters, comparing weeks in 2007, following implementation of the extension, with equivalent weeks in 2006. Percentage increases of up to 25 percent are seen at Harrow Road, with increases of between 5 and 7 percent on the Earls Court One Way System. Other links show only marginal increases or even small reductions.

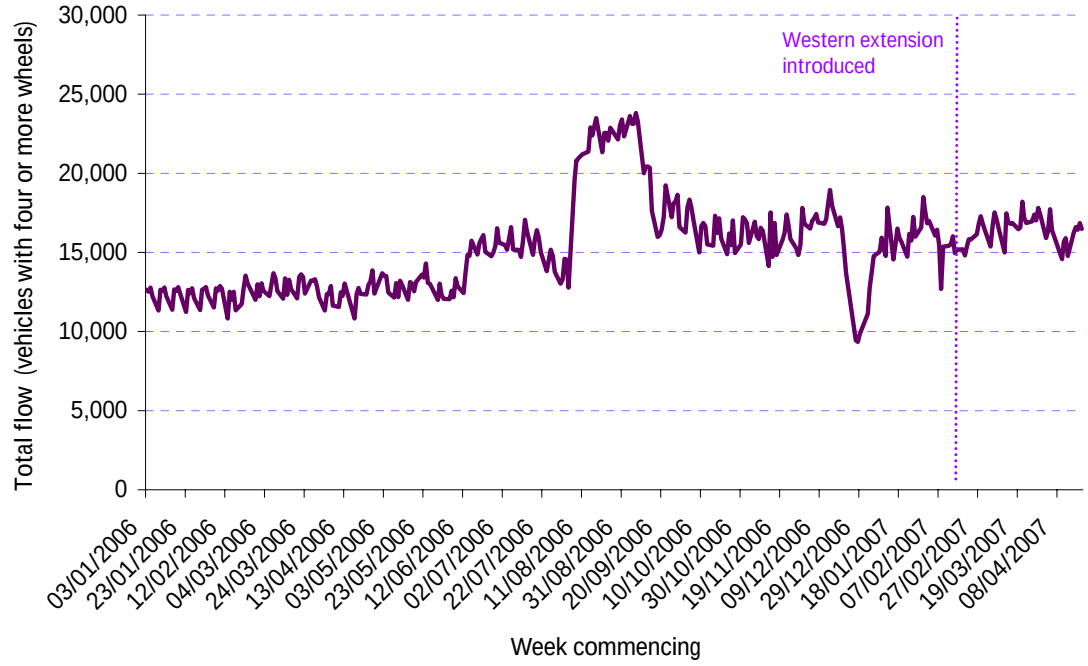
Harrow Road near Edgware Road was affected by roadworks during 2006 and early 2007, most notably the temporary closure of the Marylebone Road flyover between 7 August and 15 September, and by the re-opening of Bishop's Bridge at Paddington on 14 June 2007. It is likely that the apparent increases shown in Figure 14.14 for this site reflect the traffic consequences of these developments. Figure 14.15 shows continuous combined direction flows on this road since the start of 2006. It is clear that there was a substantial but temporary increase in flows during the summer of 2006, directly coinciding with the temporary closure of the Marylebone Road flyover. Furthermore, there is a progressive 'background' increase in traffic, starting in June 2006 when Bishop's Bridge was reopened, and continuing after the Marylebone Road flyover reopened.

Figure 14.14 Average directional charging hours flow across individual western boundary road links. Weeks immediately after implementation of western extension compared with equivalent weeks in 2006. Vehicles with four or more wheels.



It is clear from Figure 14.15 that changes to traffic at this point were not directly associated with the western extension, and primarily reflected the reinstatement of Bishop's Bridge Road, the closure of which during 2006 had led to atypically low flows on Harrow Road.

Figure 14.15 Traffic at Harrow Road, near Edgware Road. Combined direction charging hours flows. Vehicles with four or more wheels.



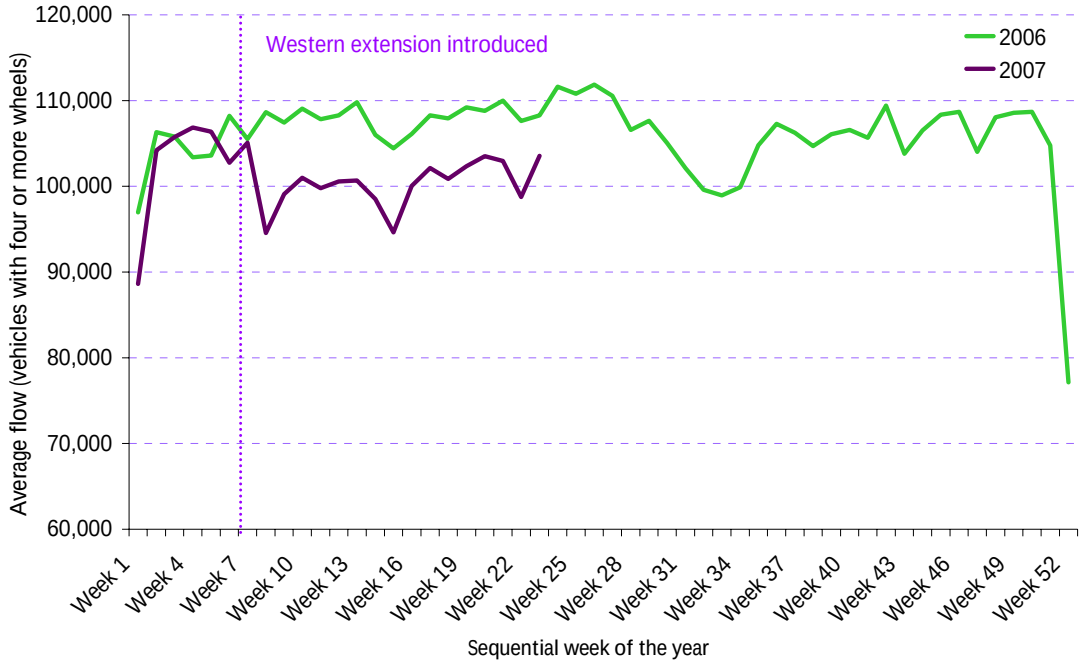
14.8 Wider indications of traffic change

As described in Section 9, TfL has also made extensive provision for monitoring wider traffic changes outside the immediate western extension zone.

TfL expected overall reductions in radial traffic in an 'annulus' surrounding the extension zone, reflecting fewer trips being made to and from the extension zone. This would be partly counterbalanced by the possibility of increased orbital traffic, reflecting drivers making diversionary movements around the zone on the network of roads beyond the immediate boundary route. There are two screenline opportunities to asses these impacts that are particularly suitable for monitoring using automatic traffic counters.

West London railway screenline

Figure 14.16 Average daily charging hours flow by week across the west London railway screenline. Vehicles with four or more wheels.



This screenline measures radial traffic moving to and from the extension zone from the west. The picture here (Figure 14.16) is one of consistent reductions of between 6 and 7 percent in two-way vehicle movements during charging hours, reflecting the impact of fewer trips to and from the extension zone in this part of inner London outside the extended zone.

Western extension Thames Bridges screenline

This measures cross-river traffic on the approach to the extension zone from the south. The picture here is similar to that at the west London railway line. The early months following the introduction of the extension saw consistent reductions to two-way vehicle movements (vehicles with four or more wheels during charging hours) of around 7 percent.

Emerging results from both of these indicators are consistent with the traffic changes observed in the extension zone itself and on the boundary route, and with TfL's expectations for the scheme.

14.9 Traffic change in the original central London zone

The western extension is expected to have an effect on traffic conditions in the original central zone, but the expected impacts are relatively small and the mechanisms involved somewhat complex.

Most obvious are the implications of the inter-available residents' discount for the extended scheme. From 9 October 2006, residents of the extension zone (and certain clearly-defined 'buffer areas' outside the extension zone) could register for residents' discount status, and therefore receive the equivalent of a 90 percent discount on the daily charge. From this date and having registered, these residents could purchase discounted charges for the central zone, which may have led to some increases of traffic. More widely, the co-existence of the original and extended zones will change the relative attractiveness of trips between the two parts of the extended zone for different categories of chargepayer, potentially increasing the degree of interaction between the two parts of the extended zone across the free passage route.
TfL's expectation was for overall traffic entering the original central zone to increase by about 2 percent as a consequence of the extension.

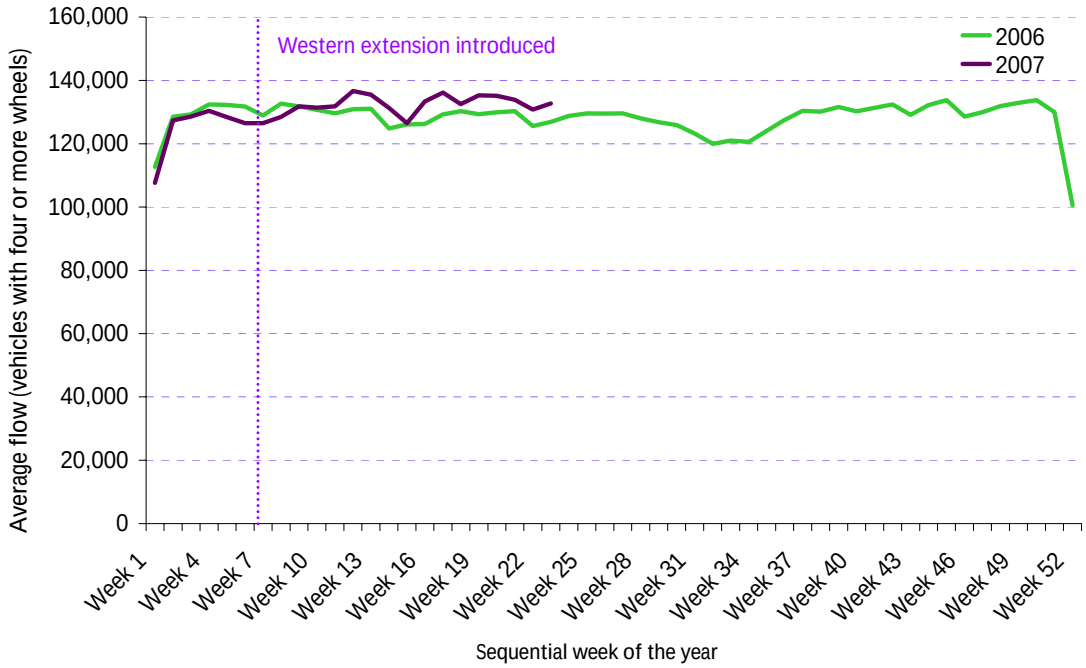
Monitoring traffic impacts in the central zone

The existing automatic counter coverage of key central zone traffic indicators (see Section 2) was adapted to provide early feedback on traffic conditions over the implementation period of the extension. These adaptations consisted of adding two additional counters to increase measurement precision for traffic entering and leaving the western edge of the central zone (adjacent to the free passage route), and re-basing existing time-series (for 2006) to reflect the new charging hours.

Traffic entering the central zone

Figure 14.17 shows traffic entering the central zone across 18 high-flow inbound roads. Taking the additional site and charging hours re-basing into account, it is equivalent to Figure 2.3 in Section 2 of this report. The overall picture is that traffic in early 2007 is tending to be slightly higher than that in early 2006. Certain weeks in 2007 have seen central zone traffic up to 5 percent higher than equivalent weeks in 2006. Whilst experience with this indicator suggests that such differences are occasionally to be expected, reflecting normal variability, it is probable that increased travel by extension zone residents is a contributory factor.

Figure 14.17 Average daily charging hours flow by week across 18 major roads entering the original central London congestion charging zone. Revised charging hours, 2006 and 2007. Vehicles with four or more wheels.



Were this to be the case, the effect would be most apparent on the western edge of the original central zone, directly adjacent to the free passage route. The overall pattern here is similar to Figure 14.17, with increases of around 4 or 5 percent in some recent weeks. These sites are only a relatively small sub-set (four) of the 18 total sites, and therefore the similar absolute percentage change in traffic here means that the observed increases in Figure 14.17 are more general across the central zone. The additional increment of residents' trips is therefore perhaps turning out to be somewhat higher than TfL expected, or is likely to be only part of the picture affecting traffic levels in the original central zone over recent months.

Traffic circulating in the central zone

Automatic counters located on a representative selection of roads within the central zone provide an indicator (after re-basing) that is equivalent to that in Figure 2.6 of this report. Here, the tendency is towards lower traffic levels in Spring 2007 compared with Spring 2006, which is a different trend than that suggested by Figure 14.17. The possible reasons for this apparent divergence in the indicators of central zone traffic following the implementation of the extension are not yet fully understood, but atypical data for 2006 or road network changes affecting traffic flows at the relatively small number of counting sites may be contributory factors. At this stage, TfL's assessment would be that traffic circulating in the original central London charging zone has probably increased, at least partly as a result of increased trips by extension zone residents. The scale of the increase is not yet clear, but early monitoring appears to be pointing towards the higher end of TfL's range of expectation for traffic change in the original central zone as a consequence of the western extension scheme.

Traffic on the Inner Ring Road

The Inner Ring Road forms the boundary of the original central zone. It comprises the free passage route between the existing and extension zones (see Section 14.7) and also an 'eastern boundary', equivalent to the 'western boundary' around the extension zone. There are 17 permanent counters on this route. TfL expected that traffic volumes on this route would be substantially unaffected by the western extension.

Figure 14.18 Average daily flow by week across 17 representative links on the Inner Ring Road, including free passage route. Revised charging hours, 2006 and 2007. Vehicles with four or more wheels.

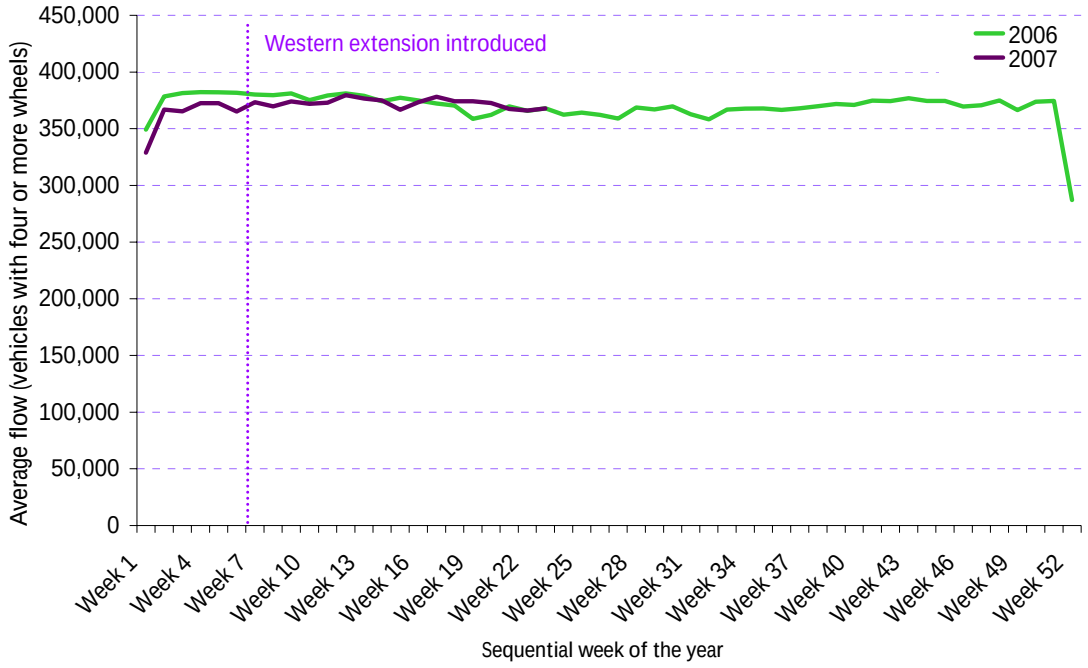


Figure 14.18 shows that this has largely been the case, traffic levels in the period following the implementation of the extension being almost identical to that seen in equivalent weeks in early 2006.

In summary in relation to the original central zone therefore:

- There are indications of higher volumes of traffic entering the original charging zone following the implementation of the extension compared to equivalent weeks in early 2006. Additional trips by residents of the extension zone have probably contributed to this. Indications of increases to traffic entering the central zone are not however reflected in available indicators of traffic circulating within the zone, and the overall picture here therefore remains unclear.
- Traffic volumes on the Inner Ring Road are effectively unchanged, compared to equivalent weeks in early 2006.

14.10 Traffic speeds and congestion

A definition of congestion for this purpose is given in Section 10. Congestion is inherently more difficult to measure than traffic volumes, ideally requiring a run of several comparable moving car observer surveys, each of which takes three months to complete and validate. Definitive results describing the medium-term impacts of the extension on congestion are therefore beyond the scope of this report, although some encouraging initial results are available.

TfL was able to make use of a skeletal network of automatic number plate reading equipped cameras in and around the extension zone across the implementation period to monitor day by day trends in average traffic speeds, a proxy for congestion. These provided encouraging albeit highly indicative data, showing an apparent trend towards increased average traffic speeds – of up to 10 percent – inside the extension zone that would broadly correspond to the projected reductions in congestion expected by TfL.

In late May 2007, data from the first moving car observer surveys of congestion to be conducted since the implementation of the extension have become available. These are tending to confirm the earlier, camera-based measurements and indicate reductions in congestion that are within TfL's expected range, taking into account the comparisons that are possible and appropriate at this stage.

TfL's expectations for the impact of the western extension on congestion can be summarised:

- TfL expected that the projected reductions to traffic circulating within the extension zone would lead to reductions in congestion of between 17 and 24 percent.
- Possible small increases to traffic in the original central zone, resulting from additional trips by residents of the extension zone, could be expected to feed through to increases in congestion here of up to 5 percent.
- TfL expected no material change to congestion on the boundary routes surrounding the extension zone or the existing central zone.
- Reductions to radial traffic approaching the extension zone more widely in inner London were expected to lead to small reductions in congestion in an annulus surrounding the extension zone, although this was not expected to be measurable in the short-term from the surveys planned by TfL.

Initial indications of congestion impacts from moving car observer surveys

Moving car observer surveys provide good medium-run estimates of congestion changes, as they are not unduly affected by short-term variations in road traffic conditions. However, they are affected by seasonal factors and – ideally – a run of several surveys would be used to assess the changes in congestion resulting from the extension. As described in Section 10, bi-monthly surveys of the western extension and original central zone have provided baselines against which post-extension conditions can be assessed. Results from the first bi-monthly surveys since the

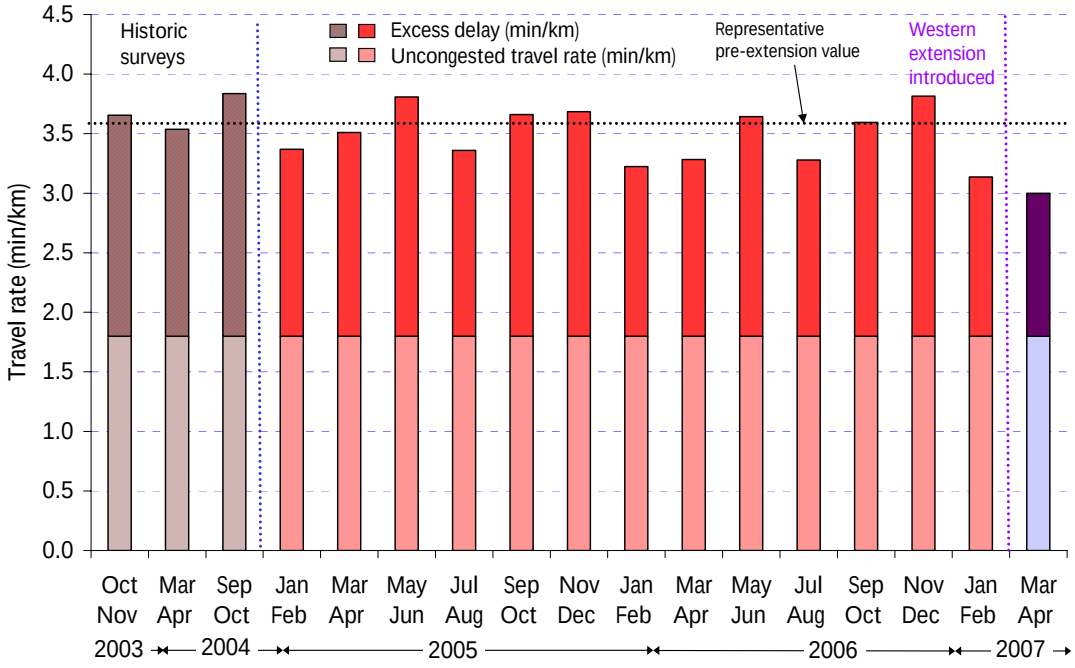
implementation of the extension have now been received by TfL and provide an early indicator of the impacts of the scheme.

Figure 14.19 shows that excess delays within the western extension in March/April 2007 were 1.2 minutes per kilometre. This compares to the average representative value of 1.75 minutes per kilometre for surveys undertaken in 2005 and 2006 and represents a reduction in congestion of around 30 percent. This comparison is however potentially misleading, as it is evident from the Figure that congestion in this area varies considerably between individual bi-monthly surveys.

A more appropriate comparison is therefore to compare the March/April 2007 result against the average value from the two preceding March/April surveys in 2005 and 2006. This gives reductions of about 15 percent against March/April 2006, and about 30 percent against March/April 2005. Averaging the two preceding March/April surveys gives a reduction of 20-25 percent. TfL considers that this represents the most robust estimate of the change in congestion that is possible with the data so far available.

This reduction is towards the higher end of TfL's range of expectation for the extension scheme. However, it is an initial result based on one survey only, and consequently may not reflect longer-term 'settled' conditions.

Figure 14.19 Congestion inside the western extension zone. Results from the March/April 2007 moving car observer survey, compared with appropriate pre-extension surveys.



Note that, as discussed in Section 9 of this report, charging hours travel rates are based on 07.00 to 18.30 up to an including the January/February 2007 survey, and on the revised charging hours of 07.00 to 18.00 from and including the March/April 2007 survey. As actual survey runs were in both cases timed to finish before 18.00 this should not have a material impact on the comparison. TfL will however analyse in

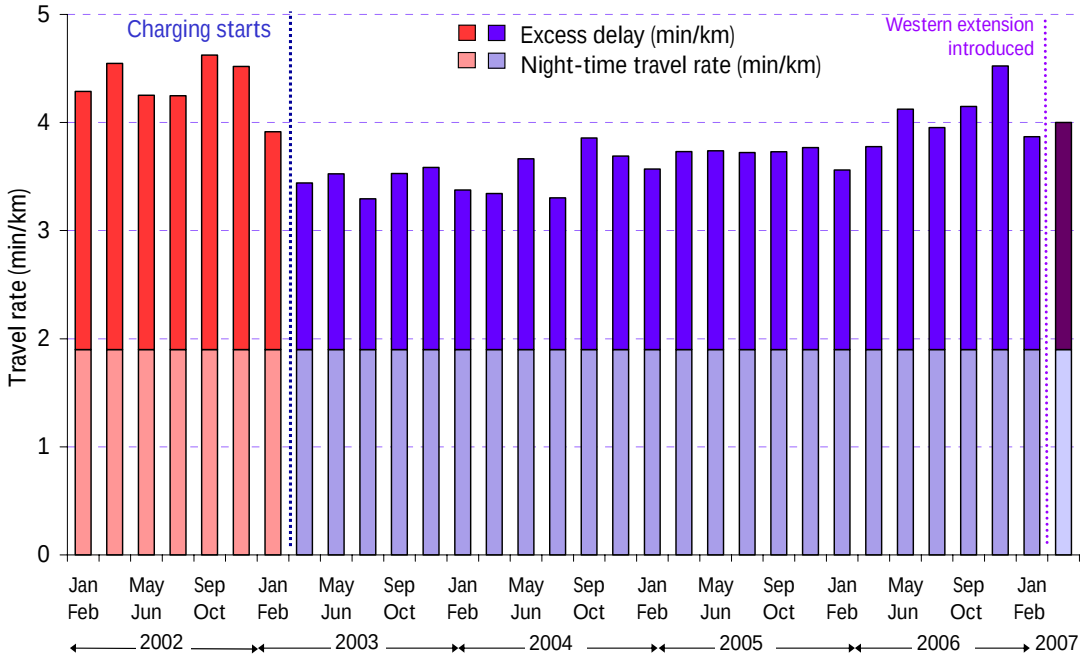
detail the impacts of the revision to charging hours on both traffic patterns and congestion in due course.

Figure 14.20 shows the equivalent graphic for congestion inside the original central London charging zone. Here, the March/April 2007 survey returns a value for excess delay of 2.1 minutes per kilometre. Although a relatively low value compared to late 2006, this survey nevertheless continues the recent trend towards increased congestion in the central zone, as discussed in Section 3 of this report.

Here, the most appropriate comparison is also against the average of the two preceding March/April surveys. These were 1.9 minutes per kilometre for March/April 2006, and 1.8 minutes per kilometre for March/April 2005, giving an average excess delay of 1.85 minutes per kilometre.

This result must be interpreted in the context of the recent trend towards increased congestion in the original central London zone. With the exception of possible increases in traffic in the central zone arising from the inter-available residents' discount from October 2006, the recent increases in congestion in the original central zone have arisen largely independently of any influence from the western extension. Therefore, the most appropriate comparison for the March/April 2007 result would be the average value for equivalent surveys in 2005 and 2006, adjusted for this 'background' trend.

Figure 14.20 Congestion in the original central London charging zone. Results from March/April 2007 moving car observer survey compared with appropriate pre-extension surveys.



Whilst it is not possible to compute this precisely, examination of Figure 14.20 suggests that the indicated increase of about 15 percent between 2005/2006 and 2007 is closely in line with the background trend over the same period. TfL would therefore conclude at this stage that, whilst congestion in the original central zone

has clearly increased over the past 12 months, there is as yet no detectable impact that might be directly attributable to the western extension. Data over a longer period is required to allow TfL to robustly assess the various influences on congestion in the original charging zone.