

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

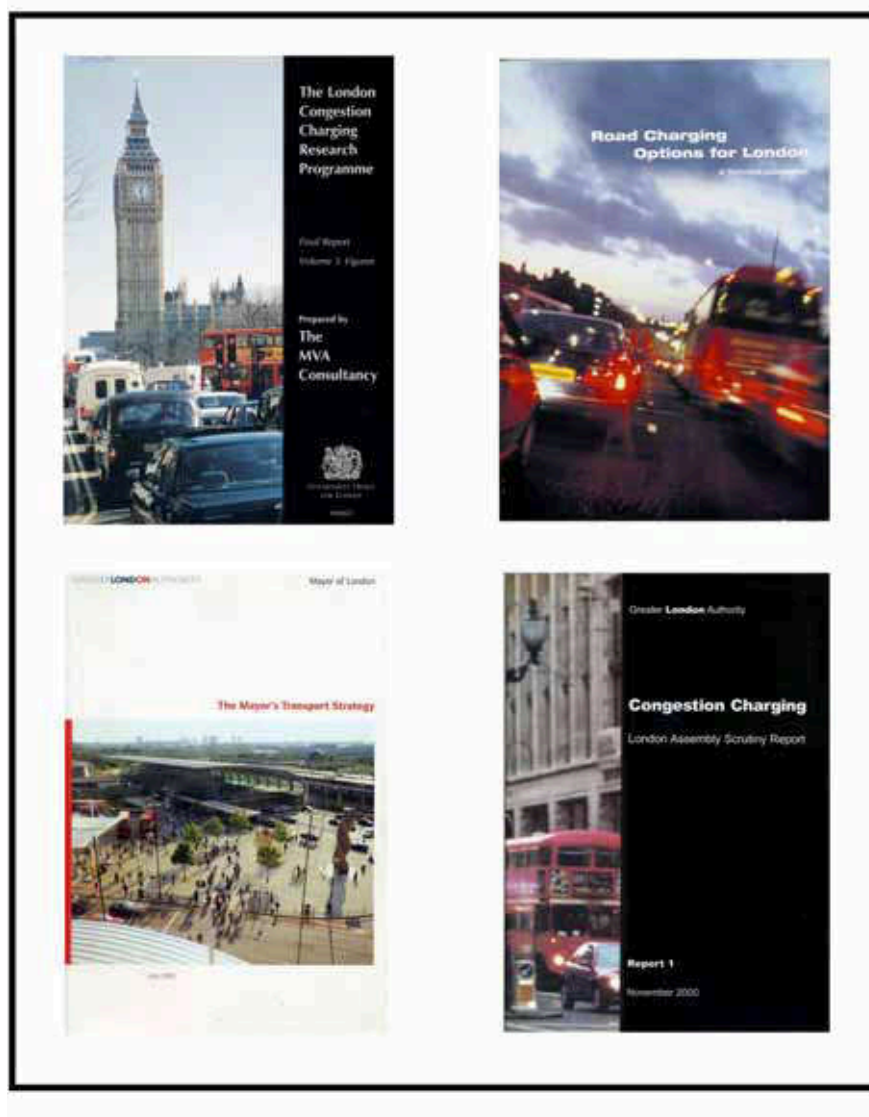
The development of the current central London scheme can be traced to the election of a Labour administration in May 1997.

- 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.

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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 a 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.

7. Congestion charging in central London: a retrospective

- 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.

7. Congestion charging in central London: a retrospective

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 CO₂ 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.

7. Congestion charging in central London: a retrospective

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	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 CO₂ 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.

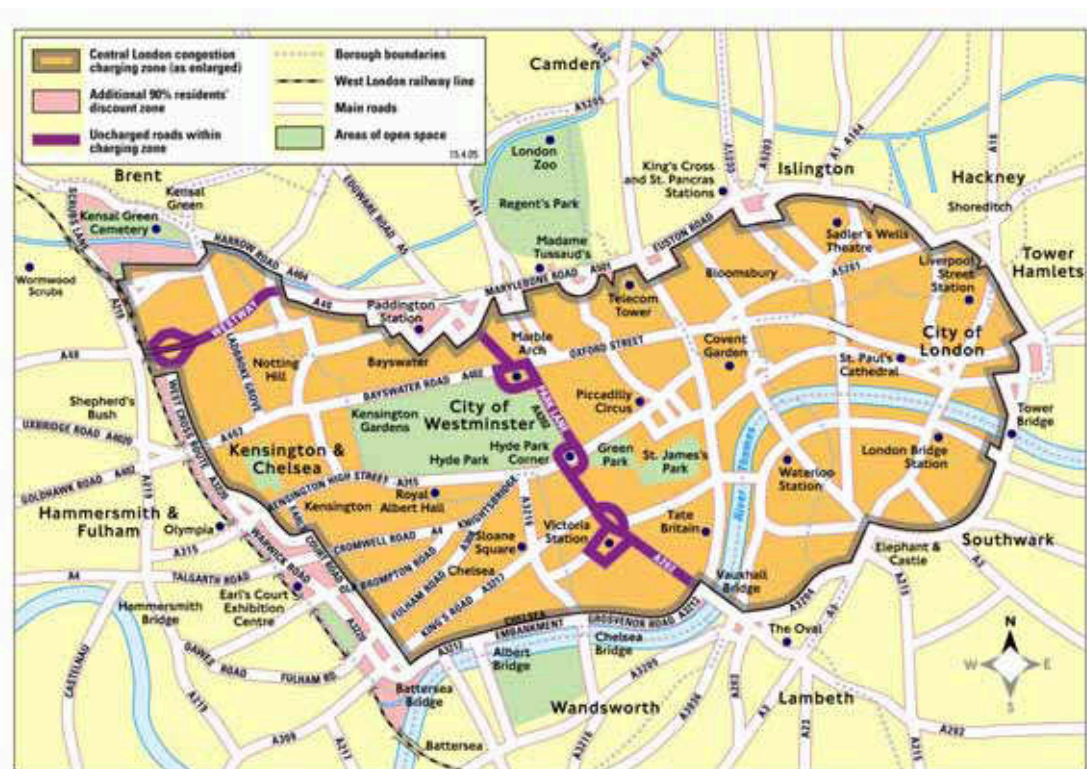
8. Introduction to the western extension

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 (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.

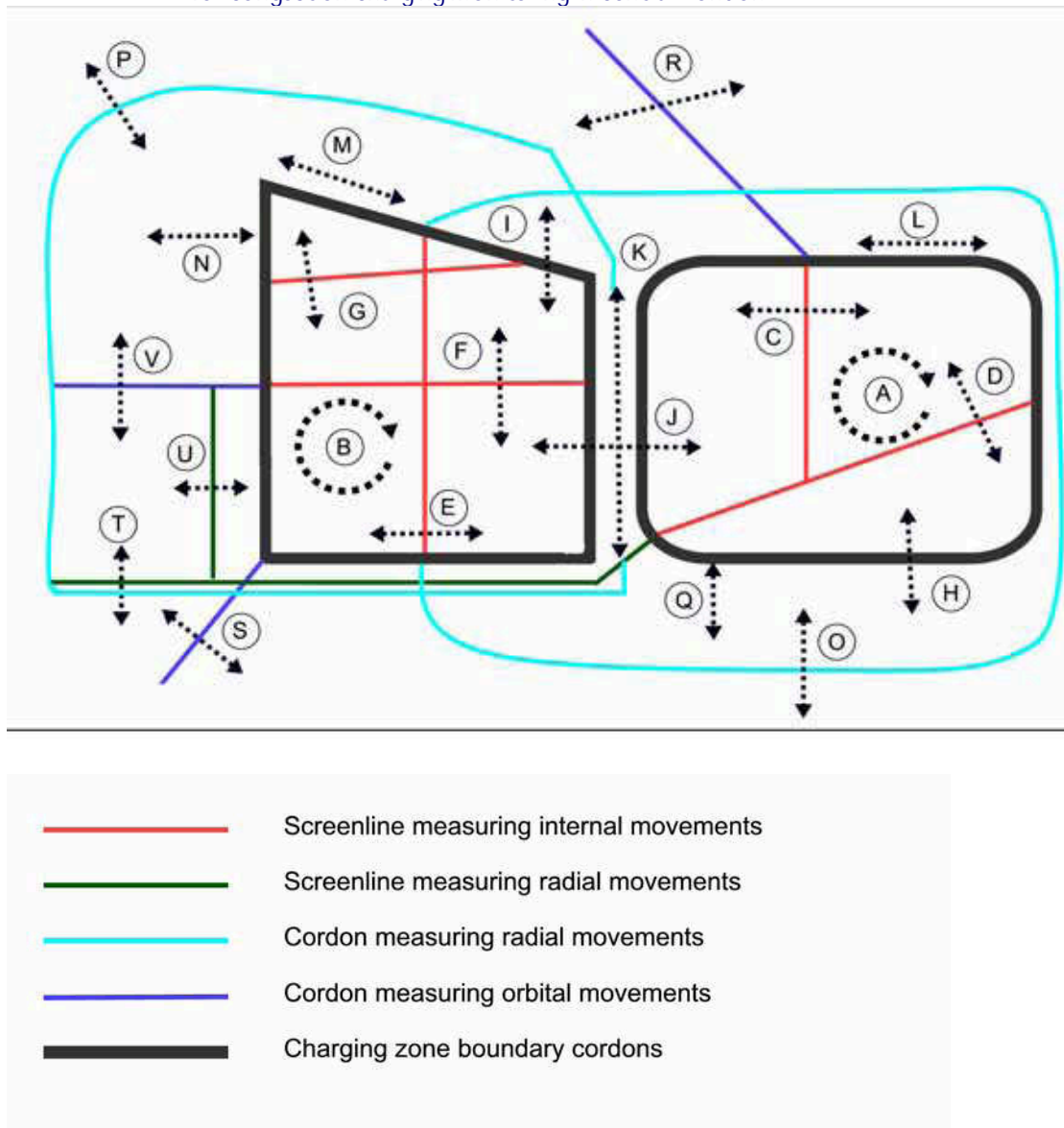
Generally, there are several indicators for each key traffic movement of interest. Collectively, and taking the particular strengths and weaknesses of each indicator into account, they should over time build to provide a comprehensive and definitive picture of the traffic impacts of the extension scheme. 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 A 40 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.

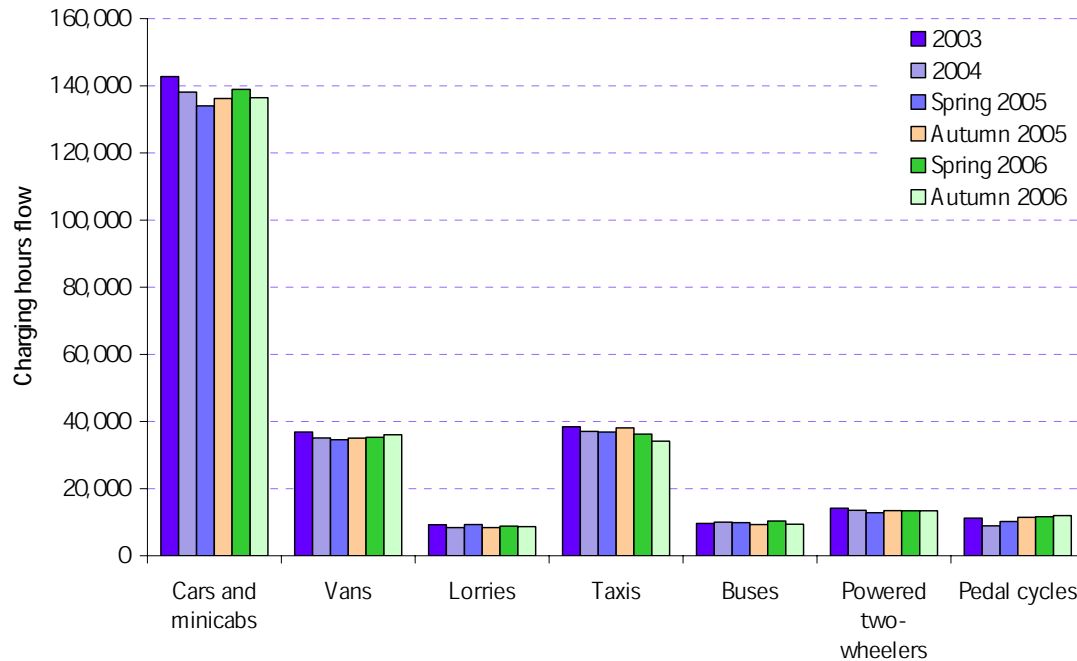


Table 9.3 compares traffic volumes and vehicle proportions entering the future western extension before charging in 2005 and 2006 with equivalent data for the central London charging zone in 2002 (before the introduction of charging there) and 2006. The total volume of four-wheeled traffic entering the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

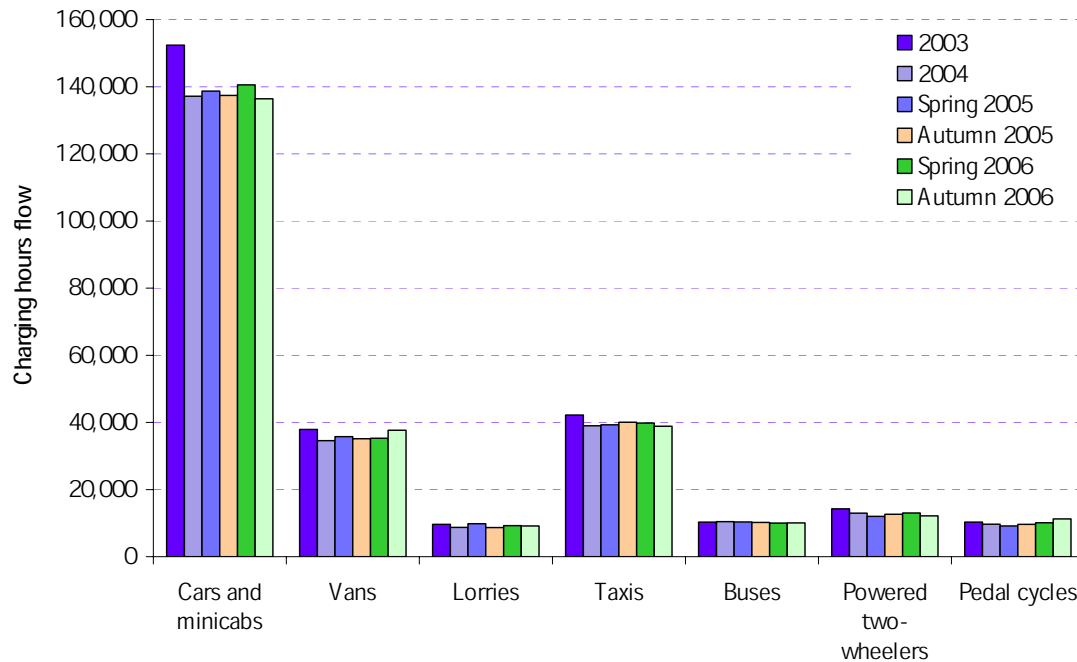


Table 9.4 Traffic leaving the western extension zone across all outbound roads. 07.00-18.00, 2005 and 2006. Including selected central zone indicators for comparison.

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

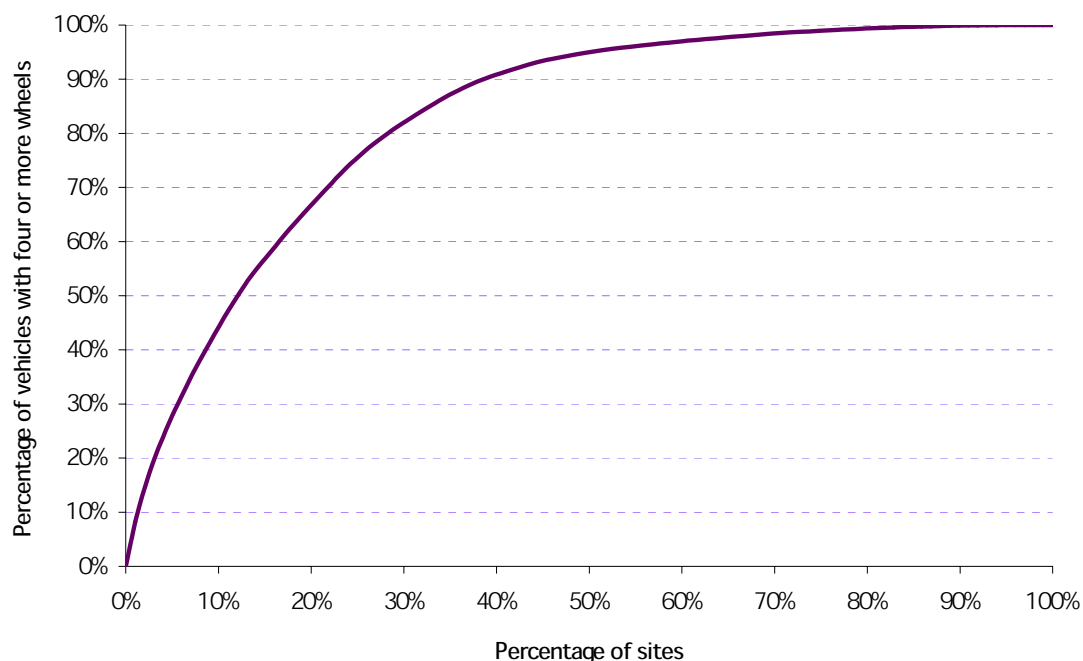
These manual classified counts provide much information on the characteristics of traffic entering and leaving the western extension prior to the start of the charging. This section highlights some key features of interest.

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.

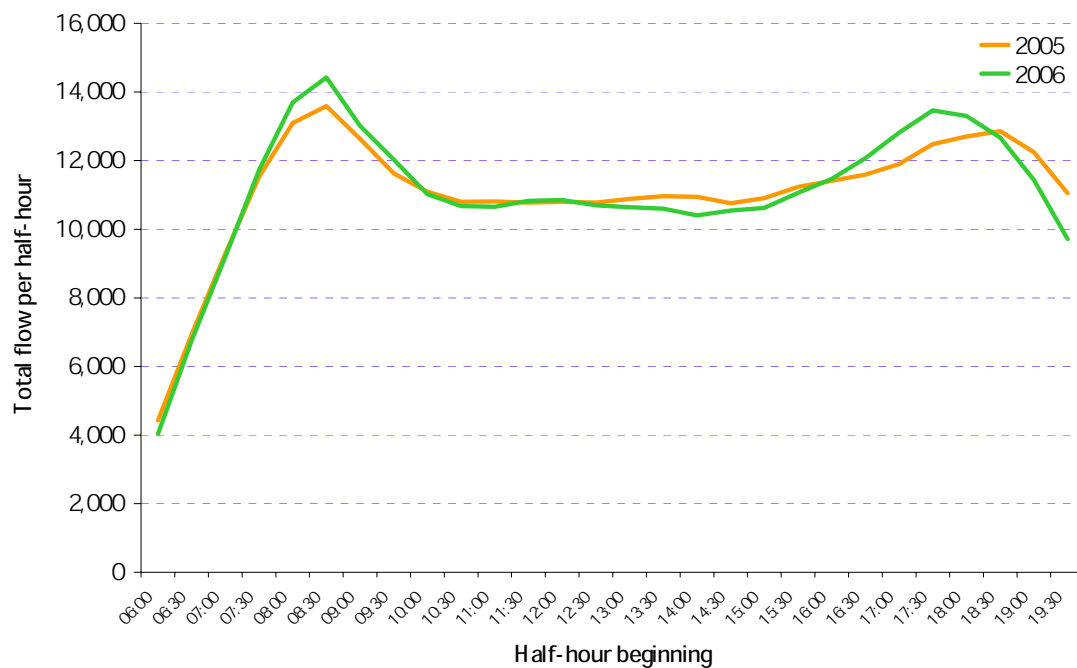
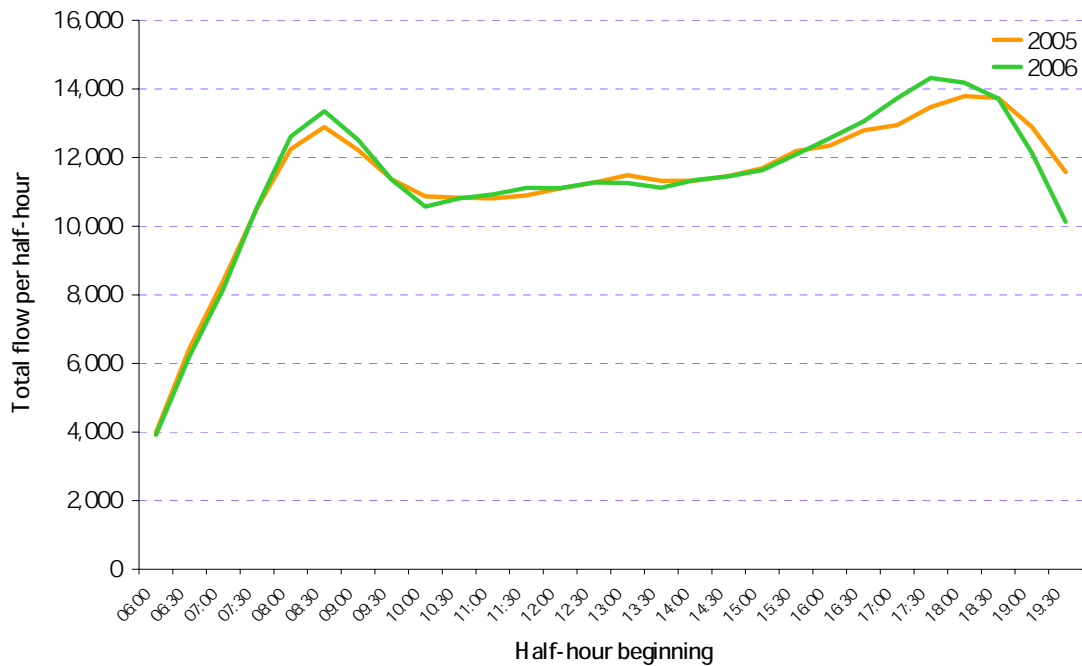


Figure 9.6 Traffic leaving the western extension zone by time of day. Annualised weekdays for 2005 and 2006.



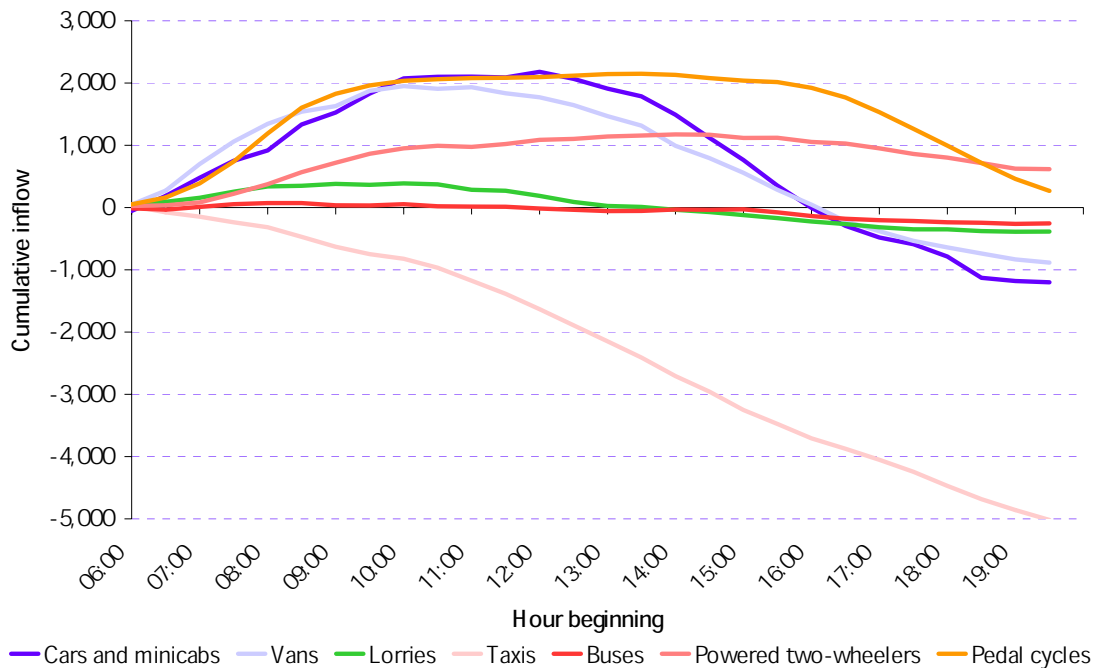
Balance of inbound and outbound flow

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 A 40 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

9. Western extension zone: traffic patterns

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

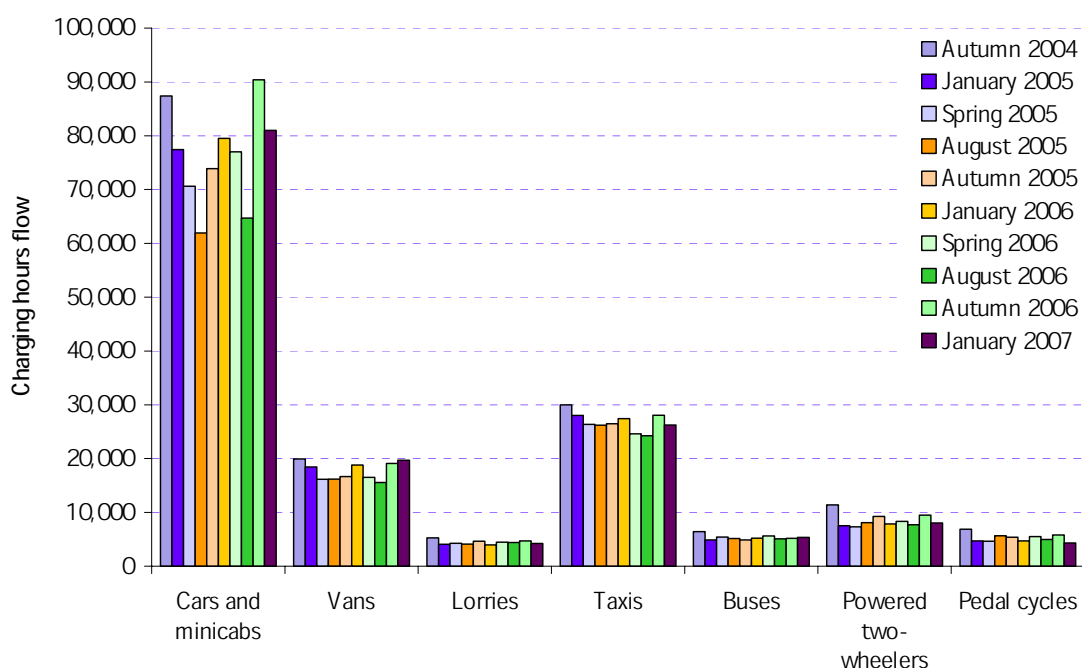
may be entitled to a resident's discount or other discount or exemption, eg as a licensed minicab), compared to about 69 percent in the central zone in 2002, and 58 percent in 2006 with charging at £8.

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.



9. Western extension zone: traffic patterns

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 A 40 Westway screenline within the western extension

The A 40 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 A 40 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 A 40 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 (vehicle 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 A 40 Westway

The elevated section of the A 40 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 (1 000s)	2005 percentage	2006 average two-way flow (1 000s)	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%

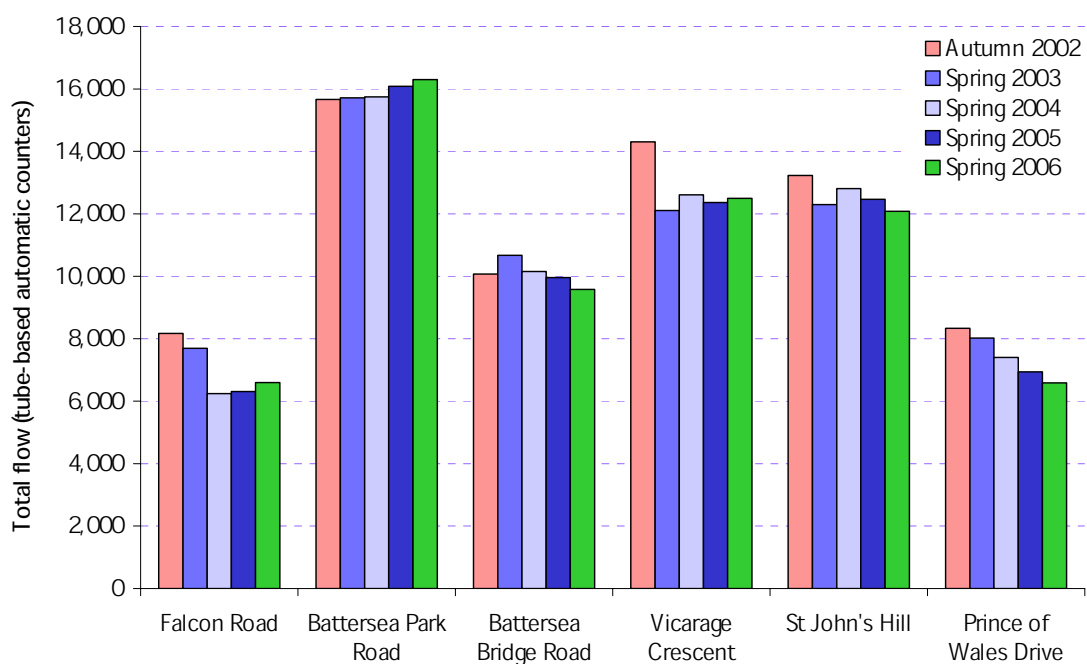
Indicated flows are very similar for both 2005 and 2006, with typically 164,000

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.

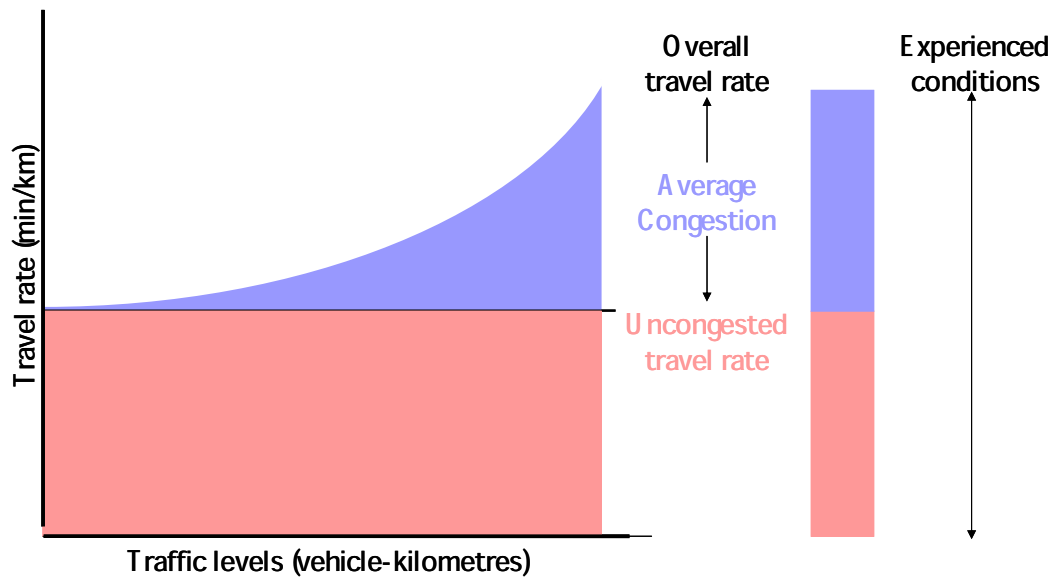
Capacity is influenced by a combination of the basic physical characteristics of the network (topology, carriageway size), the disposition of kerbside parking and loading, various traffic control measures (speed limits, traffic signal settings, bus priority measures etc.) and a range of more transient 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 (n 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 (n 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.

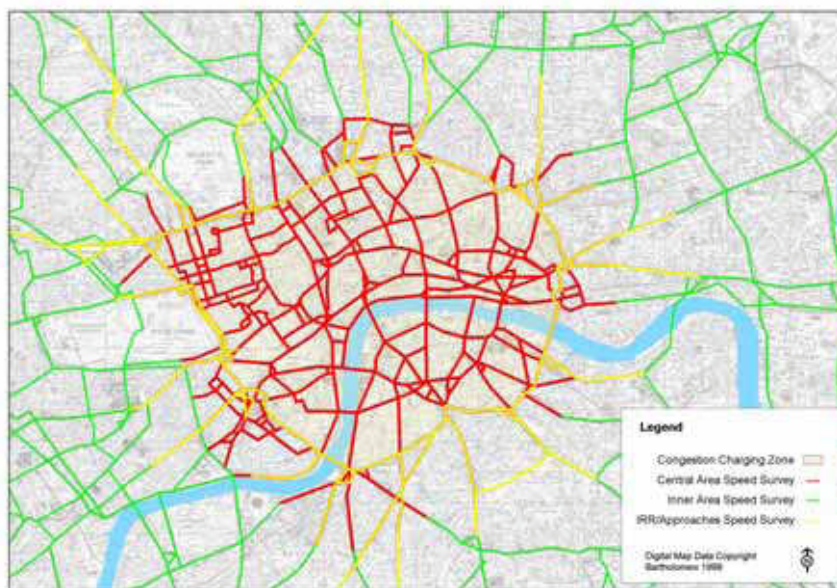
An important aspect of the methodology for these surveys is that they are optimised to give a medium-run view of average congestion which is not unduly distorted by transient events, such as accidents, temporary closures or weather conditions. Since a two-month period during which to complete the central 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.

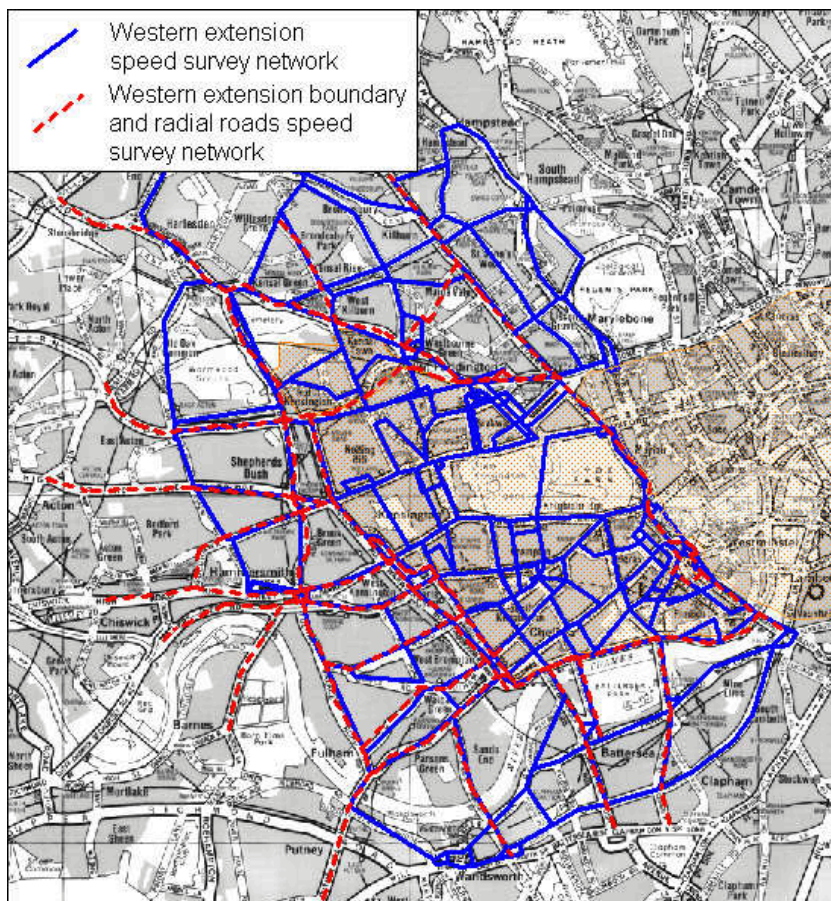
10. Western extension zone: congestion

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

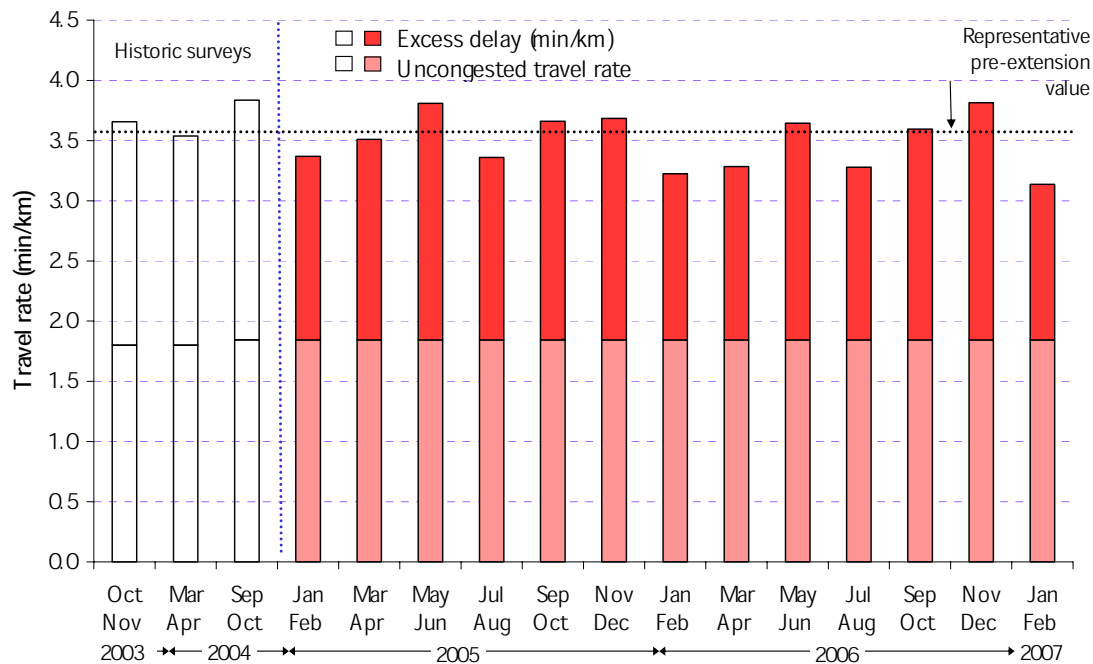
Figure 10.4 shows the available time-series of congestion measurements for the major road network inside the western extension. As the definition of the proposed extension zone changed whilst the scheme proposals were being developed, these observations have been harmonised so that all surveys relate 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.

10. Western extension zone: congestion

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.

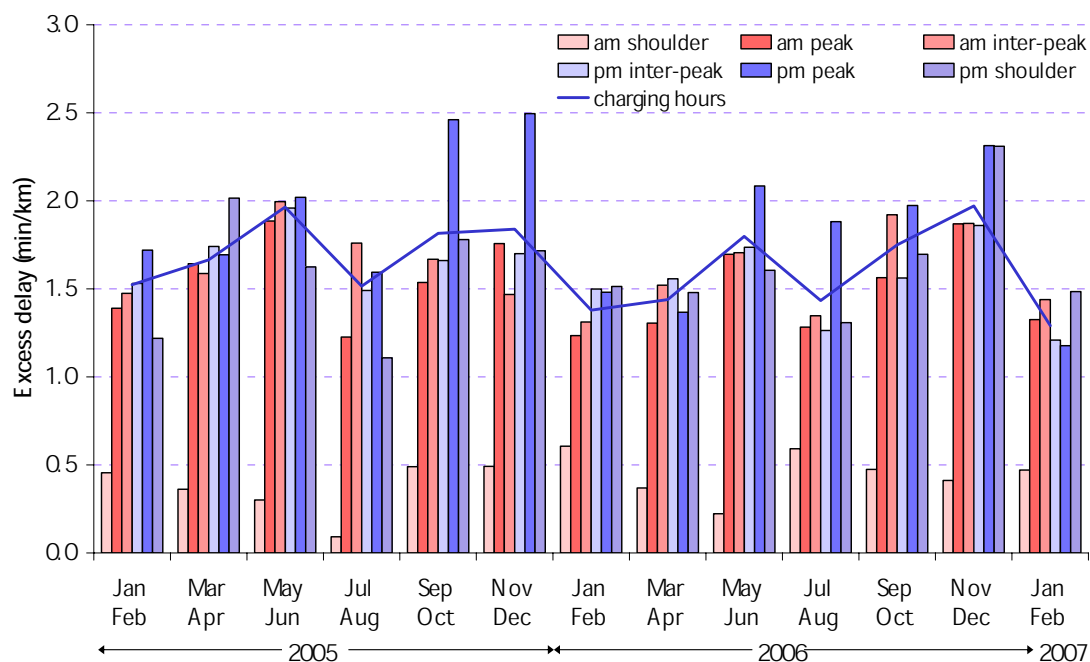
The available time series for this survey makes an interesting comparison with those for the original central zone and inner London, described in Section 3. The deterioration in conditions that characterised the central and inner London data during 2006 was not apparent and, taking statistical considerations 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.

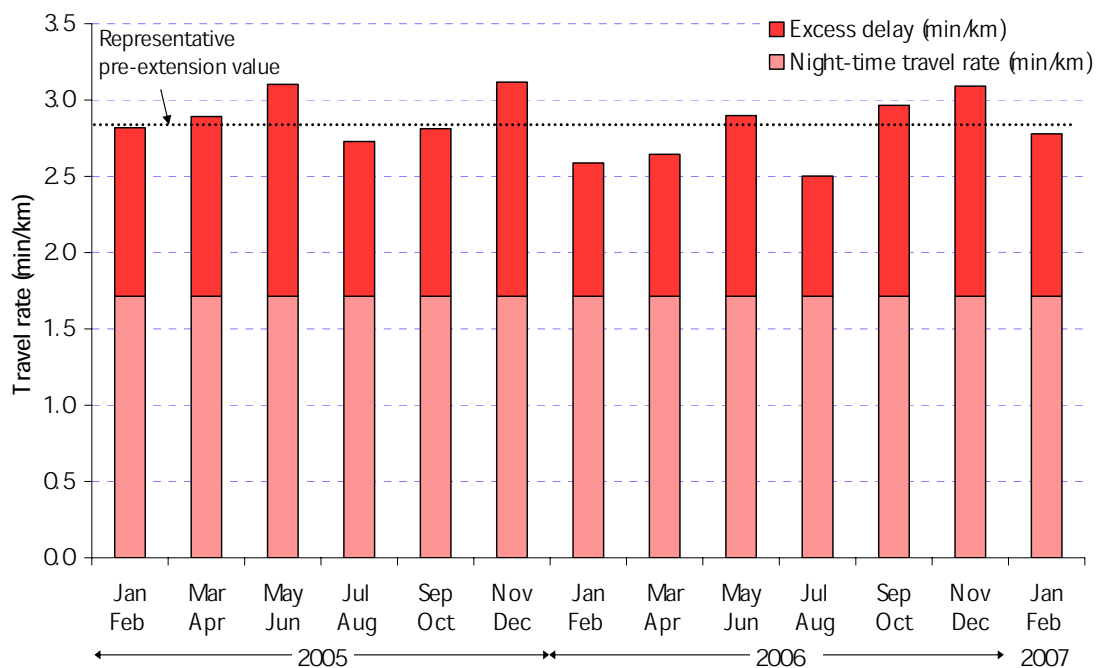
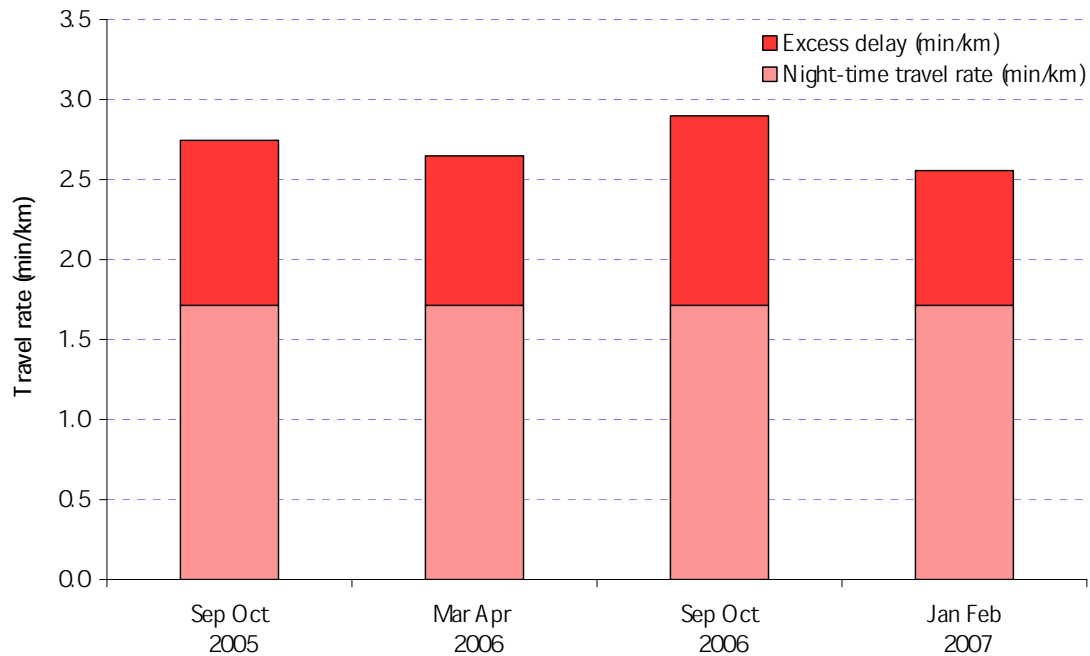


Figure 10.7 shows equivalent data from the western extension boundary route survey. In this case, only four surveys have been carried out prior to the introduction of the extension, three of which (the Spring and Autumn surveys) can be considered representative in seasonal terms. Taking again the observed 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.



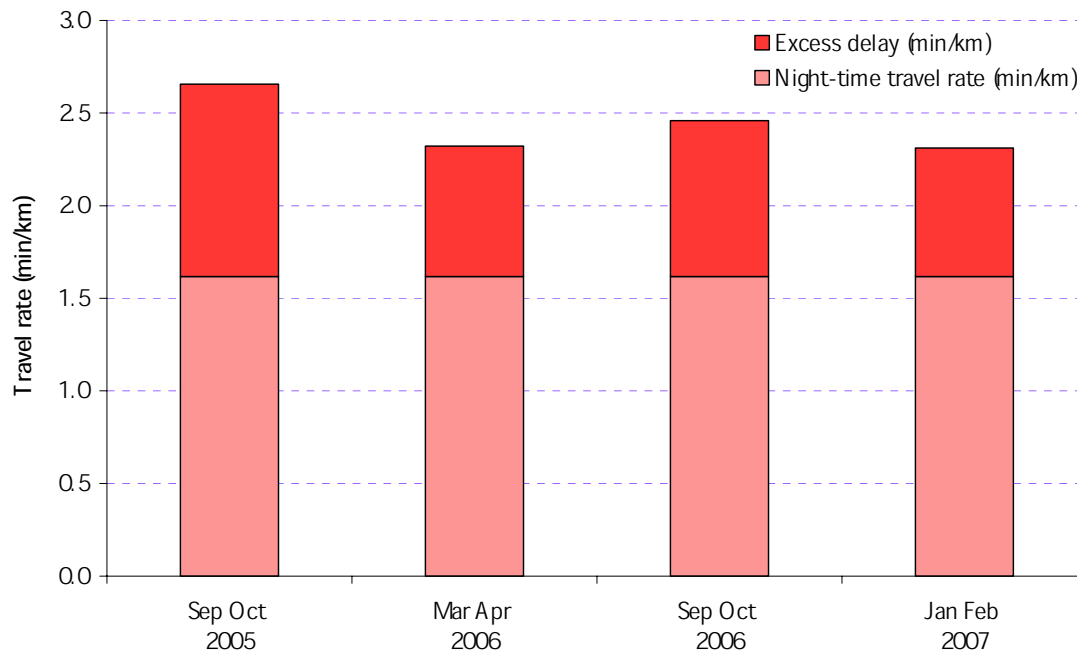
Typical excess delays on the western extension boundary route before the introduction of the extension are therefore 1.15 (western extension) or 1.00 (western extension boundary routes) minutes per kilometre, depending on the survey used.

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.

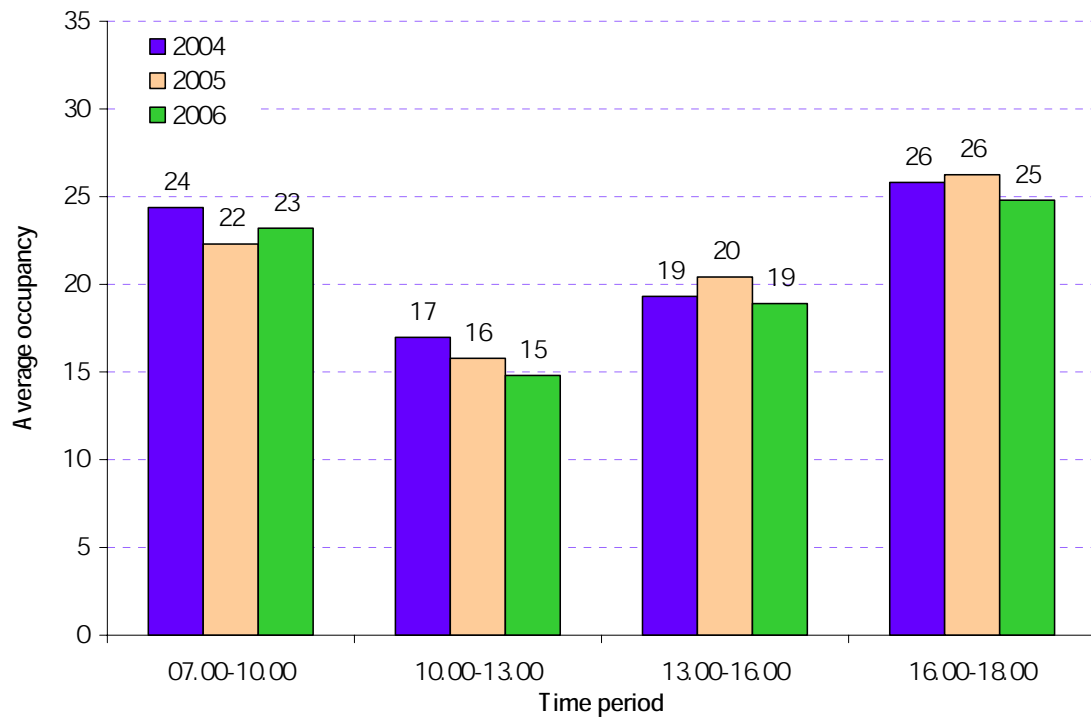
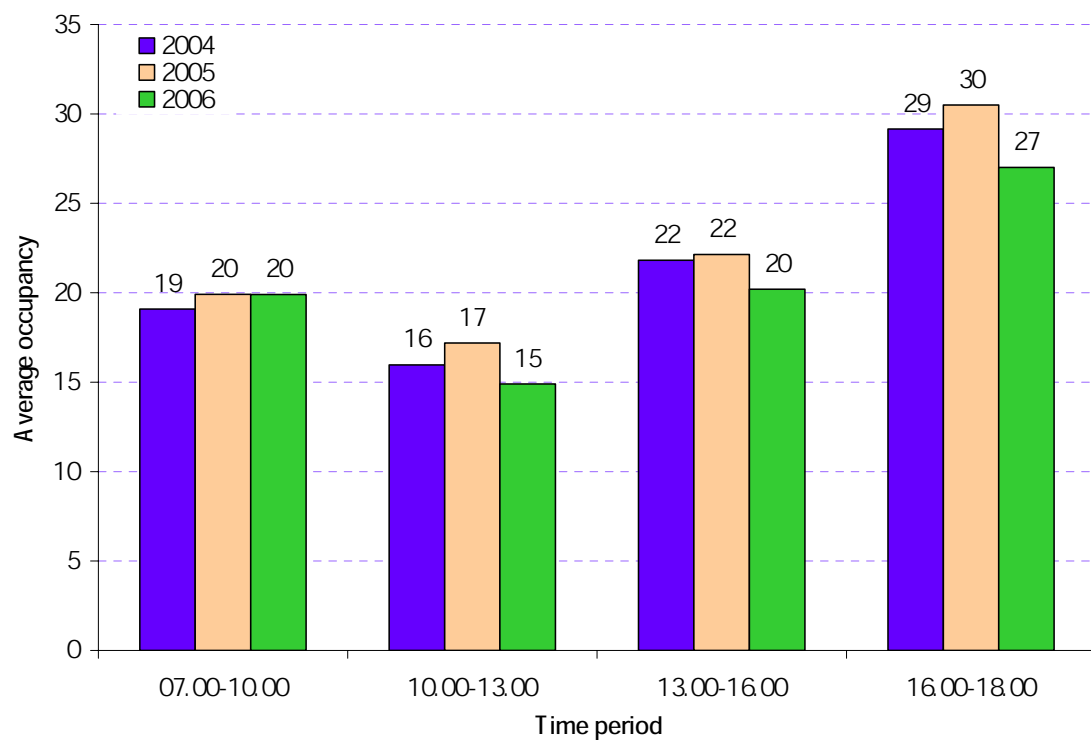


Figure 11.2 Average number of passengers per bus, outbound, crossing the western extension zone boundary, 2004 to 2006.



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

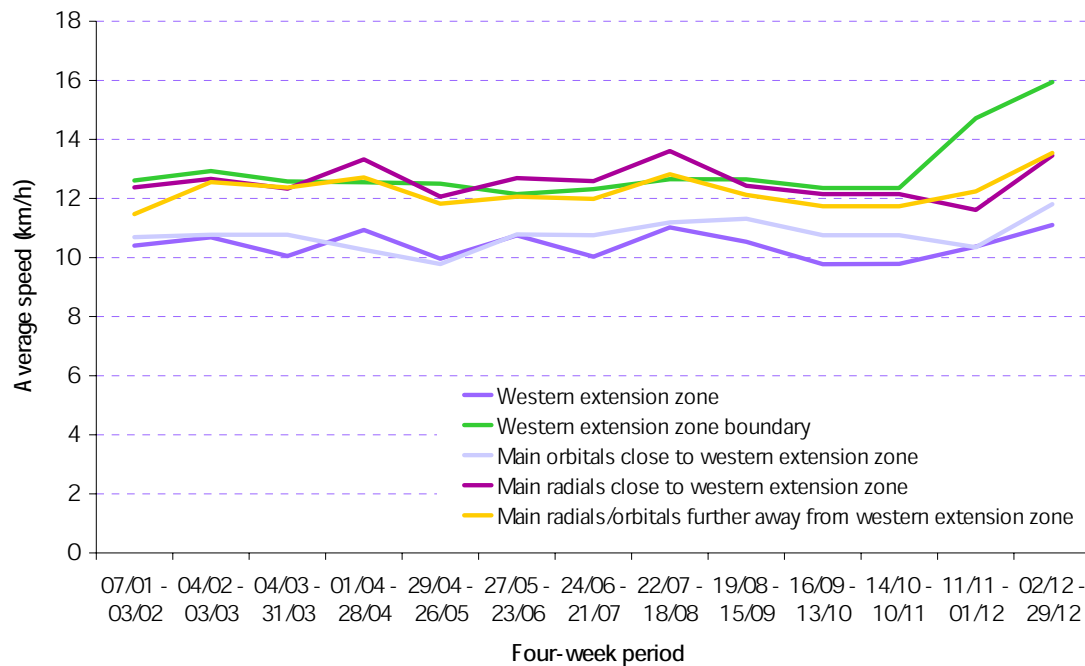
Bus network speeds

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

11. Western extension zone: public transport, accidents and air quality

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.

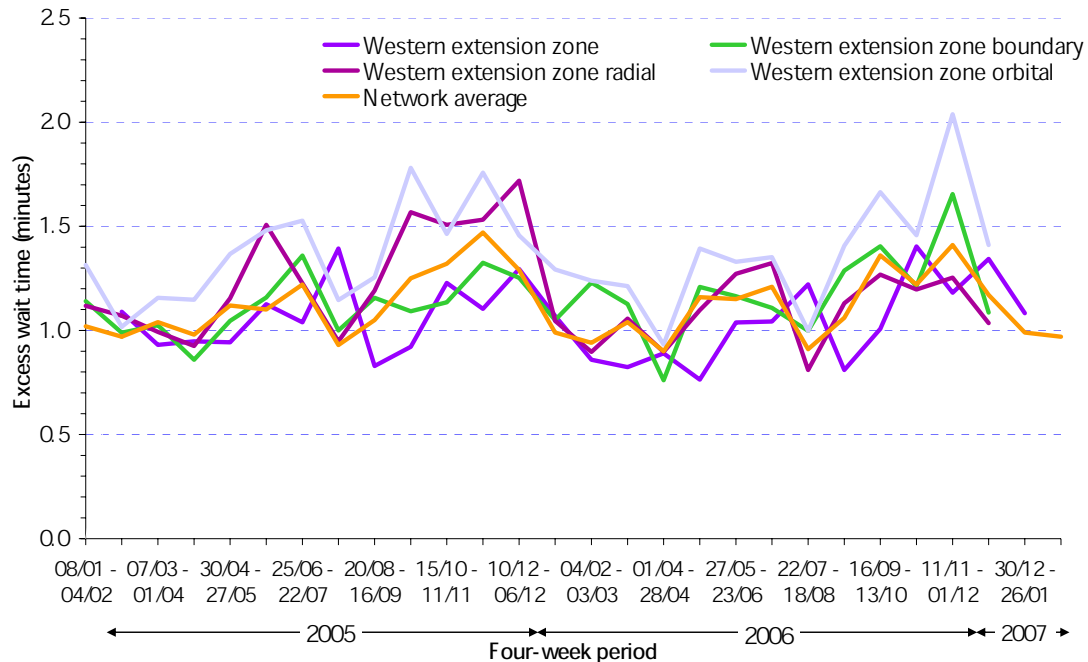
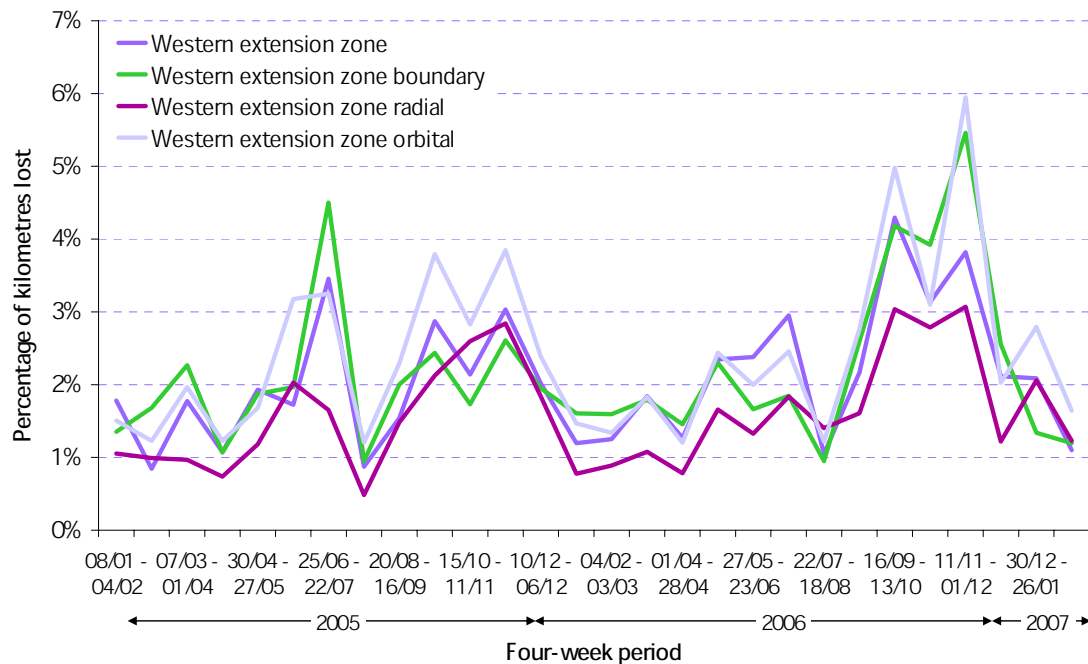


Figure 11.5 Percentage of bus kilometres lost due to traffic delays, January 2005 to January 2007.



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

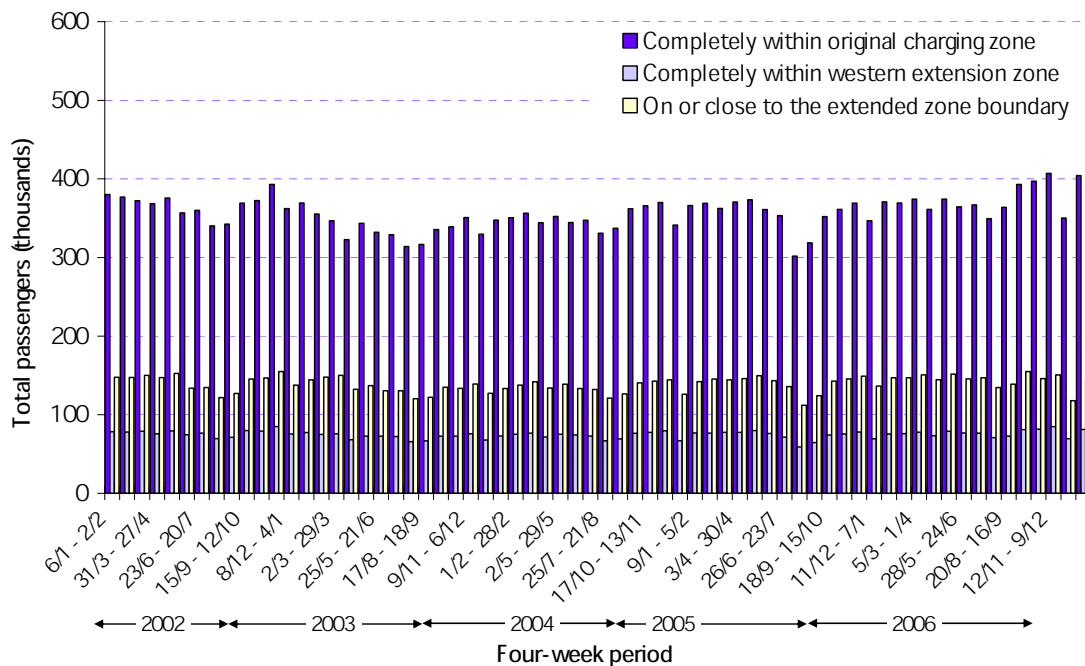
Underground patronage

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 (PM₁₀) 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 PM₁₀ 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 PM₁₀ were both expected to decrease by about 2 percent.

- Commensurate net reductions in emissions of Carbon Dioxide (CO₂) 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
<i>Sites in suburban outer London</i>	
Slade Green, LB Bexley	Not applicable
Kingsbury, LB Brent	
Eltham, LB Greenwich	
Cranford, LB Hounslow	
Teddington, RB Richmond-u-Thames (NO _x only)	
Thornton Heath, LB Croydon (PM ₁₀ only)	
<i>Sites surrounding the extended charging zone</i>	
Upper Street, LB Islington	Acton High Street, LB Ealing
Poplar, LB Tower Hamlets	Holloway Road, LB Islington
Ealing Town Hall, LB Ealing (NO _x only)	Chiswick High Road, LB Hounslow
Bethnal Green, LB Tower Hamlets (PM ₁₀ only)	Mile End Road, LB Tower Hamlets (NO _x only)
Elephant & Castle, LB Southwark (NO _x only)	Swiss Cottage, LB Camden (PM ₁₀ only)
	Hammersmith Broadway, LB H&F (PM ₁₀ only)
<i>Sites within the western extension zone</i>	
North Kensington, RBK&C	Cromwell Road, RBK&C
Pembroke Road, RBK&C (NO _x only)	Kings Road, RBK&C (NO _x only)
	Knightsbridge, RBK&C (NO _x only)
<i>Sites within the original central London zone</i>	
Russell Square, Bloomsbury, LB Camden	Shaftesbury Avenue, LB Camden
Senator House, City of London (NO _x only)	
Horseferry Road, City of Westminster (NO _x only)	

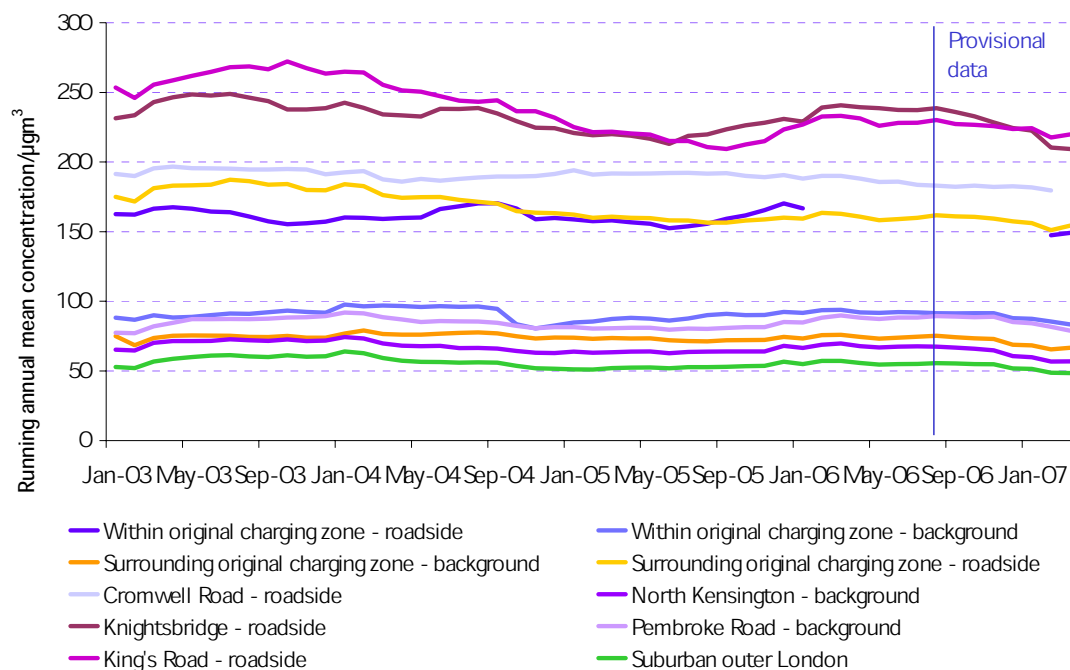
Trends for sites within the extended charging zone are presented individually to provide as much detail as possible. These trends are therefore likely to appear to be more variable than for other comparator sites, as trends in the latter will have been averaged over a group of similar sites. Sites outside 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 NO₂ 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.



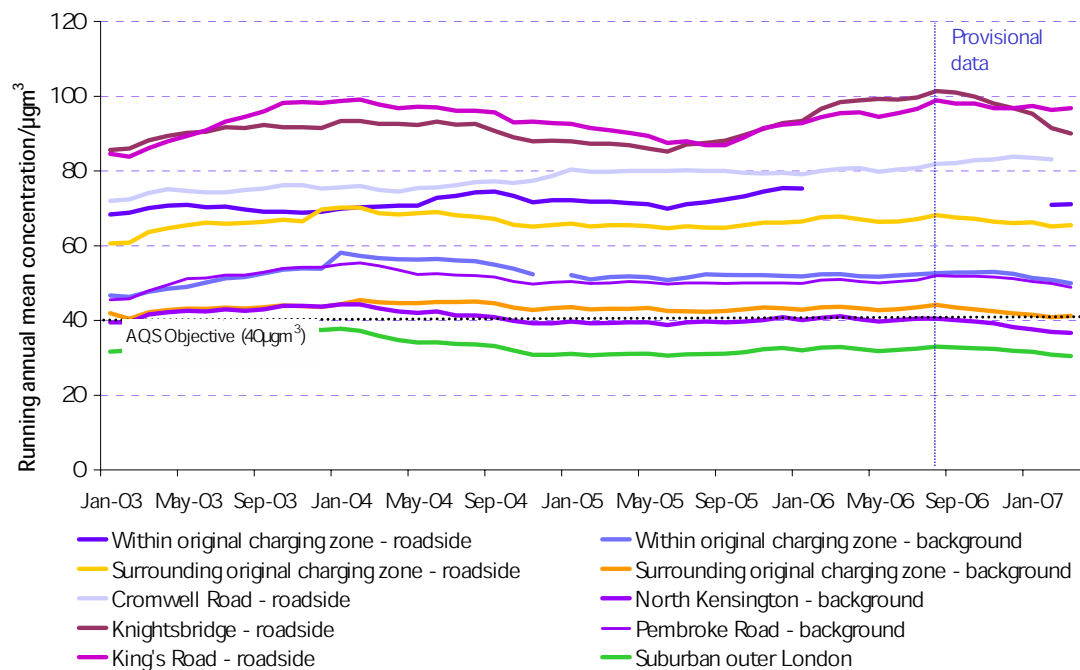
Nitrogen Dioxide (NO₂)

Figure 11.8 shows running annual mean concentrations for NO₂ at the same groups of sites. As noted in Section 4, NO₂ 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 NO₂ 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 NO₂ at sites within the western extension zone is greater than that seen elsewhere. NO₂ 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 NO₂ concentrations at western extension indicator sites.



Fine particulate matter (PM₁₀)

PM₁₀ 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 PM₁₀ in London.

There are two key measures of PM₁₀. 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/NO₂ (above)

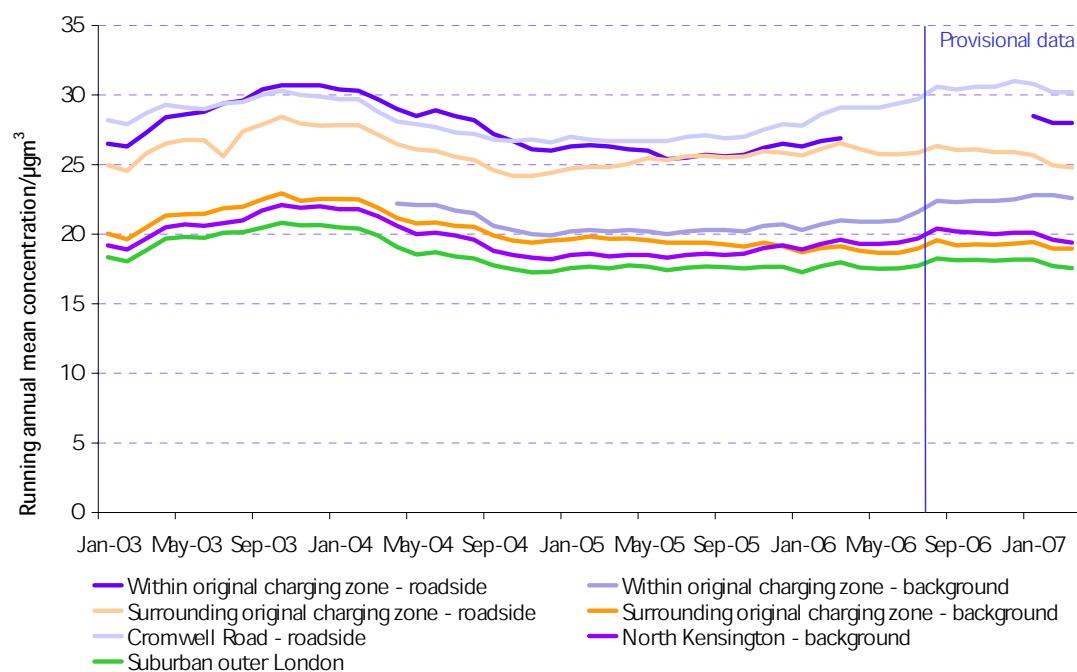
The second, which relates directly to the National Air Quality Strategy objective, is the number of days in any one year that the prescribed concentration (50µg³) is exceeded. The National Air Quality objectives for 2005 permit this on no more than 35 occasions in any one year. Figure 11.10 shows the '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.

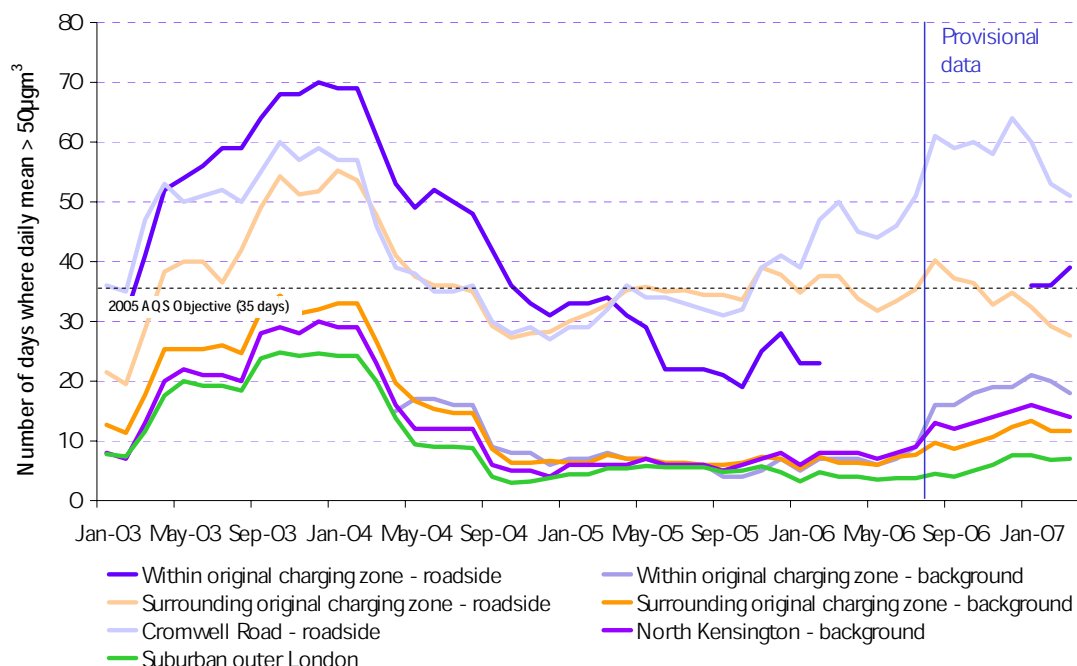
Looking at Figure 11.9, the overall trend in PM_{10} concentrations is fairly indeterminate and similar to that observed in relation to the original central scheme. Only very small reductions in PM_{10} concentration are perceptible at the majority of sites. With the exception of Cromwell Road, which 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 PM₁₀ 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

121 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.

122 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.

124 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.

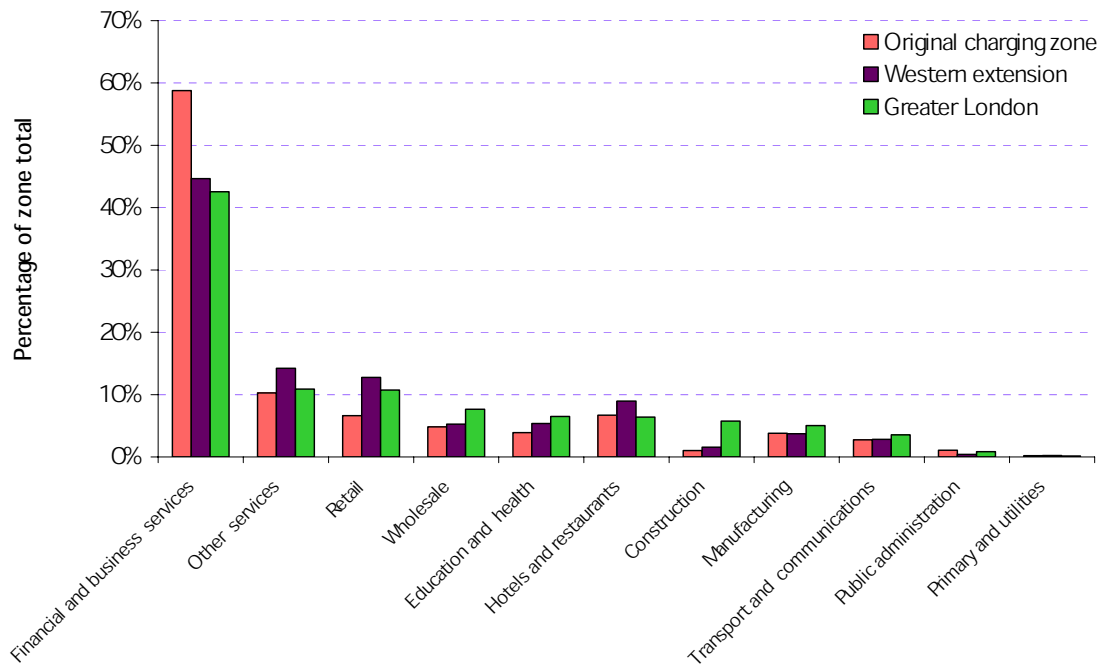
Compared to the original central London zone, the western extension is relatively less represented in the financial and business services sector in terms of employee jobs and business units, as Table 12.2 shows. By contrast, the western extension zone is relatively more represented in sectors such as 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%

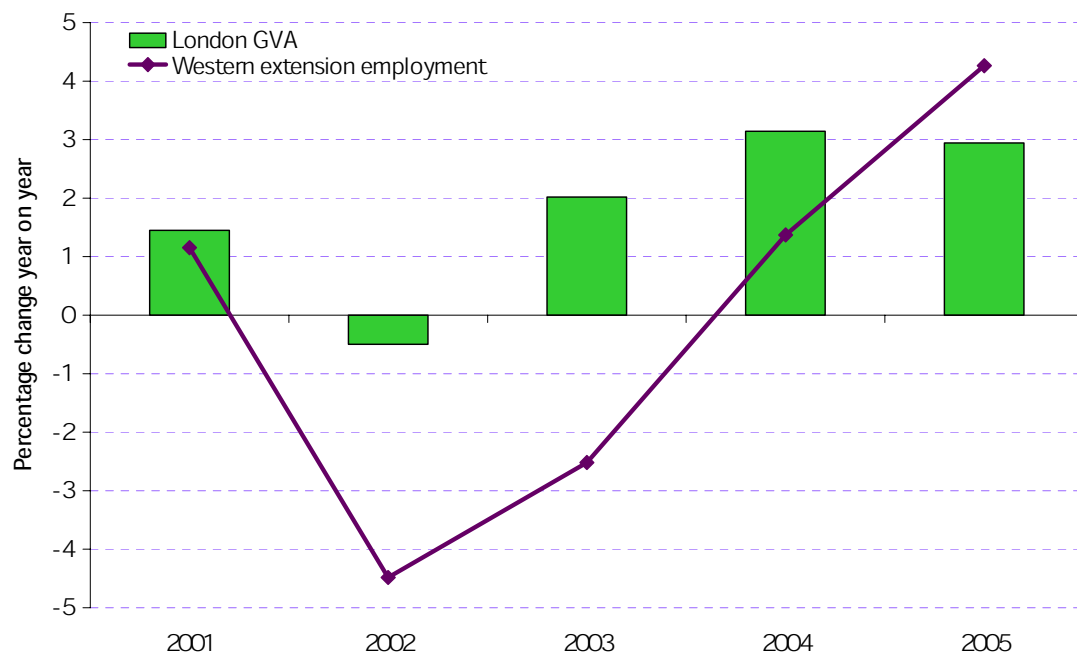
Source: Annual Business Inquiry, Office for National Statistics, January 2007 (rounded)

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

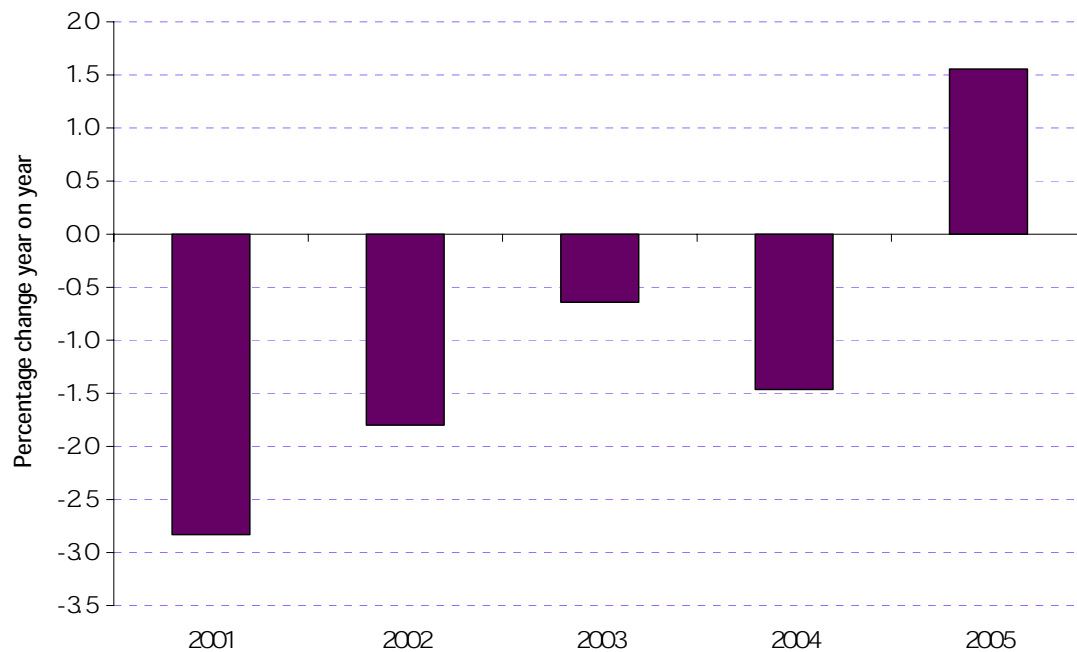


The recent trend in employment in the western extension has very closely reflected general economic activity in London. Over recent years, growth in western extension zone employment has closely corresponded to economic growth in London as a whole. Figure 12.2 shows that recently there has been a prolonged 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



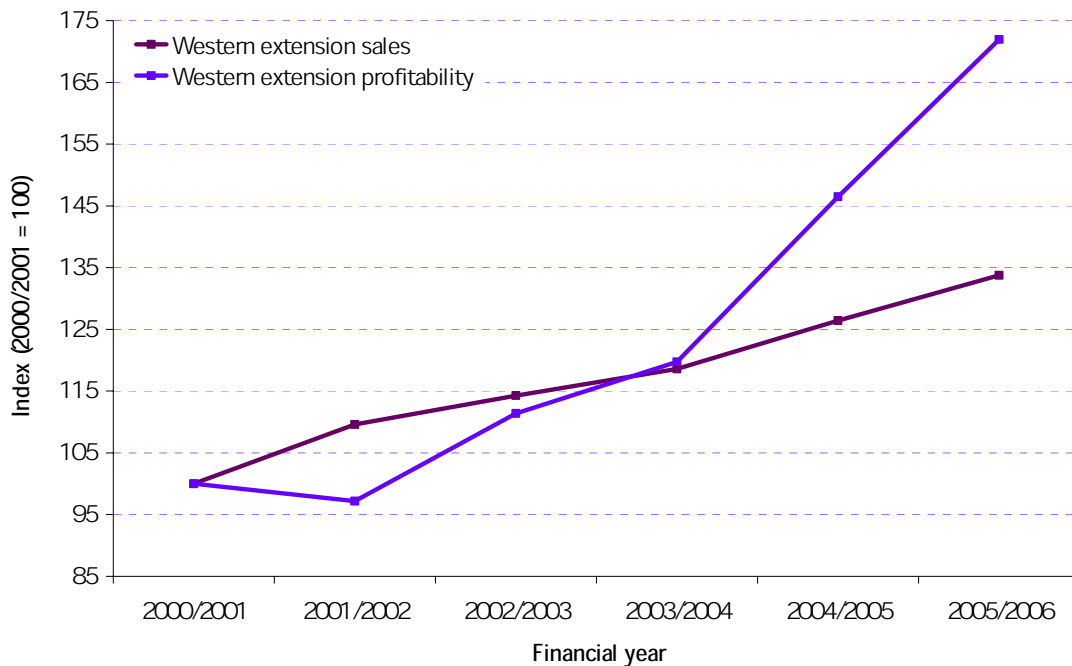
Source: *Annual Business Inquiry*, Office for National Statistics, January 2007.

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

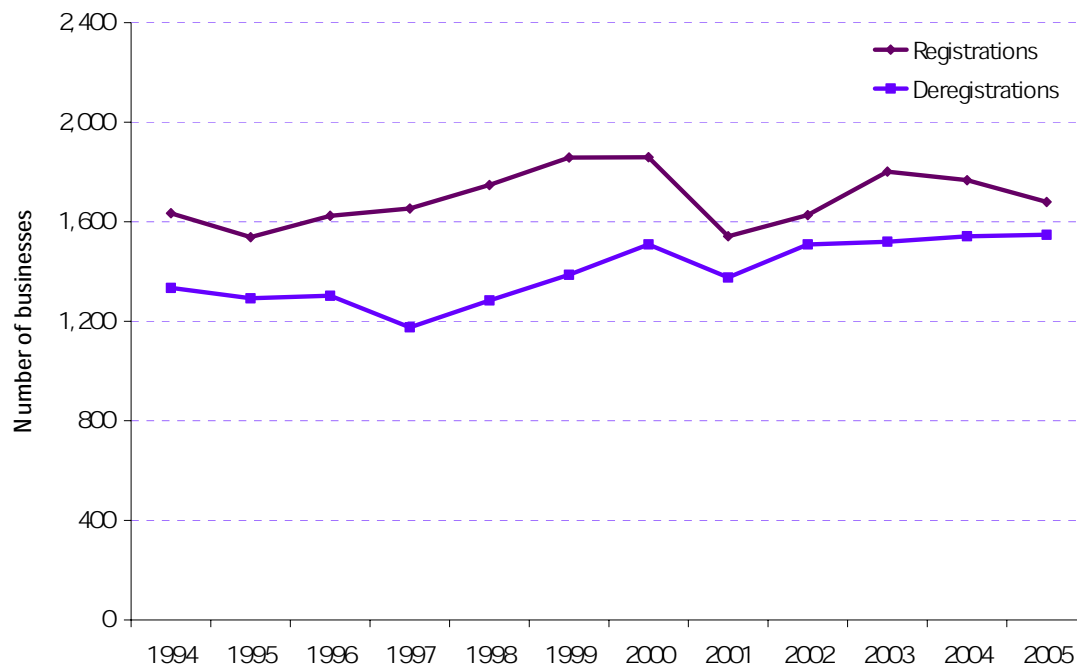
VAT registrations

The VAT registrations database contains records for over 1.8million 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

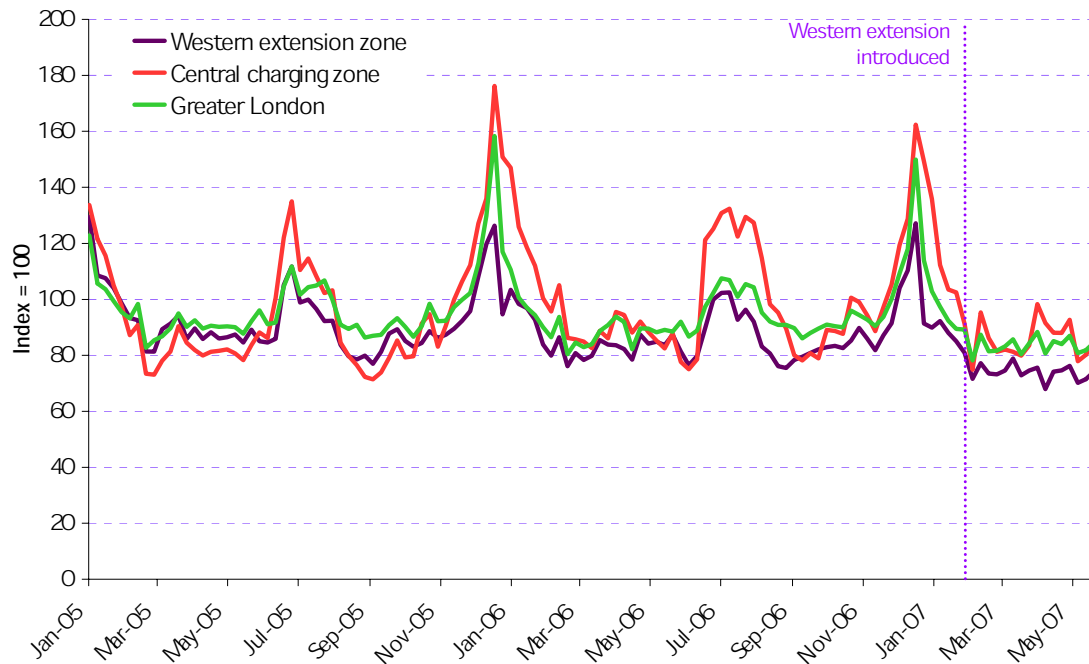
Of the approximately 14,500 VAT registered businesses in the area of the future western extension in 2005, financial and business services represented 51 percent. The next three largest sectors were public services, wholesale and retail, and hotels and restaurants sectors, representing 18 percent, 16 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,

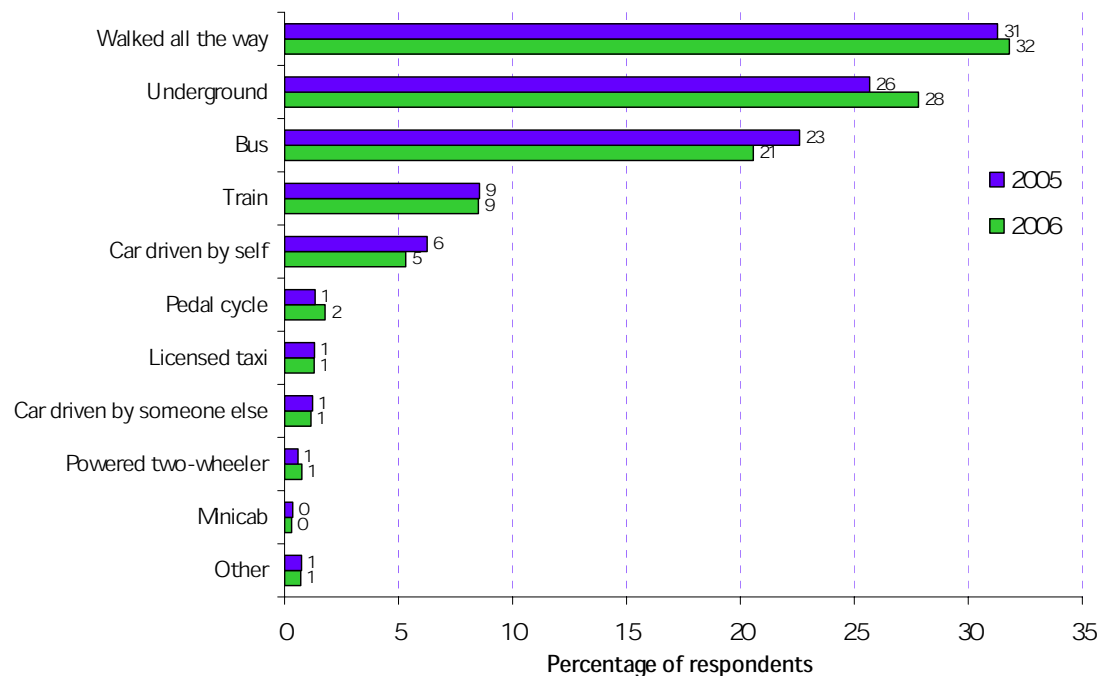
including the results of the most recent survey wave, undertaken between October and December 2006

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.

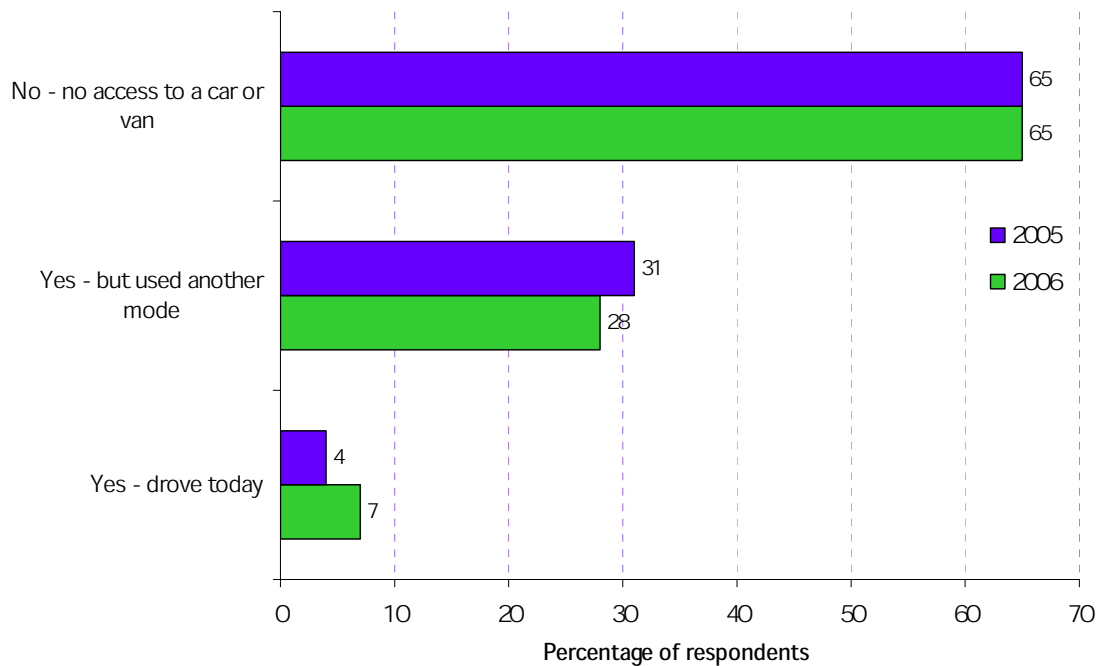
Diners

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.

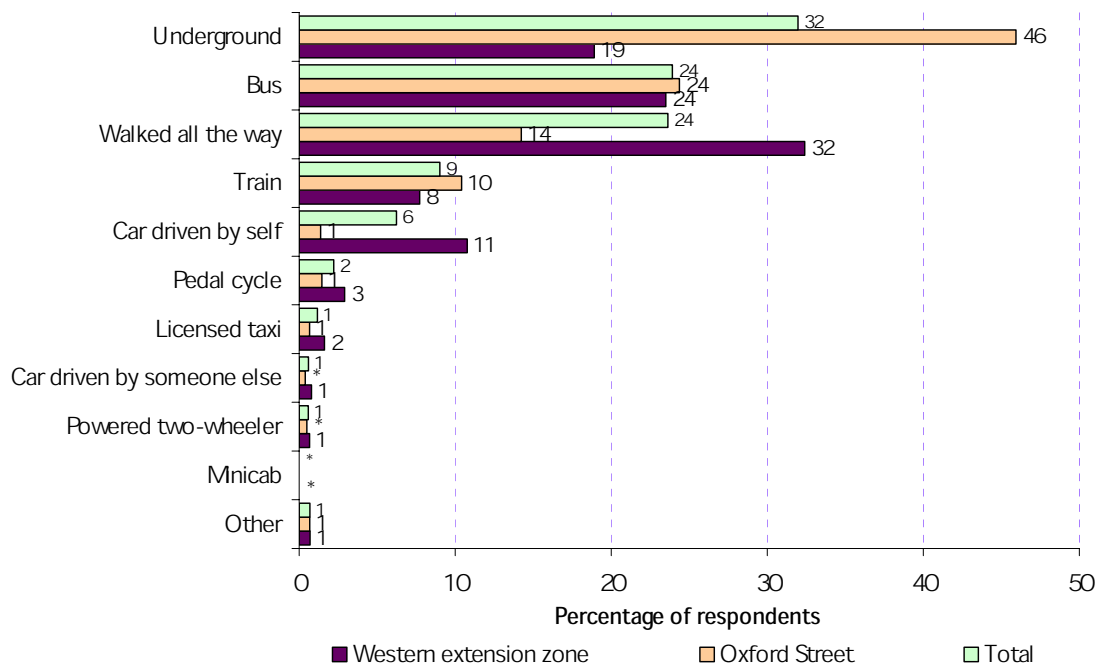
Surveys were conducted in Autumn 2006 outside the Boots and Peter Jones stores on King's Road, Chelsea and outside the Boots and John Lewis stores on Oxford Street as comparators. The exit surveys will be repeated in Autumn 2007 in order to capture any changes in behaviour that have taken place since 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.

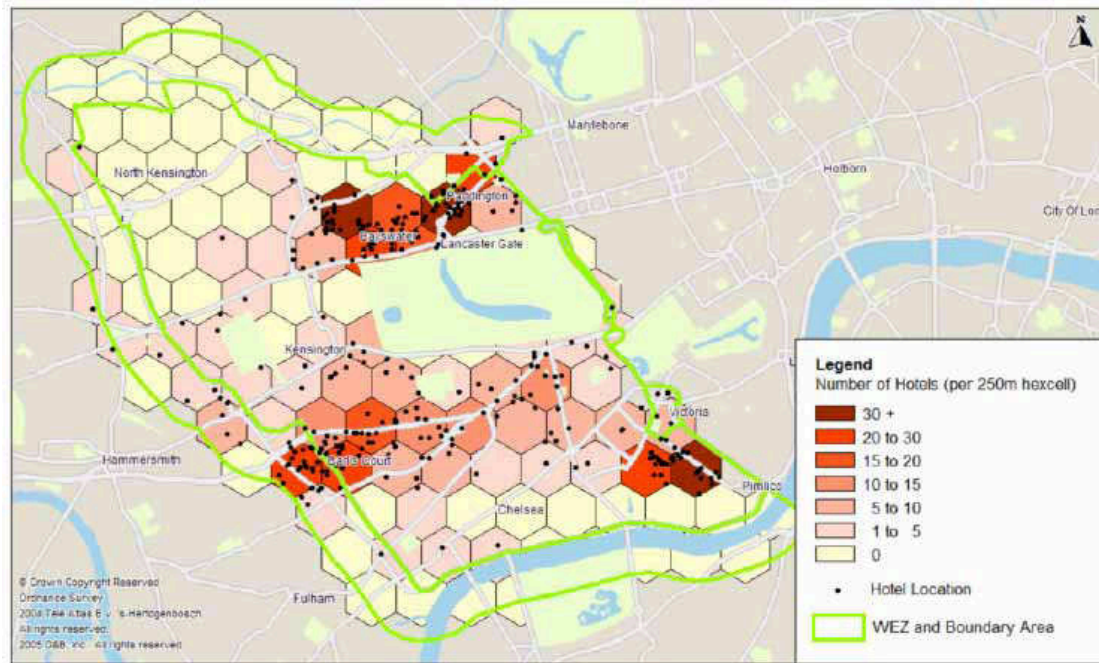
TfL will closely follow the progress of the White City development and incorporate assessments of the economic impacts of White City within the business and economic monitoring programme for the western extension scheme.

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.

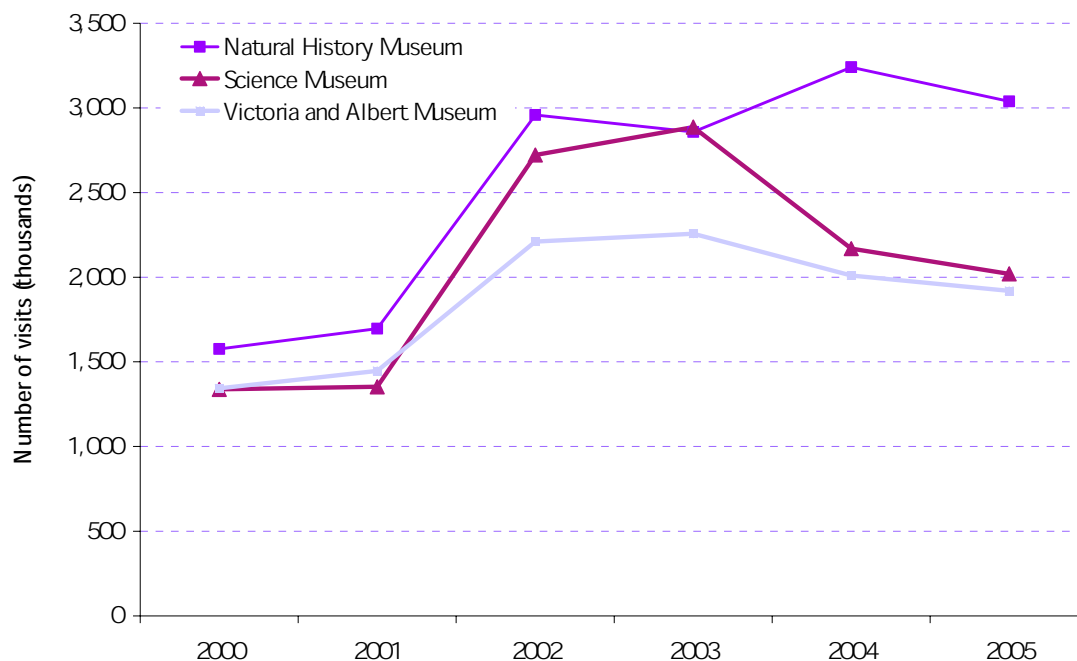
Figure 12.10 illustrates hotel densities in the western extension based on data from Dun & Bradstreet for 2006. There are over 400 hotels in the zone with a particularly high density around Earls Court, Victoria and Paddington.

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 in 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.

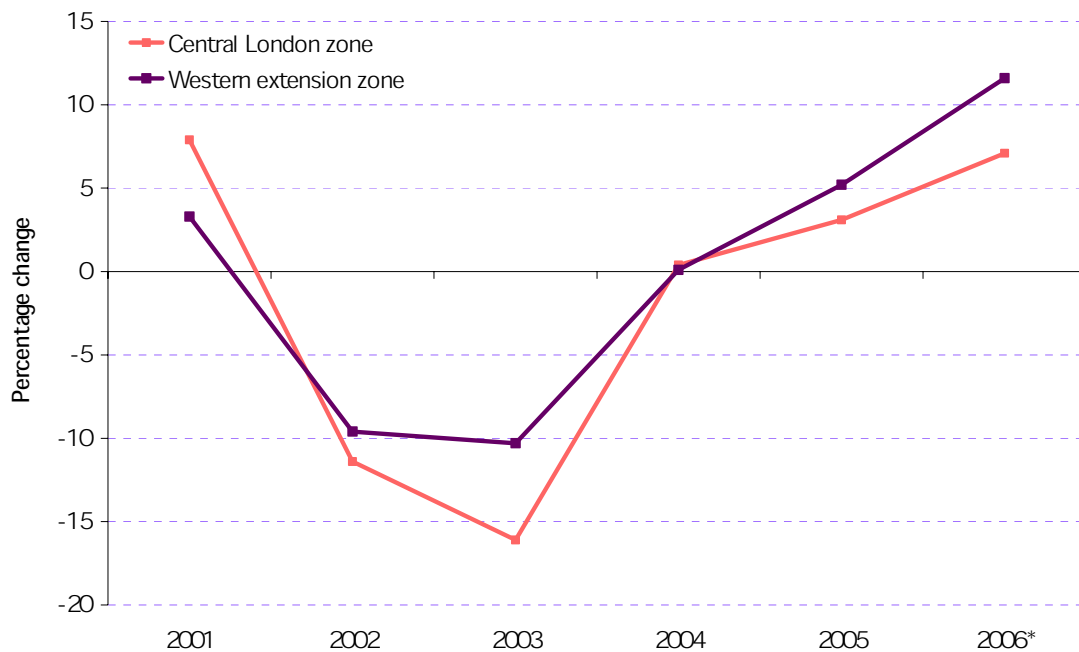
The performance of commercial properties within the western extension zone is assessed in terms of rental value and yield growth of retail and office properties. This is further assessed against the performance of commercial properties in Greater London as a comparator benchmark.

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



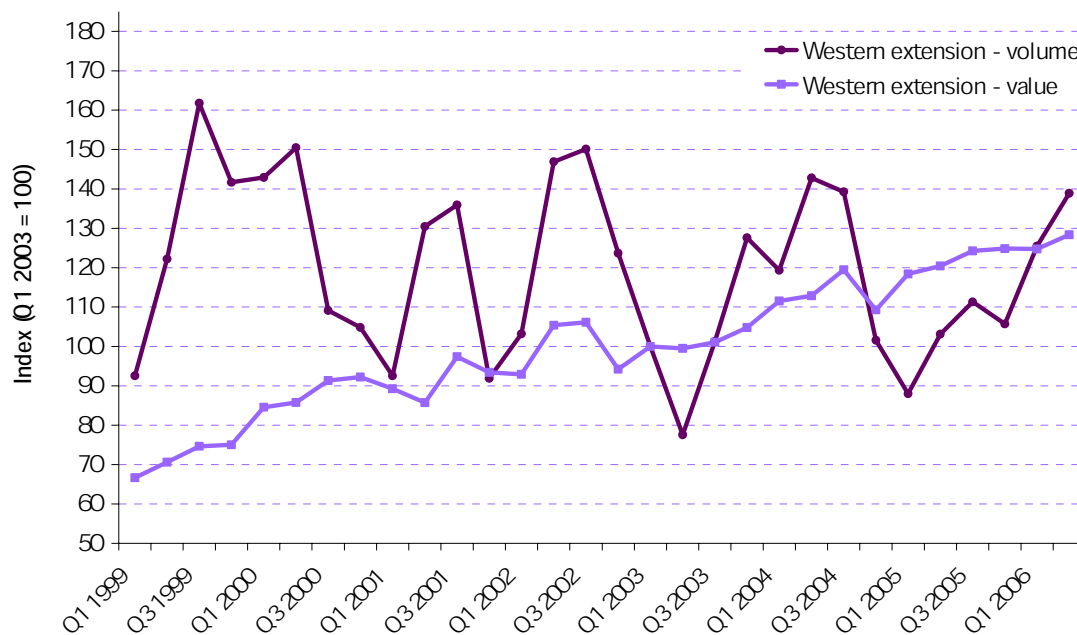
Note: * 9 months to September 2006

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

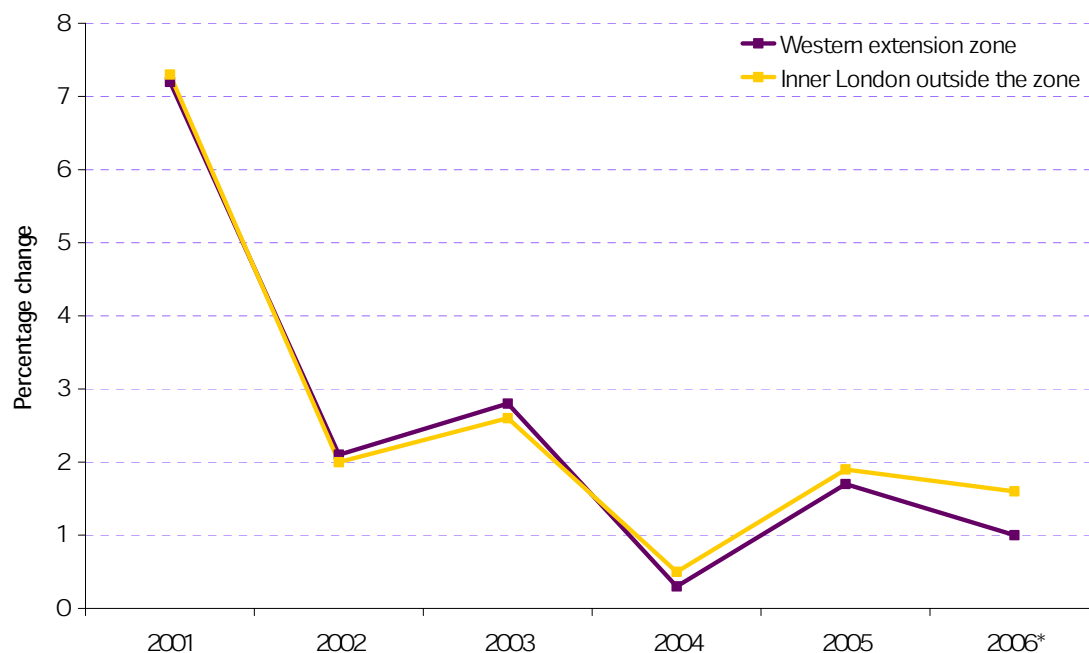


Source: HM Land Registry, 2006

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

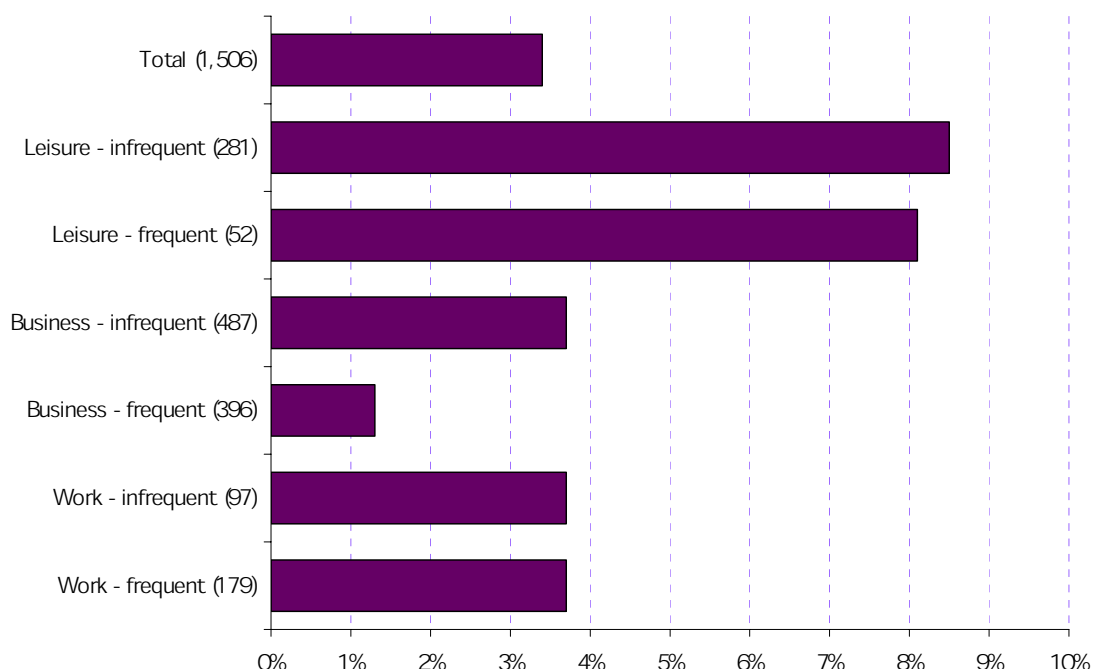
- Although every effort has been made to ensure that the social survey samples are representative of the population, it is likely that some groups are under – or over – represented. Care should be taken when considering findings relating to small or 'harder to reach' groups within the population.
- Furthermore, 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.

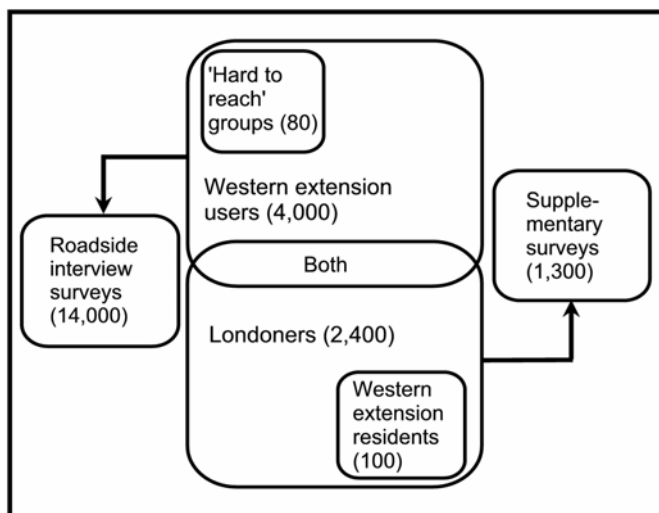
The western extension roadside interview surveys

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.

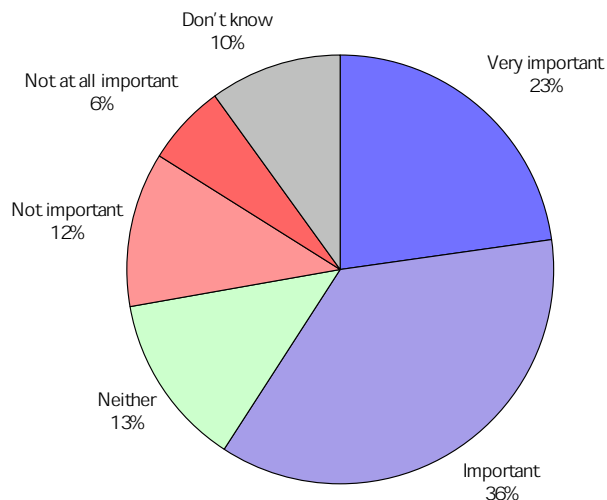
Existing levels of congestion

Around sixty percent of both *Londoners* and *western 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.

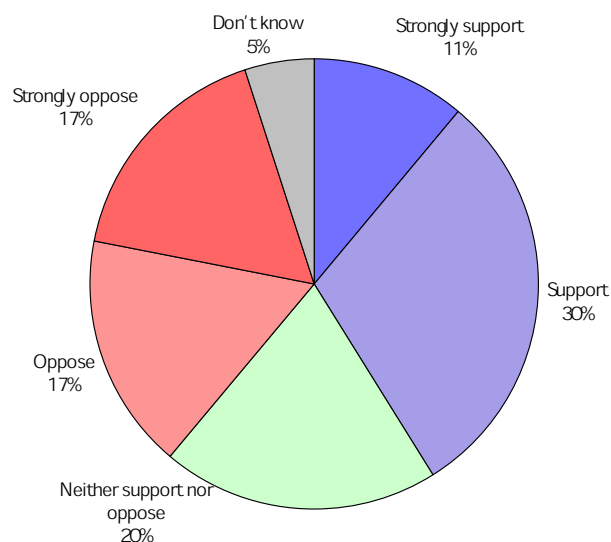
Londoners were also asked their opinion about the levels of congestion in their own local area, which covered the full diversity of residential areas in London. Here, about one third (32 percent) felt that traffic congestion in their local area had got worse over last year, whilst only 7 percent thought 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

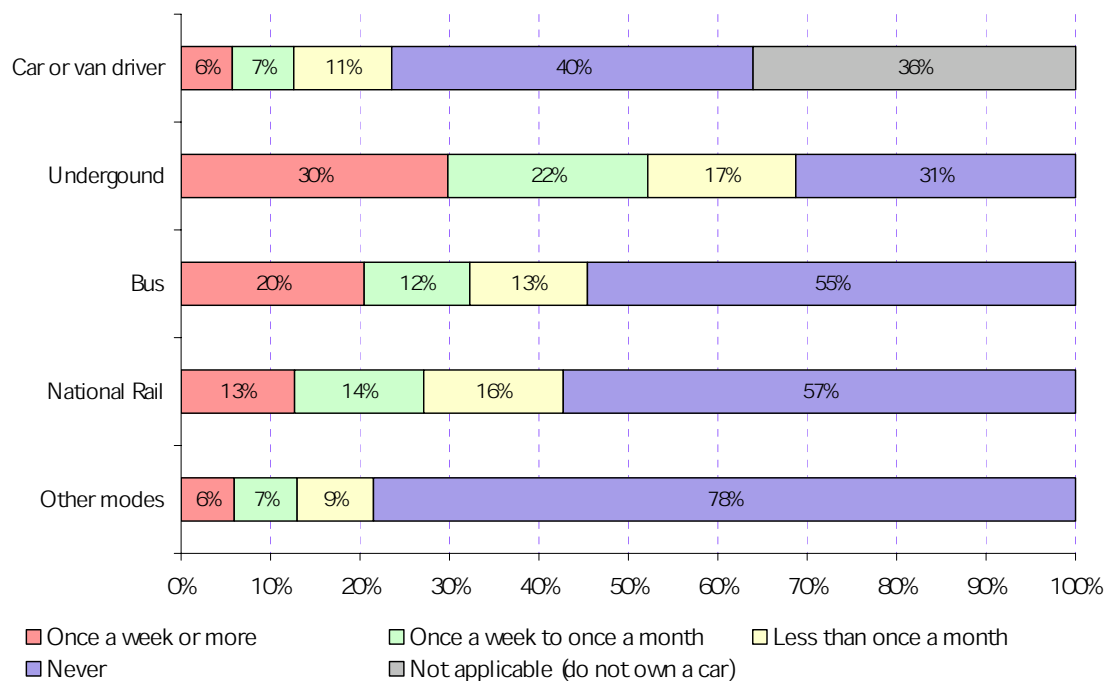
The following sections describe broad travel behaviour patterns by respondents to the two principal social impacts surveys. Although the numbers involved cannot be taken as precisely quantifying these aspects, they are indicative in a broad sense and helpful in understanding existing behaviour patterns 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.

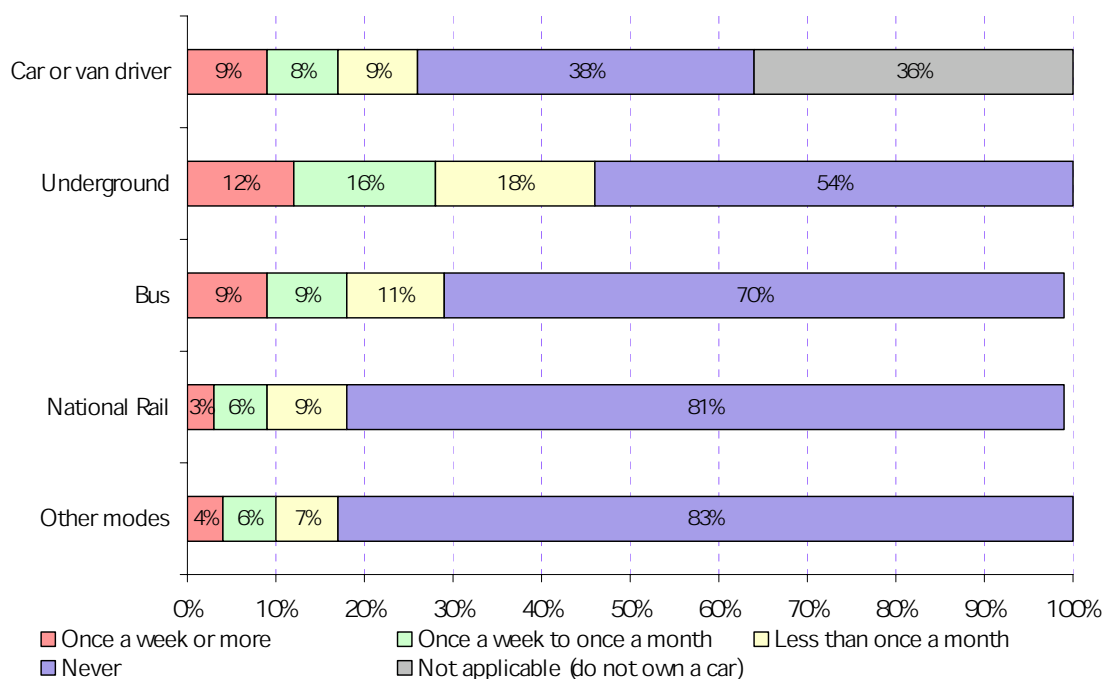
Figure 13.5 Frequency of Londoners' travel into the original central London congestion charging zone during current charging hours (07.00-18.30) Londoners Survey, January-February 2007.



*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.

13 Western extension zone: social and behavioural impacts

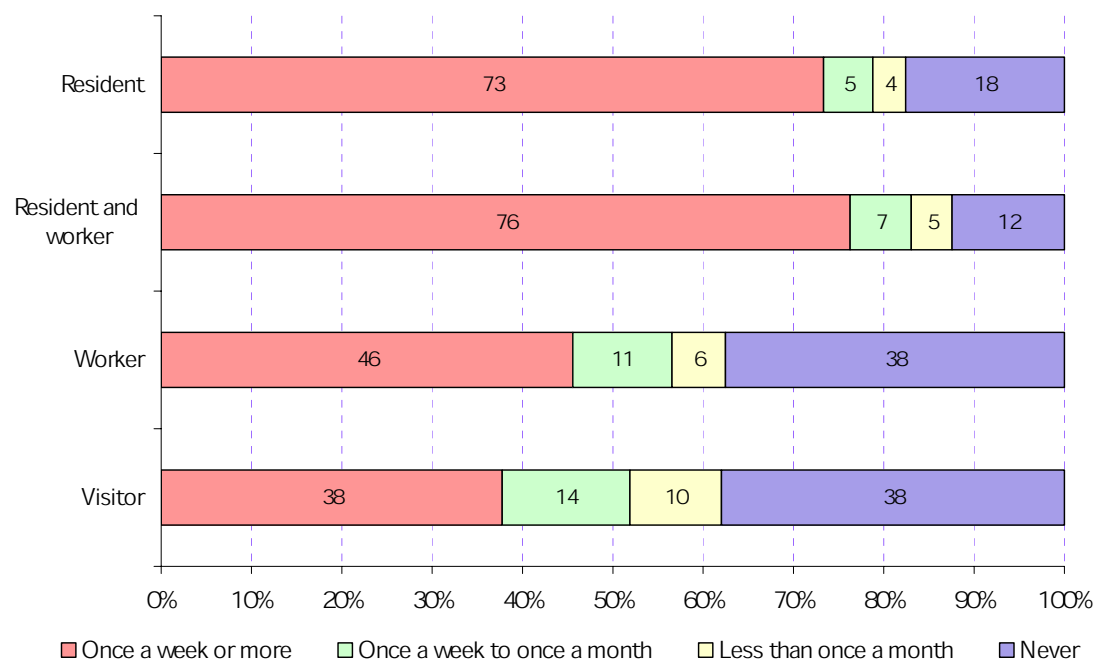
Table 13.1 Frequency of travel in or into the western extension zone during future charging hours (07.00-18.00) by mode. Western extension users survey, Wave 1, column percentages.

	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%

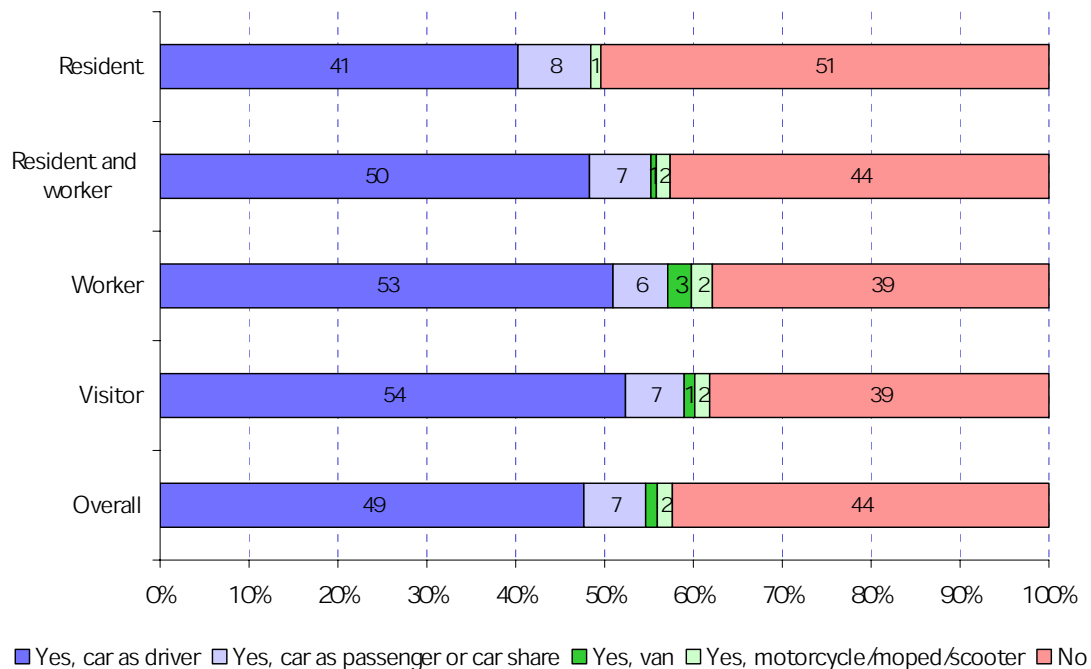
Access to cars/vans, parking and congestion charging payments

- 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.

13 Western extension zone: social and behavioural impacts

- 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 (53percent compared to 40percent)
- More than half (58percent) 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 (49percent) 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 (53percent and 38percent respectively) compared to Londoners survey respondents living in other areas of London (66percent)
- Amongst *Londoners* who frequently drive (once or more per week) in the western extension zone, nearly two thirds (65percent) 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, 43percent said they personally paid for parking in the western extension zone.

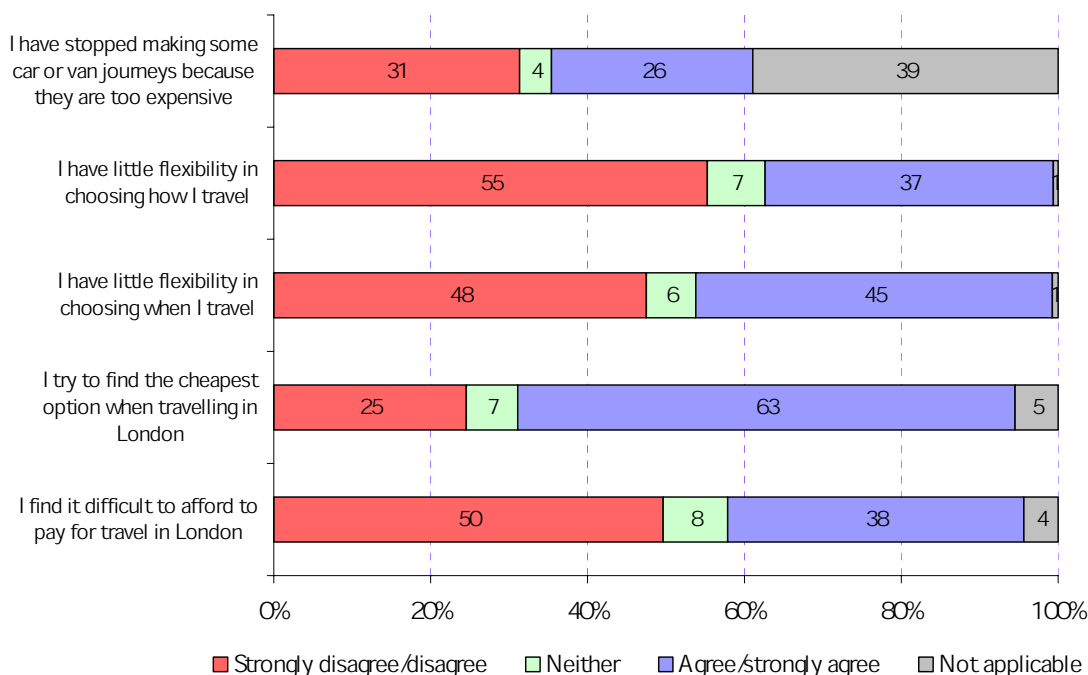
Affordability and flexibility of travel in London

- Responses from both surveys in this area are generally in line with what might be expected. Around 63percent of the *western extension users* and 67 percent of *Londoners* agreed that they try to find the cheapest option when travelling in London, and 38percent and 49percent 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.

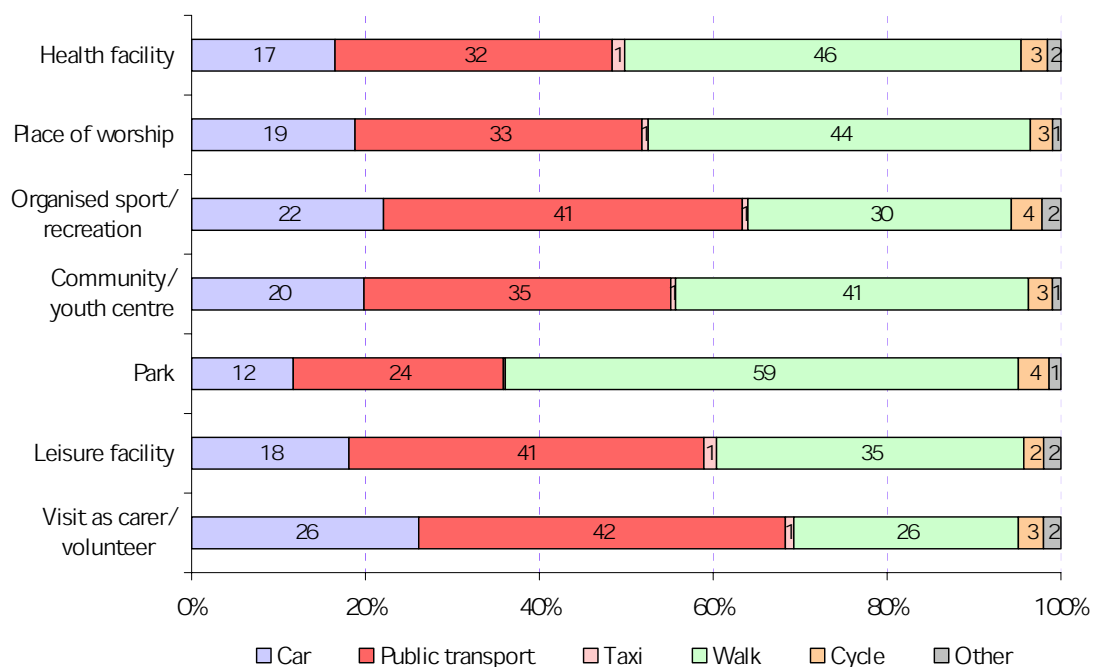
- Approximately three quarters (72 percent) of respondents felt there would be no change in the number of car journeys they made into western extension zone.

- 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
Community/youth centre: 360
Visit as carer/volunteer: 462

Place of worship: 802
Park: 2,980

Organised sport/recreation: 1,219
Leisure facilities: 2,950

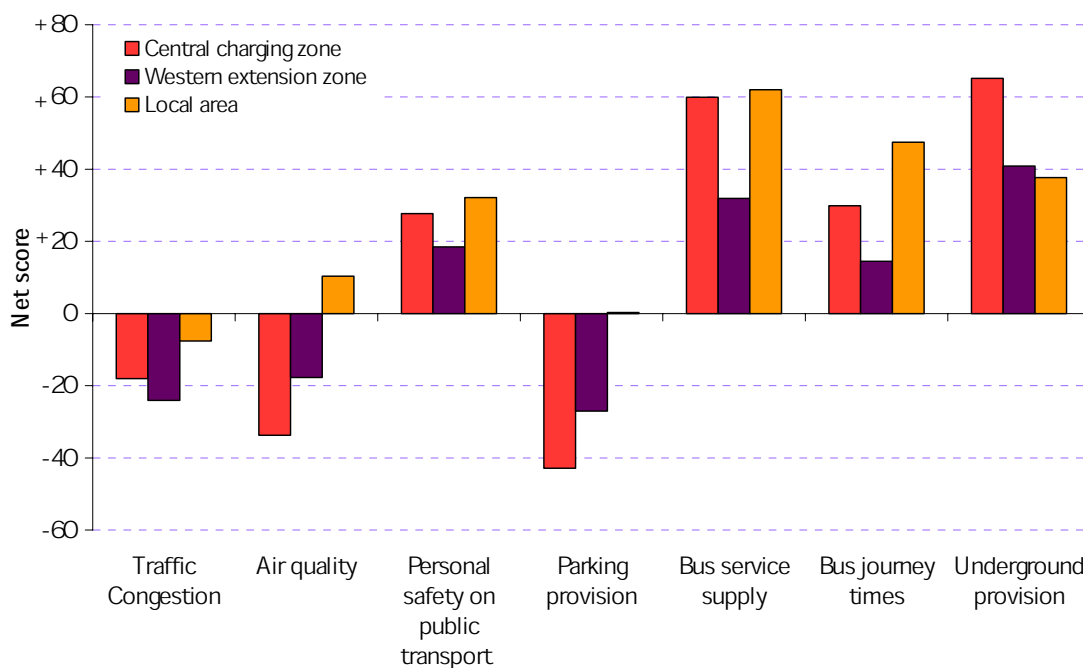
Western extension users were asked whether they expected the frequency of their trips to local services and facilities to change because of the introduction of the extension zone. The majority (more than 80 percent for each trip purpose) said they did not expect the frequency of these trips to change, 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.

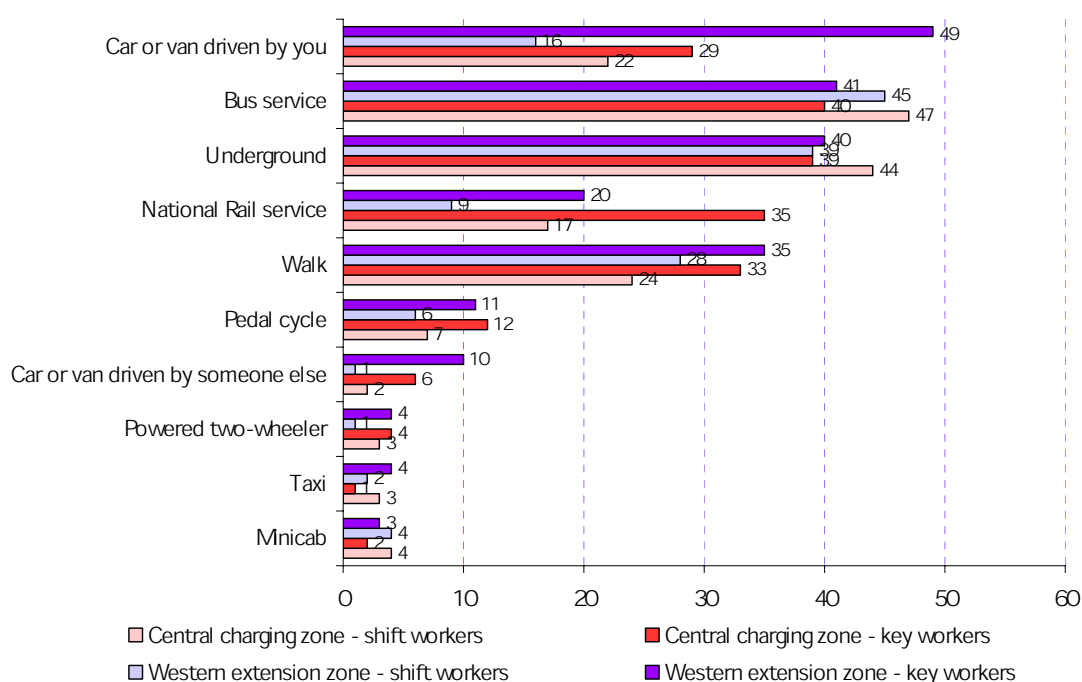
For shift workers, 127 people employed by 86 organisations in the original central London zone and 124 people employed by 87 organisations in the western extension zone were interviewed during Autumn 2006. These groups will be revisited following introduction of the extension, during Summer and Autumn 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:

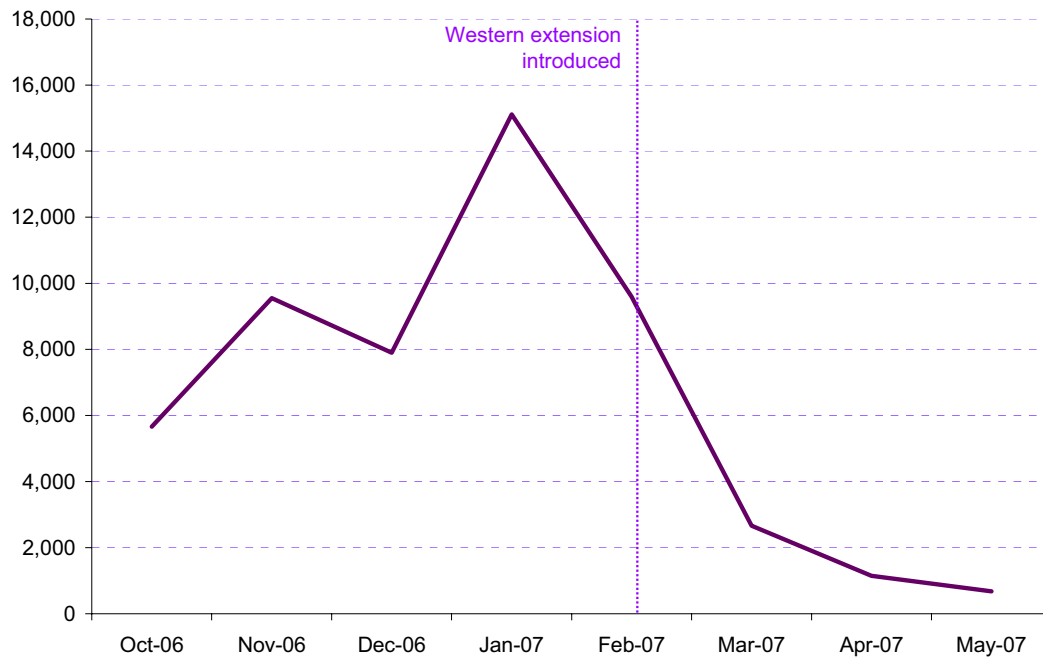
- the ability to pay the charge at the discounted 90 percent rate and have use of the central London congestion charging zone from the date of successful registration;
- the £10 registration fee was waived for all successful applications received before 19 February 2007.

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.

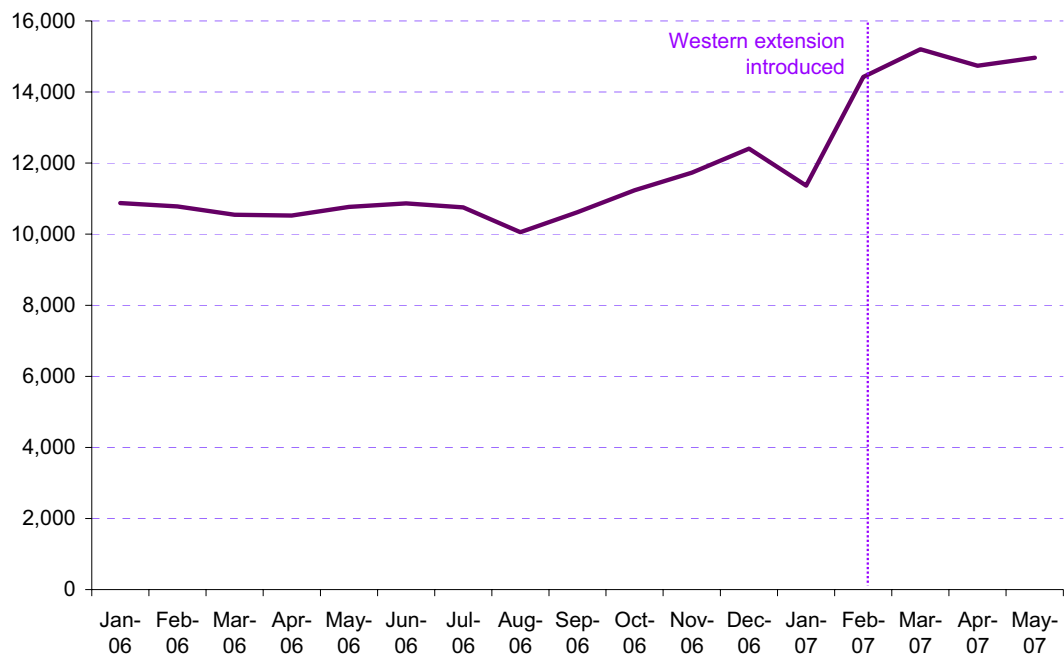
Blue Badge discount applications, which allow a 100 percent discount, increased slightly in the run up to the introduction of the western extension. The total number of active Blue Badge accounts in May 2007 was around 113,700.

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.

14. Western extension zone: the first three months

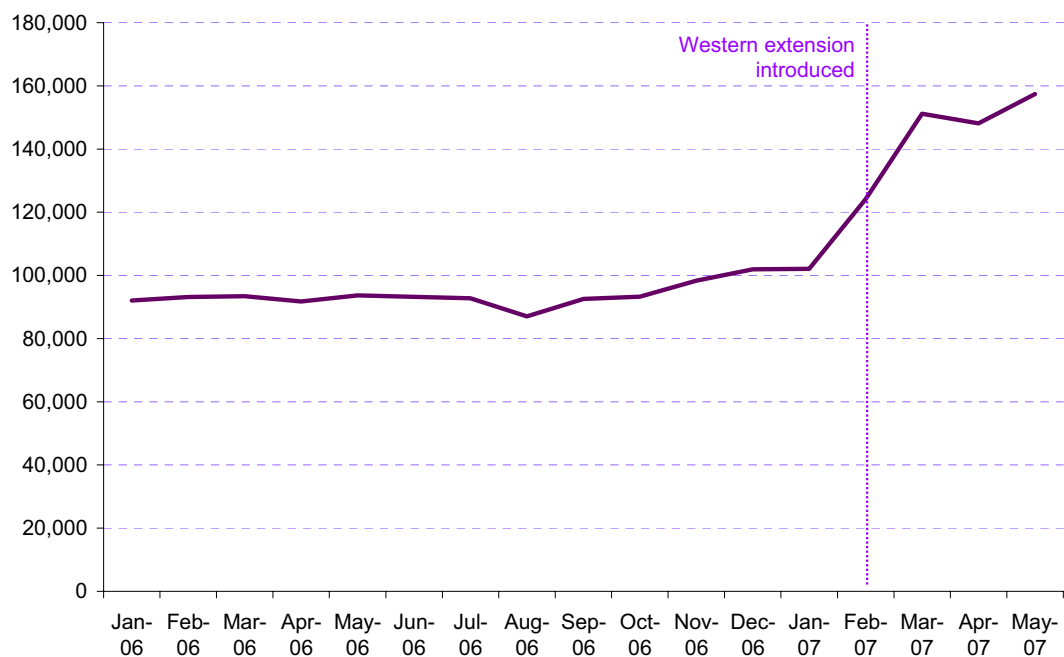
Figure 14.2 Average number of calls received at the congestion charging call centre per day.



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.

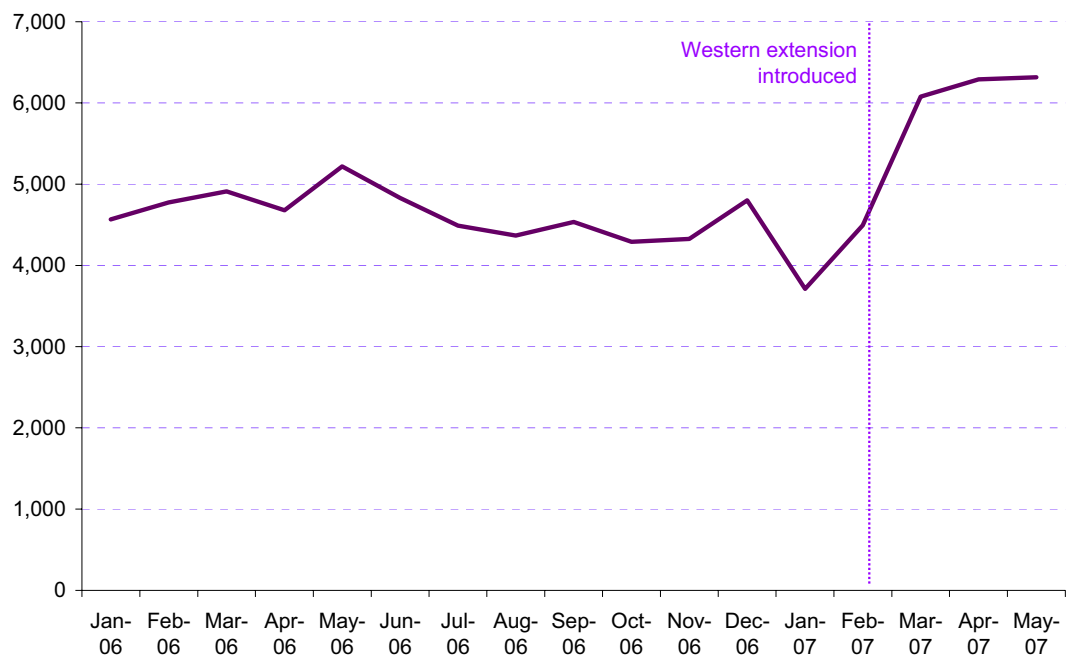
Figure 14.4 Western extension automatic numberplate reading enforcement camera site.



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

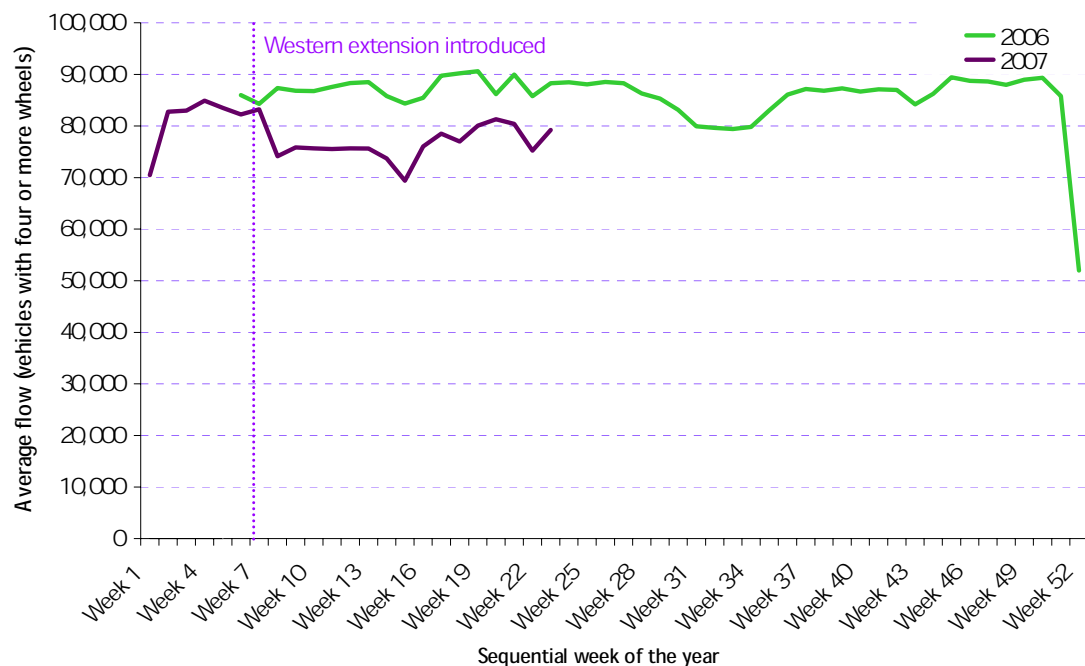
complete set (21 sites) Data are in terms of weekly average daily charging hours flows across a sample of inbound roads, with the counters being located immediately inside the boundary of the extension zone.

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.

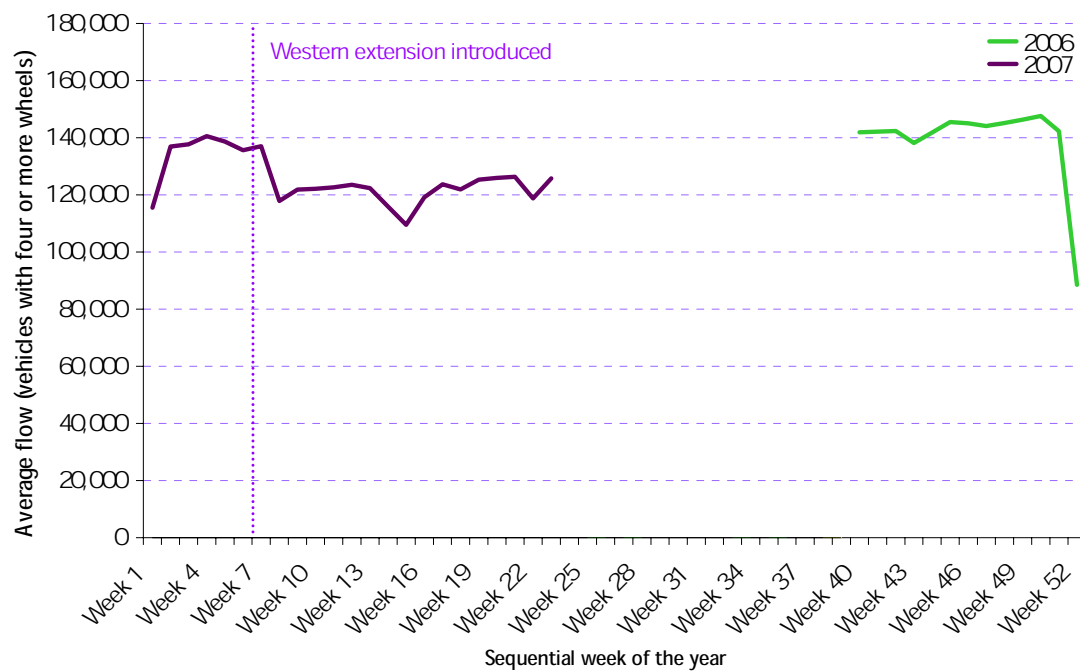
Based on these data, TfL's best estimate would be that traffic entering the extension zone is typically between 10 and 15 percent lower than would otherwise be expected. This is in line with TfL's range of expectation.

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.



14. Western extension zone: the first three months

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.

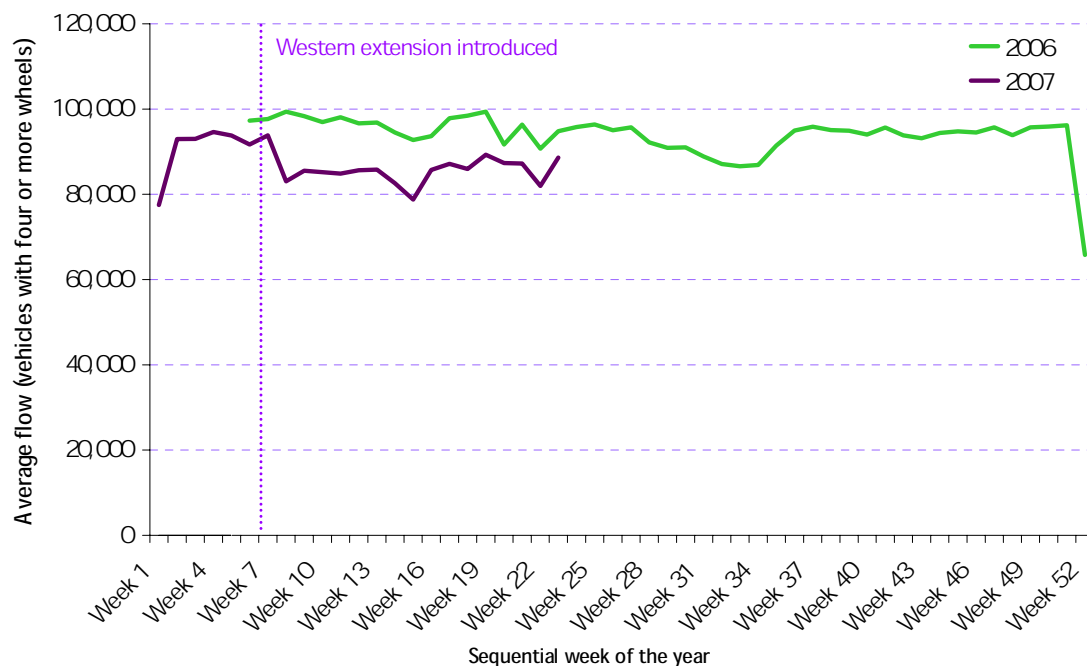
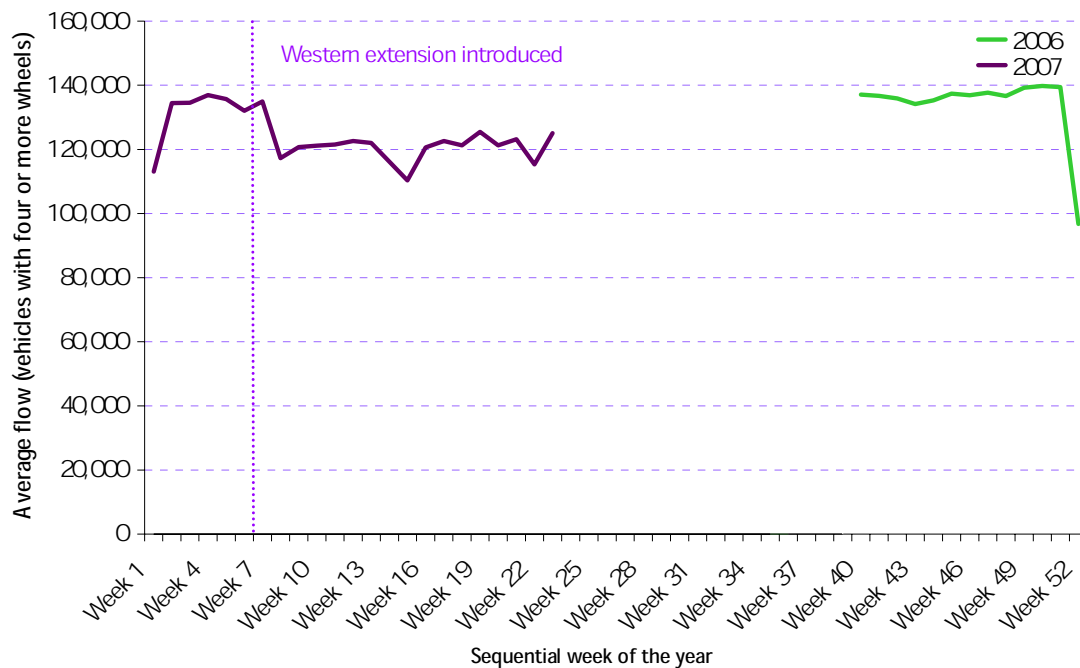


Figure 14.9 Average daily charging hours flow by week flow across 20 representative major roads exiting the western extension. Vehicles with four or more wheels.



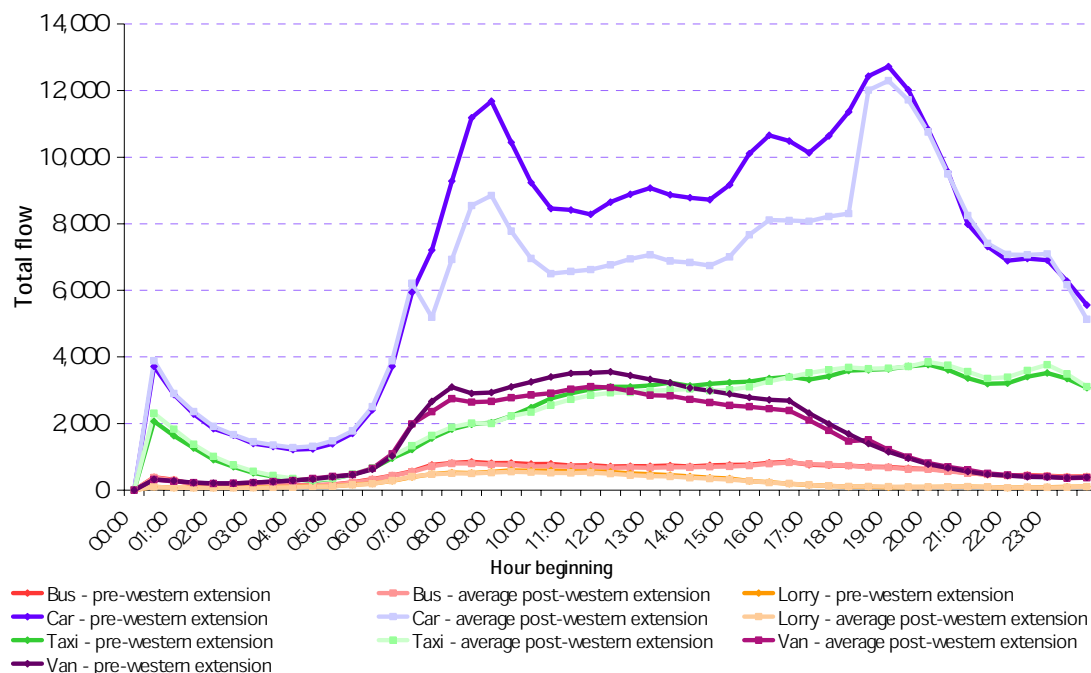
A further indicator of traffic was available over the immediate implementation period, using data from automatic number plate reading cameras enforcing the extension zone. These give a theoretical 100 percent coverage of all roads leading into and out of the extension zone and allow classification of 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 (e this indicator is liable to slightly over-state the degree of change)

14. Western extension zone: the first three months

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 goods 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.

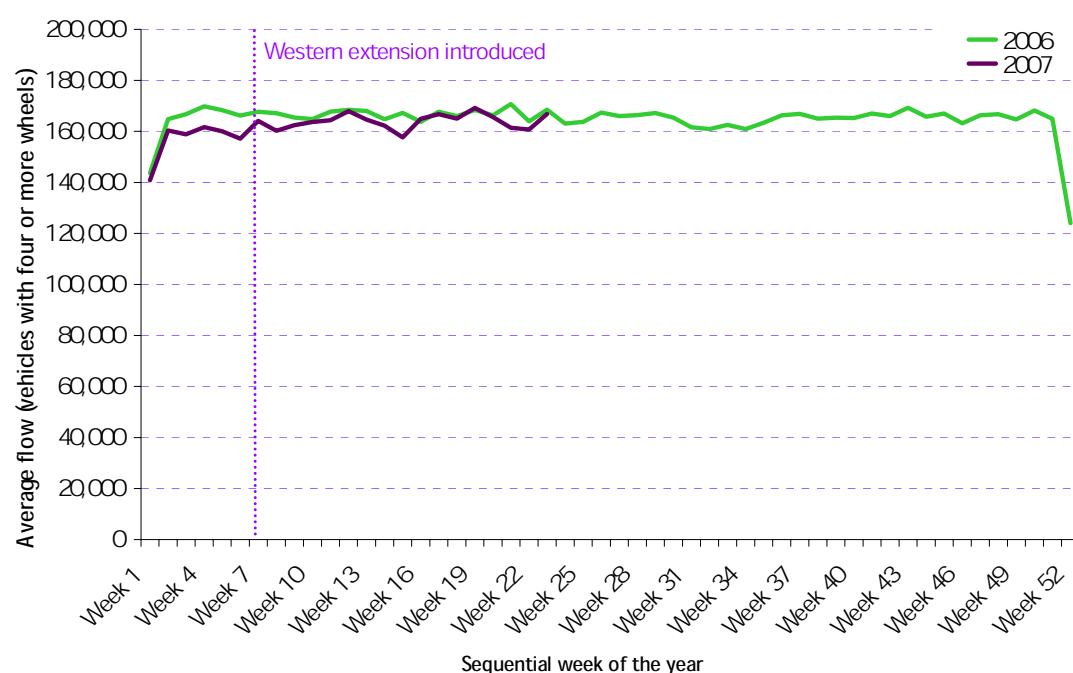
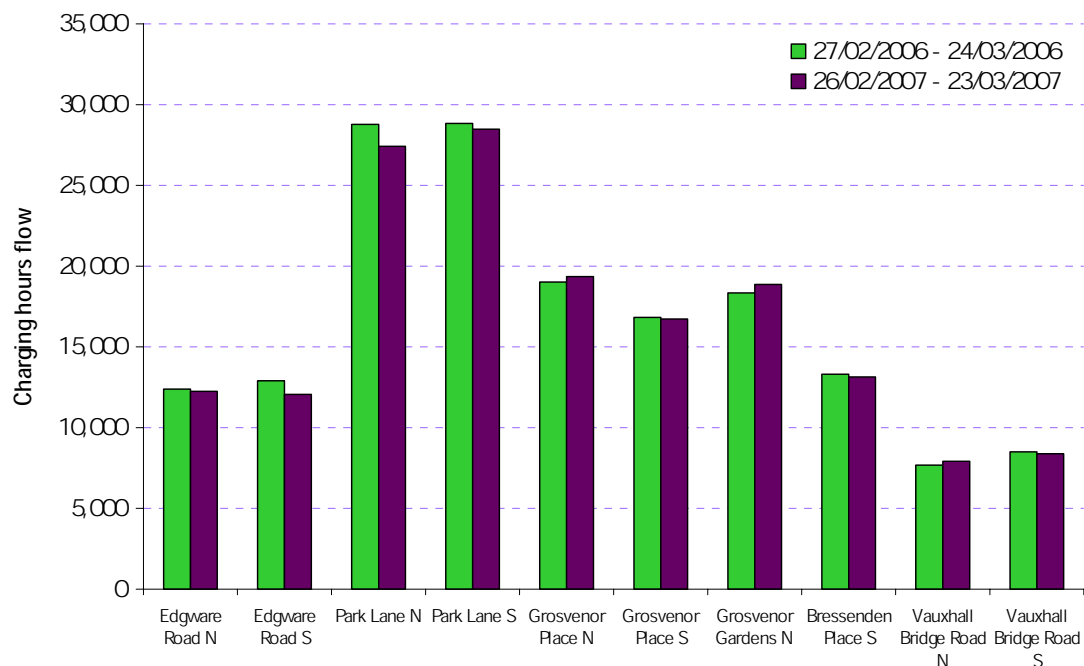


Figure 14.12 shows equivalent data at the individual site level. It compares average charging hours flow for the four (equivalent) weeks between late February and late March in both 2006 and 2007, ie the period between the February half term and Easter holidays. Flows during both periods at all sites 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

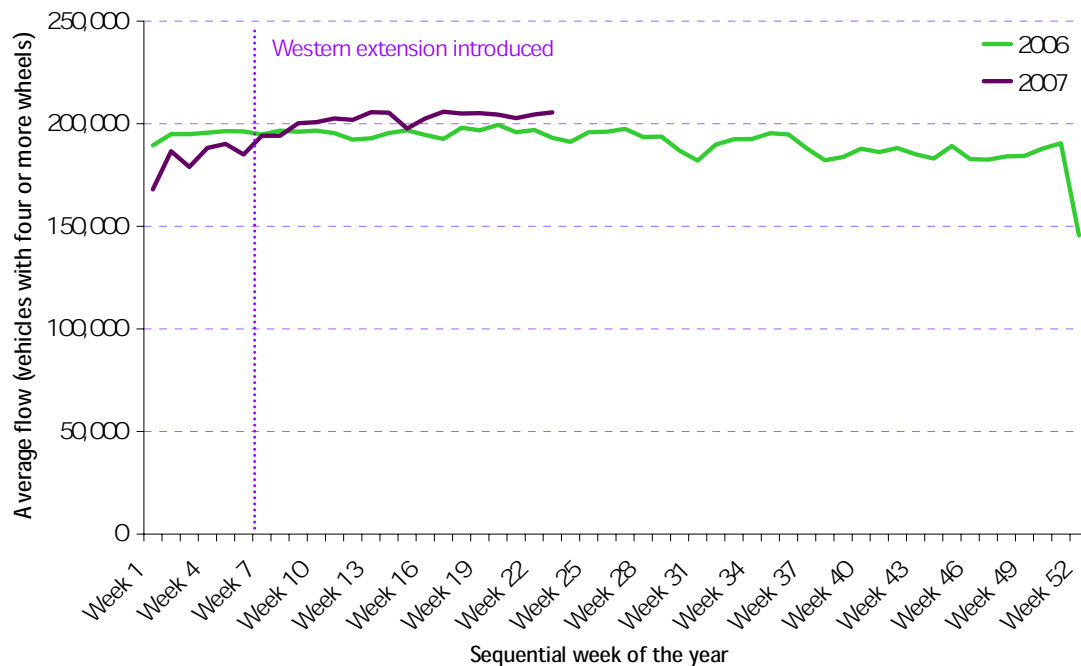
Eleven automatic counters were placed on roads comprising the remainder of the western extension zone boundary route, covering all key roads. These were also available from the start of 2006. TfL expected small increases in traffic on this route, of up to about 4 percent overall.

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.

14. Western extension zone: the first three months

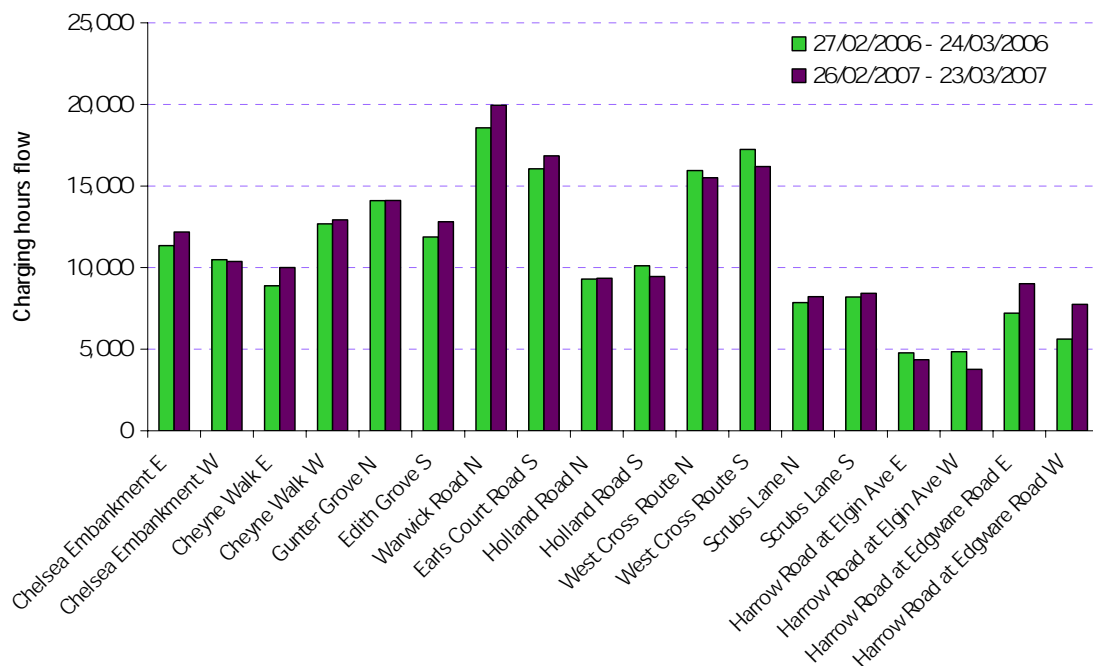
Figure 14.13 Average daily charging hours flow by week across 11 representative bi-directional links on the western boundary of the western extension. Vehicles with four or more wheels.



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.

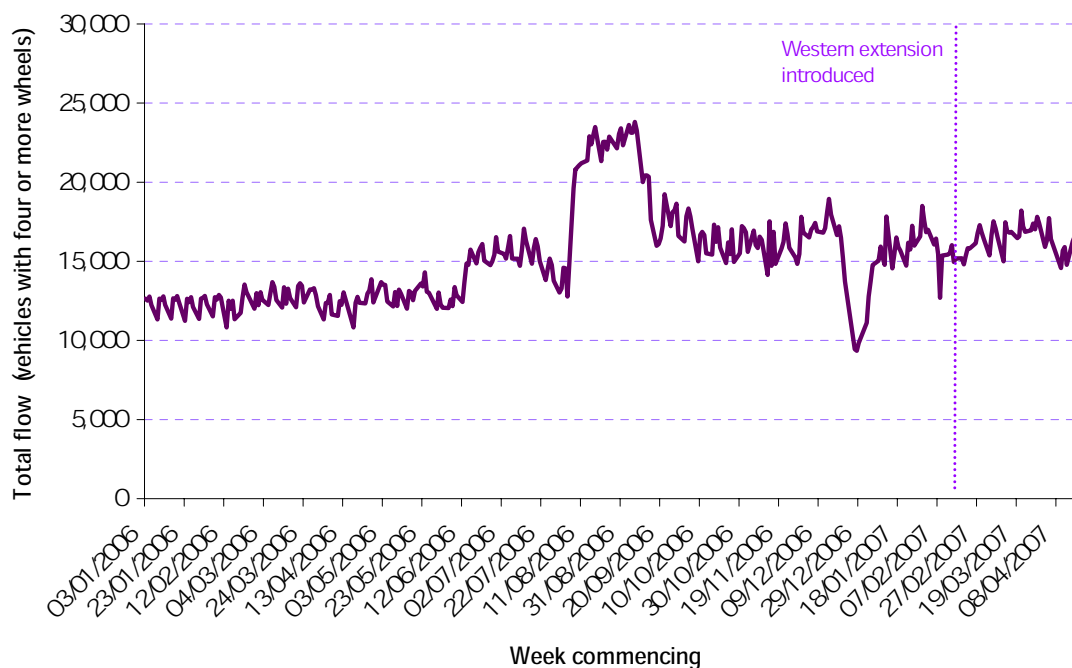
Harrow Road near Edgware Road was affected by roadworks during 2006 and early 2007, most notably the temporary closure of the Marylebone Road flyover between 7 August and 15 September, and by the re-opening of Bishop's Bridge at Paddington on 14 June 2007. It is likely that the apparent increases shown 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.



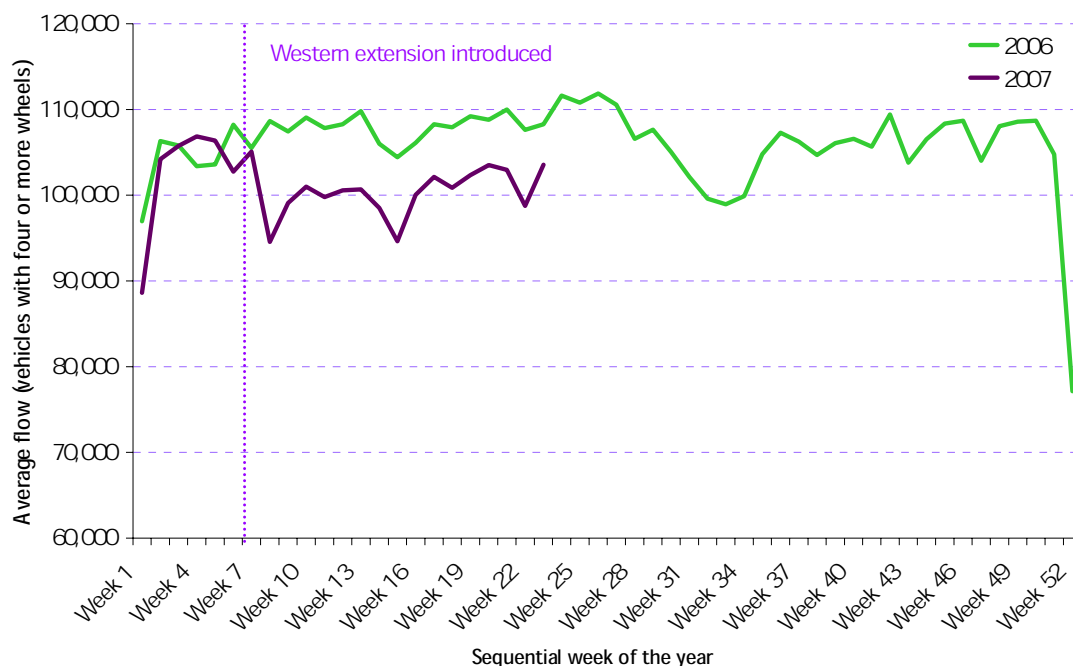
14.8 Wider indications of traffic change

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 assess 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.

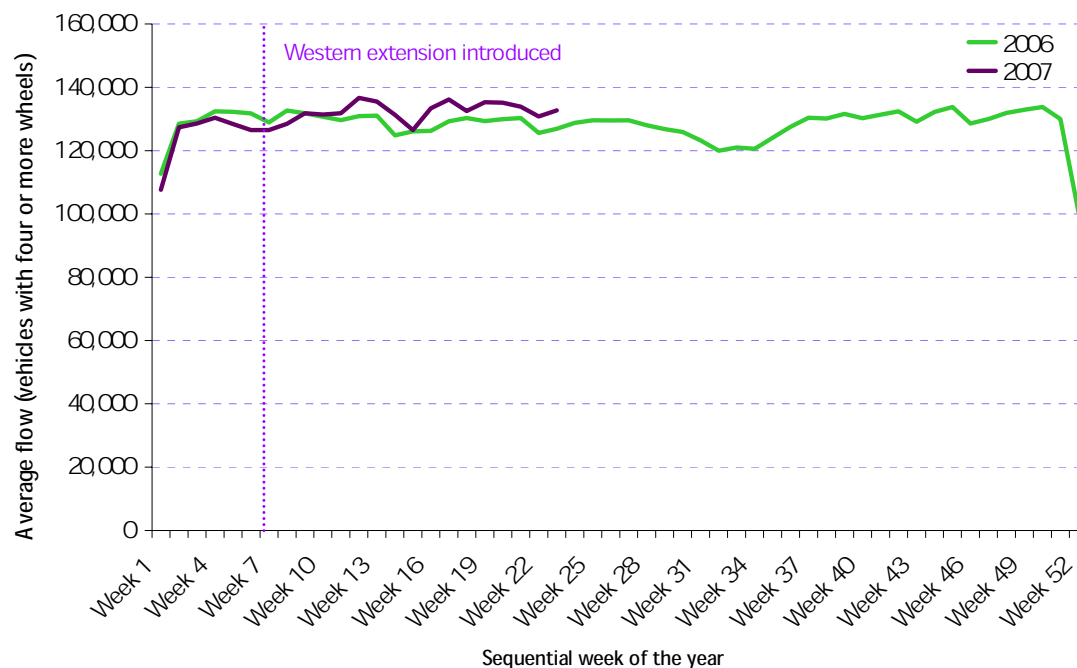
Monitoring traffic impacts in the central zone

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.

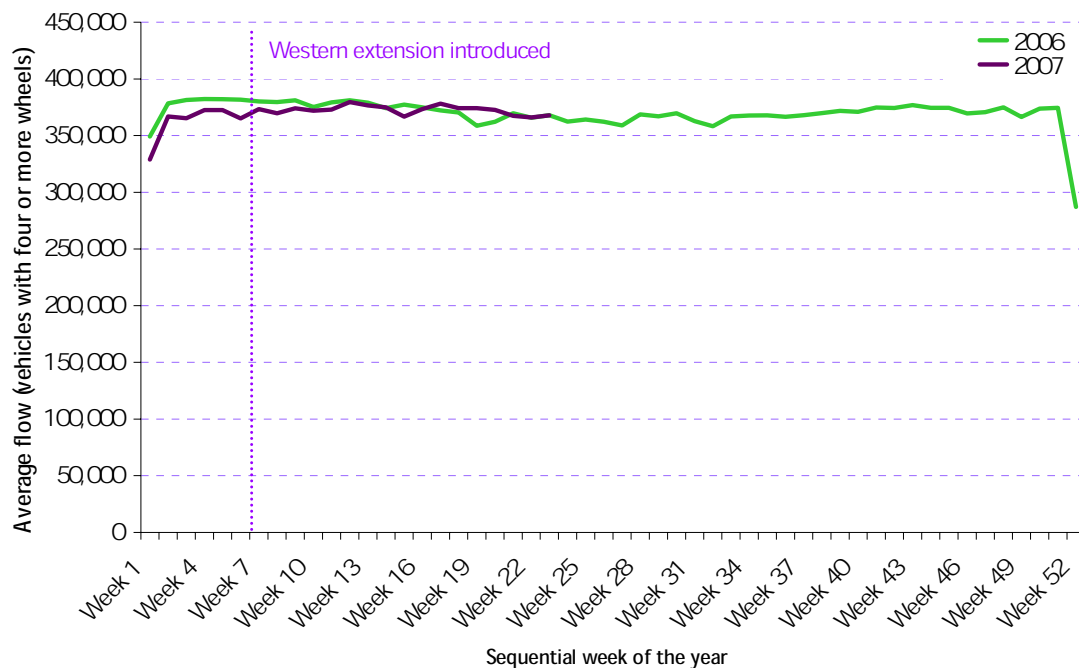


Figure 14.18 shows that this has largely been the case, traffic levels in the period following the implementation of the extension being almost identical to that seen in equivalent weeks in early 2006

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 1Q. 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 1Q, 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

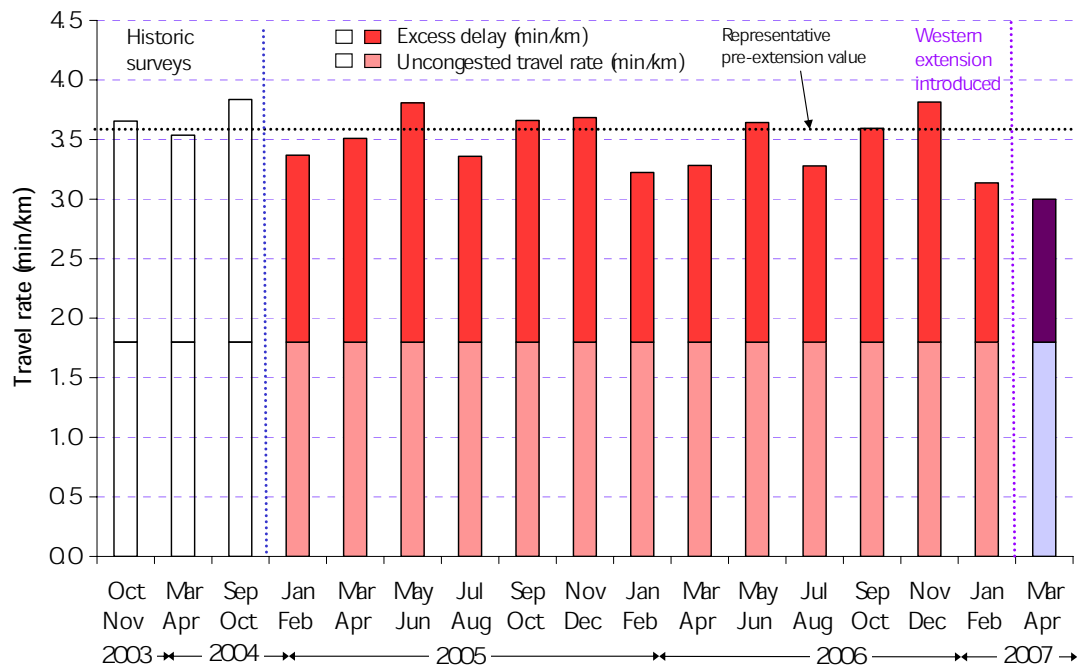
implementation of the extension have now been received by TfL and provide an early indicator of the impacts of the scheme.

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 and 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

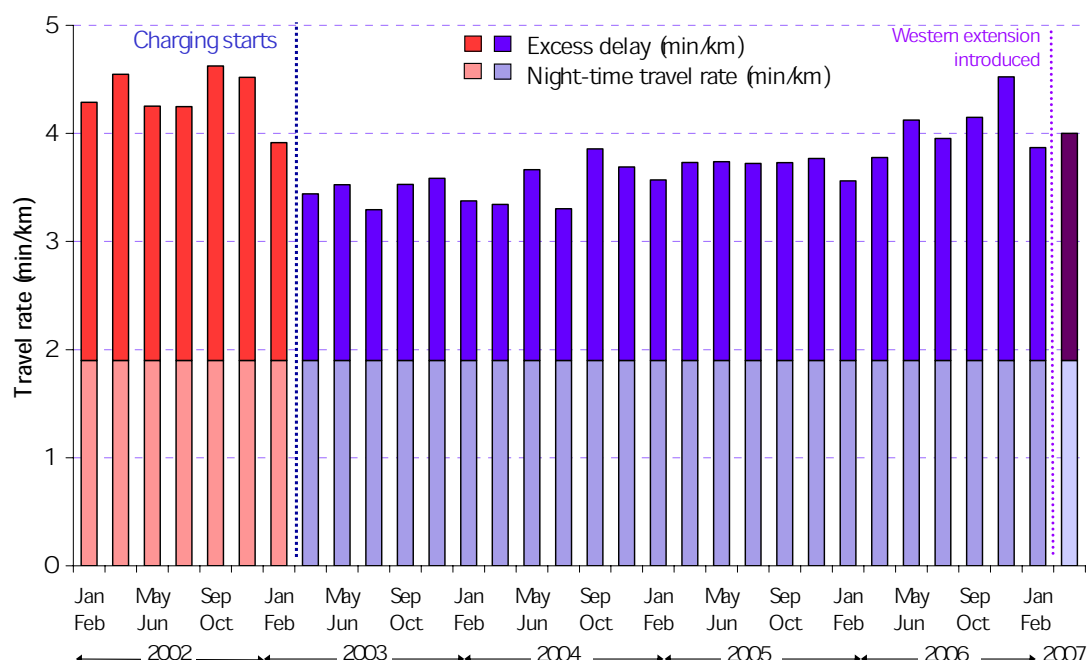
detail the impacts of the revision to charging hours on both traffic patterns and congestion in due course.

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.