Travel in London

Report 7

MAYOR OF LONDON

TRANSPORT FOR LONDON

EVERY JOURNEY MATTERS

Overview

Travel in London report 7

Travel in London summarises trends and developments relating to travel and transport in London. Its principal function is to describe how travel in London is changing and provide an interpretative overview of progress towards implementing the transport and other related strategies of the Mayor of London, in order to inform future policy development. It also provides an evidence and analysis base for the general use of stakeholders and policymakers whose responsibilities cover many different aspects of transport and travel in London.

This seventh Travel in London report draws on the latest available data, generally reflecting the 2013 calendar year, or the 2013/14 financial year, and sets these in the longer-term context of the evolution of transport and associated trends in London. This overview identifies and distils these insights, grouped loosely around the Mayor's goals for transport, as set out in his transport strategy published in 2010.

Supporting economic development and population growth

Travel in London is growing rapidly and is expected to continue to grow, but it is also changing in many ways [1]

London has grown strongly over recent decades, and is projected to continue to do so until at least well into the middle of the 21st century. The 8.42 million residents of 2013 were 25 per cent higher in number than the 'low' point reached in 1988, and this number is projected to grow to 9.86 million by 2031. This growth has been and will continue to be the primary driver of increased travel demand. Looking beneath the overall growth in travel demand which has led, among other things, to successive levels of 'record' patronage on rail-based public transport modes, a much more complex picture emerges.

Growth is affecting the main travel modes in different ways [2]

Although the main features of travel in London are broadly similar to a decade ago, there have been substantial shifts in mode choice and travel patterns. There was a 10.6 percentage point shift in net mode share towards public transport, walking and cycling between 2000 and 2013, with a 0.6 percentage point shift in 2013 itself (at the journey stage level), with public transport mode share exceeding that for private transport (at the trip level) for the first time. This is a feat unprecedented in any other World City, and means that there are today almost two million fewer daily car journeys than there would otherwise have been. This reflects the priorities of successive Mayors to invest in public transport, as well as increasing constraints – both historic and contemporary – on the ability of the road network to accommodate traffic demand.

Some signs that traffic in London is growing again after a decade of falls, this being reflected in indicators of road network performance (delay and journey time reliability) [3]

Car travel in London fell by around 15 per cent from its 1999 peak, even while London's population was growing. This pattern has been seen in other major UK cities and has been recognised in the literature under the term 'peak car'. However, the rate of decrease has fallen over recent years – both 2012 and 2013 saw growth in outer

London. Indications for 2014 are that traffic volumes have grown across London as a whole, as the economy recovers from recession and population continues to grow rapidly. It is possible that London is now seeing a movement away from a long period of stability on the road network in terms of performance indicators such as delay and journey time reliability – this will become clearer over the coming year.

But continued strong growth on the main public transport modes (4)

Since 2000, public transport modes have all seen increases in passenger numbers to varying degrees, with the number of trips on London Underground (LU) up by 20 per cent, trips by National Rail in London up more than 50 per cent, bus trips increasing by 70 per cent, and the creation of the London Overground network. The primary drivers and individual patterns differ by mode – for example the large expansion of the bus network in the early years of the last decade was associated with a corresponding increase in patronage, while the benefits of the Tube upgrade programme are now being felt in terms of new trains and substantial increases to capacity on many lines. Half of all bus trips in England take place in London.

Highest-ever levels of service are now offered on the Tube and other rail networks in London, while indicators of service quality are consistently at 'best ever' levels (5)

Scheduled Tube kilometres are up by 11 per cent since 2001, and the London Overground, extensions to the Docklands Light Railway (DLR) and the Emirates Air Line offer new high-quality services where none existed just a few years ago. Indicators of service quality, such as percentage of scheduled services operated, are now routinely at 'best ever' levels, reflecting an attractive public transport offering that performed so well in supporting the London 2012 Games.

Growing population is by far the biggest factor underlying growing demand for travel – but around 25 per cent of travel in London is by visitors and commuters from outside London (6)

In terms of who is contributing to the growth, by far the largest influence is increasing resident population. London residents make up 89 per cent of the 'daytime' population of London and account for three-quarters of trips, and this proportion has remained broadly stable over time. Note that non-residents make more trips per person, as their journeys to or from London are also included.

Commuters from outside London, as revealed by the 2011 Census Travel to Work data, comprise just 8 per cent of London's daytime population, and although numbers of these have grown, they have grown more slowly than residents. Other temporary visitors and tourists are estimated to comprise just 4 per cent of London's 'daytime' population, despite their rapid increase post-recession and their significance on the networks in certain places and at certain times (for example central London during the inter-peak). So, while population has grown by 15 per cent since 2001, overall travel demand has grown by a corresponding 20 per cent over the same period.

Employment and travel demand have become more focused on central London, but there have also been key structural changes affecting inner and outer London (7)

Employment has become more focused on central London (including Docklands), with public transport being the most appealing mode for this type of travel. This has

combined with increasing visitor traffic and factors such as the growth of the night-time economy to intensify pressures on the transport networks here.

The 2011 Census workplace travel data also reveal two trends that go some way to explaining why the public transport modes saw a greater increase in travel than other modes over the last decade. First, more people now travel to a workplace outside their home borough (74 per cent of working Londoners), meaning that it is more likely that travel will be by a mechanised mode. Second, although car driver trips in outer London make up a larger proportion of trips (estimated at 48 per cent of all trips by outer London residents), a decrease in the number of people working in outer London (6 per cent fewer jobs between 2001 and 2011) has been a contributing factor to the reducing mode share of car trips overall.

Nevertheless, the net impact has been that central and inner London have become relatively more important for employment between 2001 and 2011, drawing on a wider labour pool then previously, including from the wider South East England area and beyond.

More travel is being made outside the weekday 'peaks', but peak demand levels remain critical in relation to available capacity (8)

Over the decade 2001-2011 there was a shift towards a greater proportion of travel being made outside conventional weekday 'peak' hours. Although the absolute number of trips made by London residents has increased at all times of the day, the proportion of trips made in the peak hours has fallen, from 48.4 per cent in 2001 to 46.9 per cent in 2011. The rate of growth in non-peak travel has however been rapid, increasing by 14 per cent over the decade (residents).

There have also been some distinct modal trends. Car driver trips by London residents have fallen at most times of the day, down by 11 per cent in absolute terms but also down by 14 per cent in the morning peak, and 13 per cent in the evening peak. In contrast, inter-peak bus travel has grown strongly, by 60 per cent. A similar pattern is seen for travel by Underground, with increases in patronage of 59 per cent in the weekday inter-peak period and of 62 per cent in the period from 19:00 to close of service.

There is evidence of 'evolutionary' changes to the travel behaviour of individuals, which need to be better understood (9)

Underlying this are key 'evolutionary' changes to the ways in which individuals relate to the transport options available to them and organise their daily lives to optimise individual or wider societal benefits. Recognising, quantifying and understanding the likely future directions of these trends is important to effective future planning. Aspects include a shift towards longer-distance commuting and changes to household car ownership patterns.

Time spent travelling and distance travelled by individuals have remained relatively stable (10)

On average, and despite all of these changes, both the average time spent travelling and the average distance travelled by London residents has remained remarkably stable since the middle of the last decade – at just over 70 minutes per person per day and between 14 and 16km, with little evidence of a clear change. This accords with previous observations relating to the stability of individual 'travel time' budgets, but in the context of rapid structural change in the transport networks, the

stability of personal 'travel distance' budgets over the previous nine years is perhaps surprising.

People are making fewer shopping trips but are travelling more for leisure purposes (11)

Transport for London's (TfL's) data for London residents reveals distinct trends towards a reduction in travel for shopping (including other personal business) – down by 4.6 percentage points between 2005/06 and 2013/14, and an increase in travel for leisure purposes, up by 7.1 percentage points over the same period.

Such shifts have modal implications – for example, reduced shopping trips, perhaps reflecting increased use of the internet, feed through to fewer car trips, but perhaps more van traffic, which has increased rapidly post-recession in London (up by 7.6 per cent between 2001 and 2013). The increase in leisure travel, more strongly focused on rail as a mode and central London, partly underlies the need for developments such as the 'Night Tube' to complement the much-expanded Night bus network.

TfL is learning from 'generational' changes in travel behaviour – for example, young people are less likely to own and use a car than their predecessors (12)

TfL's analysis of long-term travel behaviour also reveals a strong 'generational' element. Well-documented aspects include increased travel by women since the 1970s – in volumetric terms now exceeding that of men (in fact, women resident in London in 2013/14 made 11 per cent more trips, on average, than men).

Less well known, but probably a major factor underlying recent trends in road traffic, is an apparent generational shift in the attitudes of younger people to car ownership and use. Increased motoring costs (including insurance) and other pressing calls on their income; the increasing location of young professionals in dense inner London well provided with good public transport options; and the shifting sands of social networks, now increasingly mediated through mobile telecommunications, have seen a 13 per cent drop in weekday car driver trips among Londoners in their 20s between 2001 and 2011. There are other such effects. Increasing bus travel has mainly been driven by younger and older people, with policies such as free and reduced rate educational travel, while the growth in rail travel has mainly been driven by people of younger working age.

TfL will continue to monitor this to understand whether these trends will be sustained as these individuals become older, or whether factors such as car ownership among younger age groups is simply being delayed owing to current economic stringency. Similar questions underlie goals such as the Mayor's aspiration to 'normalise' cycling, which in practical terms will require substantial convergence in the uptake of cycling across socio-demographic groups – males aged between 25 and 44 currently account for 48 per cent of all cycling trips, and public health stands to gain greatly from encouraging under-represented groups to travel by bike.

A wide range of other factors has also driven changes in travel demand (13)

As revealed by TfL's 'Drivers of Demand for Travel in London' study, a wide range of factors other than increasing transport supply have also been at play. These have included factors affecting underlying demand, such as the growth in London Gross Value Added (GVA), up by 72 per cent since 2000, despite the recession. Inner

London saw real incomes increase by 18 per cent from 2003 to their peak in 2009, while in outer London there has surprisingly been no increase in average incomes since 2003. With the majority of car travel taking place in outer London, this stagnation in incomes may have placed a cap on the amount of car travel, while inner London has benefitted to a greater extent from public transport improvements, and has seen car travel fall despite rising incomes.

There have also been some fundamental structural changes to the drivers of travel demand, including changes in attitudes to car ownership and the types and location of employment in London. London has also seen continued in-migration, including from European Union (EU) Accession States, while the rate of out-migration has slowed, resulting in increasing numbers of families with children living in the Capital. The proportion of Londoners born in EU states other than the UK and Ireland rose from 3 per cent in 2001 to 11 per cent in 2011. That many of these migrants are more likely not to own cars and to live in inner London explains part of the phenomenon of decreasing car use, even with rising population – which has become known as 'peak car'. Also, a pronounced densification of inner London, including initiatives such as car-free developments, relative to outer London, has contributed to sustained mode shift toward walking, cycling and public transport.

Anticipating and providing for future transport challenges – the Tube upgrade, TfL's plans for the Night Tube and emerging proposals for Crossrail 2 (14)

Continuation of this trend in the context of projected future population growth, through providing new and enhanced high-quality services at appropriate fares levels that are aligned to people's lifestyles, must therefore be a priority for future planning.

TfL's Tube upgrade programme is now delivering substantial benefits in terms of capacity and service quality. This has seen the introduction of new rolling stock on the Victoria and sub-surface lines, and plans are underway to design new trains for the deep Tube lines to be introduced in the 2020s. At the same time signalling systems have been upgraded on key lines, as part of a longer-term programme, allowing for higher-frequencies and more reliable services – for example, 34 trains per hour (tph) now operate on the central section of the Victoria line during the busiest part of the weekday peak periods.

The growth of the night-time economy has been one facet affecting several pronounced shifts in the ways that the transport networks are used throughout the day. While there are still distinct weekday peaks of demand, the general pattern since the 1970s has been a broadening of demand across the day – and into the weekends as well. Patronage on the Tube after 22.00 hours until close of service has increased by an estimated 70 per cent since 2000, compared to 30 per cent over the whole day, and the Night bus network now carries 42 million passengers per year compared with around 16 million in 2000. The advent next year of the Night Tube, aimed squarely at supporting London's growing night-time economy, is clear step along the way.

The Tube upgrade programme, Crossrail 1 and TfL's emerging proposals for Crossrail 2, offer a clear path to radically enhance the capacity and quality of London's public transport over the medium term.

Transport has a fundamental role in driving economic growth and regeneration (15)

The dual role of transport in both catalysing and servicing new developments is fundamental, harking back to the days of 'Metroland' in the early half of the 20th century and before. On the one hand, the spectacular regeneration of London's Docklands would not have been possible without the assured catalyst of the Docklands Light Railway (DLR) and the Jubilee line extension (JLE), and could not function at today's levels without them. On the other, the more recent development of the London Overground network has created new direct journey opportunities between deprived parts of inner London and now sees well-filled trains running along corridors and connecting centres that previously barely featured on maps of public transport connectivity, bringing regeneration to these diverse areas in its wake.

A similar logic underlies TfL's current planning for Opportunity Areas such as Old Oak Common and Vauxhall Nine Elms Battersea, Crossrail 1, the Northern line extension and planned extensions to the London Overground being the primary new public transport infrastructure catalysts in each case. These developments will need to be accompanied by improved studies and monitoring to more clearly identify the processes at work and the optimal use of available funding.

There are particular challenges on the road network (16)

Optimal use of London's valuable road space remains a key preoccupation for TfL. Although car use has declined year-on-year for a decade or more, congestion and journey time reliability have remained broadly stable. There are now signs that volumes of traffic may again be increasing – particularly in outer London, as population continues to grow and the economy recovers from recession.

Meanwhile, growing freight and servicing demand arising from London's physical and economic development and changed lifestyle factors, such as internet shopping, are bringing particular challenges for these elements of road traffic. With growing traffic, the spotlight falls more strongly on network and demand management initiatives and the potential impact of policies that might further remove available network capacity for general traffic.

Improving London's transport to meet the Mayor's other strategy goals

As well as supporting London's economic development and population growth, as described above, the Mayor's Transport Strategy (MTS) also addresses goals concerned with improving the safety and security of transport and travel, increasing opportunities for all Londoners through improving connectivity and physical accessibility, making sure that transport plays its role in enhancing quality of life, and reducing emissions of harmful pollutants from transport. This section looks at some key developments under each of these headings, and considers their implications.

Perceptions of the transport environment are improving – reflecting sustained investment and new and improved services (17)

As well as facilitating the basic social and economic need for travel, transport can contribute in positive ways to people's experience of daily life, their health and sense of well-being. Formal MTS perception-based indicators of the quality of the transport environment described in this report have shown a convincing if relatively

slow upward trend over recent years. The 'utility' nature of most travel means that very high scores on these indicators are unachievable, but the consistent progress reflects well in an era of increasing public expectations and the disruption caused by widespread infrastructure upgrades. The contribution of transport to the successful London 2012 Games was particularly noteworthy and appreciated by the travelling public – and lessons learned from this are being carried forward as part of the Games legacy.

Results of an exploratory survey of the health aspects of streets in London provide a practical framework for identifying and prioritising improvements as part of the Roads Task Force work (18)

This report contains a recent TfL study into how people perceive features of streets that contribute to health, developing the evidence base for TfL's 'Improving the health of Londoners: Transport action plan'. The study shows clear differences in perceived quality and provision according to the level of traffic and function/character of streets, but also that individuals are able to temper their expectations to take account of the functional reality of streets. 'Gap analysis' of perceptions versus expectations can help guide and prioritise future improvement initiatives – for example it is notable that the size of the gap is greatest for 'City hubs' and 'City places' (two of nine street types identified by the Roads Task Force) – both identified as priorities for improvement initiatives.

There have been continued improvements in transport connectivity and physical accessibility (19)

The transport networks provide connectivity and with it opportunities to access jobs and services. Incremental development to the networks since 2006, combined with 'background' increases in population and employment, is reflected in a 6.2 per cent increase in the number of jobs potentially accessible to the average Londoner in a travel time of 45 minutes by public transport.

Meanwhile, although necessarily a long-term process, there has been a 13 percentage point increase in the proportion of the public transport networks that are more accessible to disabled people since 2009/10 – this now standing at half of the networks in terms of extent (50 per cent).

Transport safety continues to improve, but there remain specific challenges (20)

In 2013 the Mayor and TfL published Safe Streets for London, London's Road Safety Action Plan, with an ambition to work together towards roads free from death and serious injury. The Plan contains 56 actions to transform road safety in the Capital, and reduce killed and serious injury casualties by 40 per cent by the end of the decade.

Great strides have been taken in recent years to make London's roads safer – in 2013 the number of people killed or seriously injured (KSI) on London's roads was down 36 per cent on the 2005-09 base average. Future increases in traffic on London's roads, the number of journeys cycled and walked, and increases in London's population mean that sustaining this level of safety improvement over the period to 2020 remains an ambitious challenge.

TfL, with its partners, prioritises the safety of the most vulnerable road users in London, which make up around 80 per cent of serious and fatal casualties, and has published specific action plans for pedestrians, cyclists and motorcyclists. The use

of risk evidence, alongside other information about the road network, is central to making London's roads safe. Groups (in terms of gender, age, ethnicity, location, mode etc.) for whom safety can be most improved have been identified using this analytical approach.

TfL will continue to deliver its road safety strategy as set out in Safe Streets for London and the vulnerable road user action plans. This, in addition to the increase in funding through the TfL Business Plan, will help to ensure that the promising reductions in KSI casualties are sustained over the longer term.

Rates of recorded crime on the transport networks have halved over the last decade (21)

There have also been impressive reductions in indices of reported crime on the transport networks. Headline statistics show reductions of up to one-half over the last decade in the main categories of crime and disorder, in spite of growing patronage. No doubt this owes a lot to better and more effective policing – such as the widespread use of CCTV and on-train policing (these also having a counter terrorism role) – but it is also clear that wider societal changes are at play, changing the nature and visibility of crime. In this way aspects such as the theft of mobile devices, 'hate' crimes of various types, future Tube staffing deployment and availability and the effective policing of the Night Tube assume greater prominence in TfL and public thinking. Initiatives such as Project Guardian, a collaborative initiative aimed at tackling sexual harassment, partly through encouraging greater reporting and awareness of these incidents, which have historically been under-reported, aim to address these contemporary concerns.

TfL continues to take steps to improve local air quality and reduce greenhouse gas emissions (22)

Local air quality remains a high-profile topic of concern in London, despite substantial progress in recent years. Primary emissions from ground-based transport have reduced over the period since 2010 – down by an estimated 30.1 per cent for particulate matter (PM_{10}), 14.7 per cent for nitrogen oxides (NO_x) and 4.8 per cent for carbon dioxide (CO_2).

Consistently good progress towards the achievement of the MTS goals (23)

The MTS is built around six transport goals, progress towards which is measured through a set of 24 Strategic Outcome Indicators. These are described throughout the report. To summarise, they show consistently good progress across all six goals:

- **'Contextual' indicators.** Overall travel demand continues to grow at a faster rate than anticipated by the MTS, reflecting rapidly increasing population and effectively 'bringing forward' the dates for which additional transport capacity will be required. Meanwhile, the impressive trend of shifting mode share towards public transport, walking and cycling continues for the 20th successive year since this measure was first recorded in 1993.
- **Supporting economic development and population growth.** Public transport capacity on many networks, including National Rail, is at highest-ever levels, with consistently excellent levels of operational reliability. However, there are capacity and reliability challenges on the road network, particularly with potentially-increasing levels of road traffic demand over the coming years. The

Tube upgrade programme has contributed to the renewal of many key assets, with TfL's operating costs being maintained at a consistent level.

- **Enhancing the quality of life for all Londoners.** Emissions from local air quality pollutants and CO_2 from ground-based transport continue to decline, reflecting improving vehicle technologies and initiatives such as London's Low Emission Zone. However, London still exceeds EU limit values for concentrations of Nitrogen Dioxide – the proposed Ultra Low Emission Zone for central London is primarily targeted at this problem. Perception and customer-satisfaction based indicators of the quality of aspects of the travel environment have moved consistently upwards over the period since 2008, delivering what is regarded as 'fairly good' or 'good' customer evaluations.
- **Improving the safety and security of all Londoners.** London's roads have become safer, with the number of people killed or seriously injured having almost halved over the last decade to the lowest level on record. As well as working towards the Mayor's target of a 40 per cent reduction in the number of people killed or seriously injured by 2020, TfL's future ambition is for London's roads to be free from death and serious injury. Future increases in traffic on London's roads, the number of journeys cycled and walked, and increases in London's population mean that sustaining this level of safety improvement remains an ambitious challenge. Indicators of recorded crime on the transport networks have shown substantial and rapid improvement over the period since 2008, while public transport operational safety remains good, in the context of increasing demand across the networks.
- **Improving transport opportunities for all Londoners.** Improvements to the transport networks continue to be reflected in incremental improvements to key indicators of transport connectivity and physical accessibility, while real fares levels for public transport have shown small incremental increases since 2008.
- **Supporting the delivery of the 2012 London Olympic and Paralympic Games and their legacy.** TfL continues to work with partners to progress the legacy of the London 2012 Games, following the notably successful contribution of transport to the delivery of the Games themselves. Travel Demand Management is one aspect that is being developed by TfL to help manage demand in relation to planned closures (eg for upgrades) and other events affecting the transport networks. TfL is employing a cross-cutting approach that brings together operational plans and experience, forecasting and analysis and customer insight in order to present information and options to customers so that they can rethink their travel choices. Progress with the transport aspects of the legacy will be reported in 2015 (Travel in London report 8), following the baselines previously set out in Travel in London report 6.

About Transport for London

We are London's integrated transport authority. Our role is to implement the Mayor's Transport Strategy to keep London working and growing and make life in London better. Transport is a key driver of economic growth, jobs and development. We look ahead to plan London's future and unlock areas of growth. We also promote sustainable transport, better air quality and better health.

We are funded by fare and tax payers and by commercial revenue from property and advertising. Every penny of our income is reinvested in transport. We are delivering one of the world's largest programmes of transport capital investment, which is building Crossrail, upgrading Tube services and stations, improving the road network and making the roads safer, especially for more vulnerable road users.

We are responsible for the London Underground, London Buses, the Docklands Light Railway, London Overground, London Tramlink, London River Services, Dial-a-Ride, Victoria Coach Station, Barclays Cycle Hire and the Emirates Air Line. We regulate taxis and the private hire trade, operate the Congestion Charging scheme, manage the 580km red route network of London's strategic roads, and operate 6,000 traffic signals.

Notes

1. Growing travel demand is explained in sections 2.2 to 2.5, whilst sections 2.6 to 2.13 explore various dimensions of changing patterns of travel demand in London.
2. Chapter 3 of this report considers travel trends as they have affected specific modes of transport.
3. Trends in road traffic in London are reviewed in sections 3.13 and 3.14 of this report, and trends in road network performance are covered in sections 4.12 and 4.13.
4. Trends in patronage of the principal public transport modes are covered in Chapter 3 of this report.
5. Trends in the operational performance of the principal public transport modes are covered in Chapter 4 of this report.
6. Sections 2.6 and 2.7 of this report deal with the contribution of non-resident visitors to travel in London.
7. See section 2.7 of this report.
8. Time of day of travel is covered in section 2.8 of this report. Sections 4.11 and 4.12 present indices of crowding and congestion on the public transport and road networks respectively.
9. See, in particular, sections 2.12 and 2.13 for examples of these changes.
10. See section 2.11 of this report.
11. See section 2.9 of this report.
12. See section 2.13 of this report.
13. See 'Drivers of demand for travel in London: A review of trends in travel demand and their causes (TfL 2014), available at: https://www.tfl.gov.uk/cdn/static/cms/documents/drivers-of-demand-for-travel-in-london.pdf. These themes are covered in sections 2.6 to 2.13 of this report.
14. TfL's Tube Upgrade programme is covered in section 4.6 of this report. TfL's plans for the Night Tube are described in section 3.7 of this report.
15. The role of transport in facilitating regeneration is explored in Chapter 9 of this report.
16. Trends in road traffic are covered in sections 3.13 and 3.14 of this report. Trends in road network performance are covered in sections 4.12 and 4.13 of this report.
17. See section 6.4 of this report.

18. Chapter 9 of this report explores aspects of public health, travel and the urban realm, including the findings from new TfL research exploring the meaning and delivery of 'healthy streets'.
19. Transport network connectivity and physical accessibility are covered in Chapter 6 of this report.
20. Chapter 5 of this report looks at aspects of safety and security on the transport networks in London.
21. See Chapter 5 of this report. Details of Project Guardian can be found at: http://www.btp.police.uk/advice_and_information/how_we_tackle_crime/project_guardian.aspx
22. Emissions from ground-based transport are covered in section 6.5 of this report.
23. The MTS uses a set of 24 top-level Strategic Outcome Indicators to monitor progress. The text that follows is a summary of progress. Details of the individual indicators can be found (and are highlighted) throughout the main text of this report.

1. Introduction and contents

1.1 Travel in London report 7

Travel in London is TfL's annual publication that examines and summarises trends and developments relating to travel and transport in London. It provides an authoritative source of key transport statistics as well as topical evidence-based analysis, and tracks trends and progress in relation to the Transport and other related strategies of the Mayor of London. It provides an interpretative overview and commentary that looks across the immediate impacts of TfL and its delivery partners, as well as external influences and trends, in shaping the contribution of transport to the daily lives of Londoners and the economic vitality of the Capital.

1.2 Monitoring the implementation of the Mayor's Transport Strategy

Travel in London reports aim to provide a comprehensive and objective evidence base for the formulation of transport policy. The Mayor of London published his Transport Strategy in May 2010 [1]. Alongside his London Plan [2], Economic Development Strategy [3] and Air Quality Strategy [4] (MAQS) these strategies mapped out the transport policy framework for London over the next decade and beyond. More recently, policy documents have been produced that address individual issues, such as the Mayor's 'Vision for Cycling'[5], the Roads Task Force's 'The vision and direction for London's streets and roads [6], and 'Improving the health of Londoners: Transport action plan' [7].

The MTS is built around six transport goals:

- Supporting economic development and population growth.
- Enhancing the quality of life for all Londoners.
- Improving the safety and security of all Londoners.
- Improving transport opportunities for all Londoners.
- Reducing the contribution of transport to climate change and improving its resilience to the impacts of climate change.
- Supporting the delivery of the London 2012 Olympic and Paralympic Games and their legacy.

At the top level, the long-term transport outcomes sought by the MTS are monitored through a set of 24 quantitative 'Strategic Outcome Indicators'. These indicators are 'outcome-based', reflecting changes in conditions experienced by Londoners. They provide a manageable means of assessing the overall direction and pace of change in relation to MTS goals. However, they do not cover all aspects of transport that will be of interest and do not, of themselves, provide a detailed understanding of topical transport issues. It is therefore necessary to take a broader and deeper view of transport trends and the factors affecting them. Collectively this leads to relevant policy insights and evidence to support the formulation of future transport plans. Providing these insights and evidence base is the core role for Travel in London reports.

1.3 Structure and content of this report

This seventh Travel in London report is organised across three main sub-sections and nine chapters, focusing on:

- **Travel demand and transport network performance (chapters 2 to 4).** This section assembles and summarises trends and developments in travel demand and transport network operational performance, including the underlying factors that influence these, such as population and economic growth. This section focuses on the first of the Mayor's six transport priorities – supporting economic development and population growth – and also provides essential contextual information.
- **Progress with MTS transport goals (chapters 5 to 8).** These chapters are framed around assessing progress towards the wider canvass of MTS transport goals relating to quality of life, transport opportunities, the contribution of transport to economic development and improved safety and security.
- **'Spotlight' chapter (chapter 9)** continues the established role of providing an analytical focus on specific topical transport-related themes from year-to-year. This year there is one spotlight chapter which looks at new data for improving the evidence base for assessing the public health impacts of transport.

A particular feature of this report is the frequent use of 'focus topics', interspersed throughout the first two sections. These provide a more in-depth analytical treatment of topics of particular contemporary interest, and this year reflect a variety of themes around interpreting travel trends, the 'Year of the Bus', developing the Tube and the contribution of transport to economic development. Summary assessments of progress towards MTS goals, and the implications of observed trends and developments are given throughout the text.

1.4 Further information

For specific technical queries on the contents of this report, readers should contact TILenquiries@tfl.gov.uk.

References

(1) The Mayor's Transport Strategy. https://www.london.gov.uk/priorities/transport/publications/mayors-transport-strategy

(2) The London Plan.

http://www.london.gov.uk/priorities/planning/london-plan

(3) The Mayor's Economic Development Strategy. https://www.london.gov.uk/priorities/business-economy/publications/economic-development-strategy

(4) The Mayor's Air Quality Strategy. https://www.london.gov.uk/priorities/environment/publications/mayors-air-quality-strategy

(5) The Mayor's Vision for Cycling in London. http://www.london.gov.uk/sites/default/files/Cycling%20Vision%20GLA%20template%20FINAL.pdf

(6) Roads Task Force Vision for London's Streets and Roads. https://www.tfl.gov.uk/cdn/static/cms/documents/rtf-report-chapter-1.pdf

(7) Improving the health of Londoners: Transport action plan. https://www.tfl.gov.uk/cdn/static/cms/documents/improving-the-health-of-londoners-transport-action-plan.pdf

Travel demand and the performance of the transport networks

2. Travel in London

2.1 Introduction and contents

This chapter looks at overall travel demand trends in London, in terms of the overall number of trips made, the mode shares for the different forms of transport, and the factors underlying these trends. It also explores how various aspects of travel in London have changed over recent decades, through eight 'focus topics' looking in more depth at specific aspects of travel change.

Sections 2.3 to 2.5 provide consolidated 'top-level' estimates and trends for travel by all people travelling in London, including residents and visitors, covering all of the main transport modes. The volume of travel in London has grown consistently over the last two decades or so, and it is of interest to better understand how different types of travel have contributed to this growth.

Sections 2.6 to 2.13 therefore pick up and explore selected aspects of travel in London, covering: the contribution of non-resident commuters and visitors (section 2.6); changing patterns of travel to work (commuting) more generally in London (section 2.7); changes in travel by time of day (section 2.8); travel for shopping and leisure purposes (section 2.9); trends in mode share and trip geography (section 2.10); personal travel time and distance 'budgets' (section 2.11); and trends in household car availability and income (section 2.12). Finally, section 2.13 summarises the findings of recently-published TfL research that looks in depth at 'generational' effects on travel behaviour among London residents, drawing on consistent data from large-scale travel surveys back to 1991.

2.2 Total travel in London

Previous Travel in London reports consolidated historic information on travel trends in London over the last decade or more. Principal features of these trends have been:

- Sustained growth in demand for travel, most directly reflecting population and employment growth but also wider social and economic factors.
- A substantial and sustained shift in mode share away from private car and towards public transport, in parallel with increased public transport supply.

In 2013:

- Total travel demand in London grew by 1.3 per cent over 2012, maintaining a now consistent pattern of annual increases stretching back to the 1990s.
- A total of 26.1 million trips were made to, from, or within London on a typical 2013 day, roughly in line with previous increases, averaging 1.1 per cent per year over the last 10 years, that have largely mirrored increasing population (growth averaging 1.3 per cent per year).
- This means that there are now 15.2 per cent more trips, and 20.7 per cent more journey stages, in London on an average day than in 2000.
- The shift in mode share away from private transport towards public transport, walking and cycling that has been a major feature of the past decade continued in 2013. In relation to 2012 there was a further 0.7 percentage point fall in the private transport mode share, falling to 36.8 per cent of trips, and a 0.7

percentage point increase in the public transport mode share (at the trip level). For the first time, public transport mode share was above that for private transport – at 36.9 per cent of trips.

- This means that, over the period between 2000 and 2013, there has been a 9.8 percentage point net shift in mode share to public transport, walking and cycling away from private transport at the trip level, with public transport, walking and cycling now accounting for 63.2 per cent of all trips in London.

2.3 Journey stages in London

Essential background and terminology

This section updates consolidated estimates of total travel in London on an average day. A **trip** is defined as a one-way movement from an origin to a destination to achieve a specific purpose, for example, to go from home to work. Each trip may involve travel by one or more individual modes of transport. These component parts of trips are referred to as **journey stages**. Key concepts relating to trips, journey stages and main mode of travel were explained in Travel in London report 5 [1].

Travel in London report 5 also discussed the requirement that had arisen for TfL to revise the methodology used for calculating estimates of trips and journey stages in London [2]. This requirement arose from changes to the input data series used to derive the estimates, most notably the release of data from the 2011 Census of Population, which revealed London's population to be higher than previously understood, but also series relating to road traffic volumes and bus passengers. The figures shown in table 2.1 are therefore on a consistent basis from 2007 to 2013.

Total number of journey stages

Daily journey stages in London in 2013 were 30.6 million, up from 30.2 million in 2012 and 29.7 million in 2011. This is a 1.3 per cent increase in journey stages in the latest year. In 2013 there were 16.8 per cent more journey stages per day in London than in 2003.

Annual growth in journey stages was particularly high for public transport, with strong growth of 5.1 per cent and 4.9 per cent on National Rail and DLR respectively. Underground stages also increased in 2013 at a faster rate than the increase in the resident population, and were 3.0 per cent higher than the previous year, while bus stages grew at a lower rate of 1.4 per cent. Car driver stages continued to fall, and were 0.6 per cent lower than in 2011. The net result of these changes is a continuation in the established trend of increased public transport use in London, with a corresponding continued net shift away from private motorised transport (although absolute traffic volumes were largely unchanged in 2013).

Notable from table 2.1 is the ten-year trend, showing a 16.8 per cent increase in total journey stages from 2003, with rail stages up by 58.3 per cent over the same period. Also notable is the 58.3 per cent increase in cycle stages since 2003.

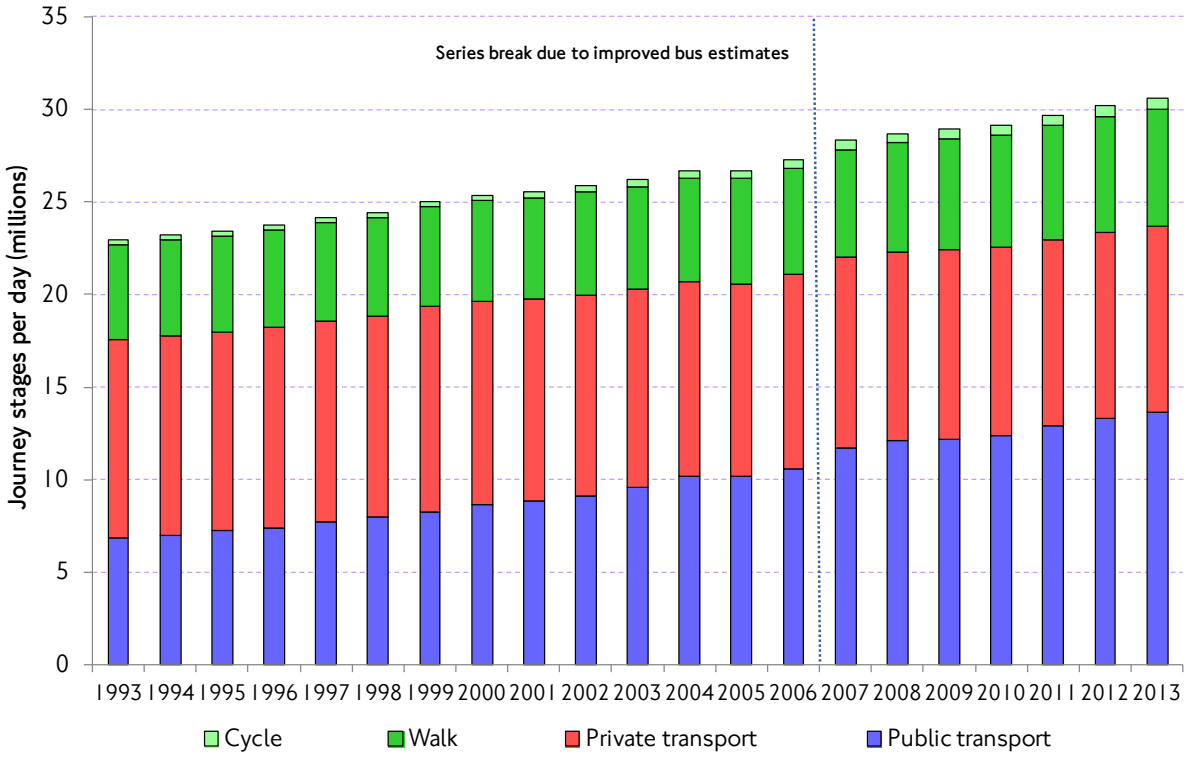
Table 2.1 Aggregate travel volumes in Greater London. Estimated daily average number of journey stages by mode, 1993 to 2013. Seven-day week.

Millions of journey stages

Year	Rail	Under-ground	DLR	Bus (incl. tram)	Taxi /PHV	Car driver	Car passenger	Motor cycle	Cycle	Walk	All modes
1993	1.4	2.0	0.0	3.1	0.3	6.8	3.7	0.2	0.3	5.2	23.0
1994	1.4	2.1	0.0	3.1	0.3	6.8	3.8	0.2	0.3	5.2	23.2
1995	1.5	2.1	0.0	3.3	0.3	6.8	3.7	0.2	0.3	5.2	23.4
1996	1.5	2.1	0.0	3.4	0.3	6.9	3.8	0.2	0.3	5.3	23.7
1997	1.6	2.2	0.1	3.5	0.3	6.9	3.8	0.2	0.3	5.3	24.1
1998	1.7	2.4	0.1	3.5	0.4	6.9	3.8	0.2	0.3	5.3	24.4
1999	1.8	2.5	0.1	3.5	0.4	7.1	3.8	0.2	0.3	5.4	25.0
2000	1.8	2.6	0.1	3.7	0.4	7.0	3.8	0.2	0.3	5.5	25.3
2001	1.8	2.6	0.1	3.9	0.4	6.9	3.7	0.2	0.3	5.5	25.6
2002	1.9	2.6	0.1	4.2	0.4	6.9	3.7	0.2	0.3	5.6	25.9
2003	1.9	2.6	0.1	4.6	0.4	6.8	3.6	0.2	0.4	5.6	26.2
2004	2.0	2.7	0.1	5.0	0.4	6.7	3.6	0.2	0.4	5.6	26.6
2005	2.0	2.6	0.1	5.0	0.4	6.6	3.6	0.2	0.4	5.7	26.7
2006	2.1	2.7	0.2	5.2	0.4	6.6	3.7	0.2	0.5	5.7	27.2
2007	2.3	2.9	0.2	5.9	0.4	6.4	3.7	0.2	0.5	5.8	28.3
2008	2.4	3.0	0.2	6.2	0.4	6.3	3.7	0.2	0.5	5.9	28.7
2009	2.3	2.9	0.2	6.3	0.4	6.3	3.7	0.2	0.5	6.0	28.9
2010	2.5	3.0	0.2	6.3	0.3	6.3	3.7	0.2	0.5	6.1	29.2
2011	2.7	3.2	0.2	6.4	0.4	6.1	3.8	0.2	0.6	6.2	29.7
2012	2.9	3.3	0.3	6.5	0.4	6.0	3.8	0.2	0.6	6.3	30.2
2013	3.1	3.4	0.3	6.5	0.4	6.0	3.8	0.2	0.6	6.3	30.6
Percentage change 2012 to 2013	*5.1*	*3.0*	*4.9*	*1.4*	*1.1*	*-0.6*	*0.0*	*-7.1*	*0.5*	*1.3*	*1.3*
2003 to 2013	*58.3*	*34.0*	*108.2*	*41.4*	*2.7*	*-11.3*	*5.4*	*-27.9*	*58.3*	*13.8*	*16.8*

Source: TfL Planning, Strategic Analysis.
1. A journey stage is a part of a trip made by a single mode of transport.
2. Each rail interchange between train operating companies is a new journey stage.
3. Bus journey stages are counted by starting a new stage each time a new bus is boarded.
4. Underground journey stages are counted by station entries; interchanges within stations are ignored.
5. Walks are counted only when they form complete trips (ie walking all the way), not when they are part of trips using other modes of transport.

Figure 2.1 Aggregate travel volumes in Greater London. Estimated daily average number of journey stages, 1993 to 2013. Seven-day week.



Source: TfL Planning, Strategic Analysis.

2.4 Trips in London

Total number of trips

The number of trips made in London in 2013 averaged 26.1 million per day, an increase of 1.2 per cent over the previous year (table 2.2). This is a very similar increase to that observed for journey stages, and continues the recently observed trend of growing travel demand.

Included in these totals are all trips with an origin, a destination, or both, in Greater London by London residents and by non-residents, including commuters and day visitors from outside London as well as overnight visitors and tourists. The London resident population in 2013 was 8.4 million, 1.3 per cent higher than in 2012 and 13.8 per cent higher than in 2003. The larger 'daytime population' of Greater London, including non-resident visitors, was estimated at 9.5 million in 2013, 1.6 per cent higher than the previous year.

Over the 10-year period from 2003, total trips have increased by 11.4 per cent, with particularly notable increases of 52.3 per cent in rail trips and 32.0 per cent in Underground and DLR trips, with cycle trips (as main mode) increasing by 53.9 per cent. Car driver trips decreased by 12.7 per cent over the same period.

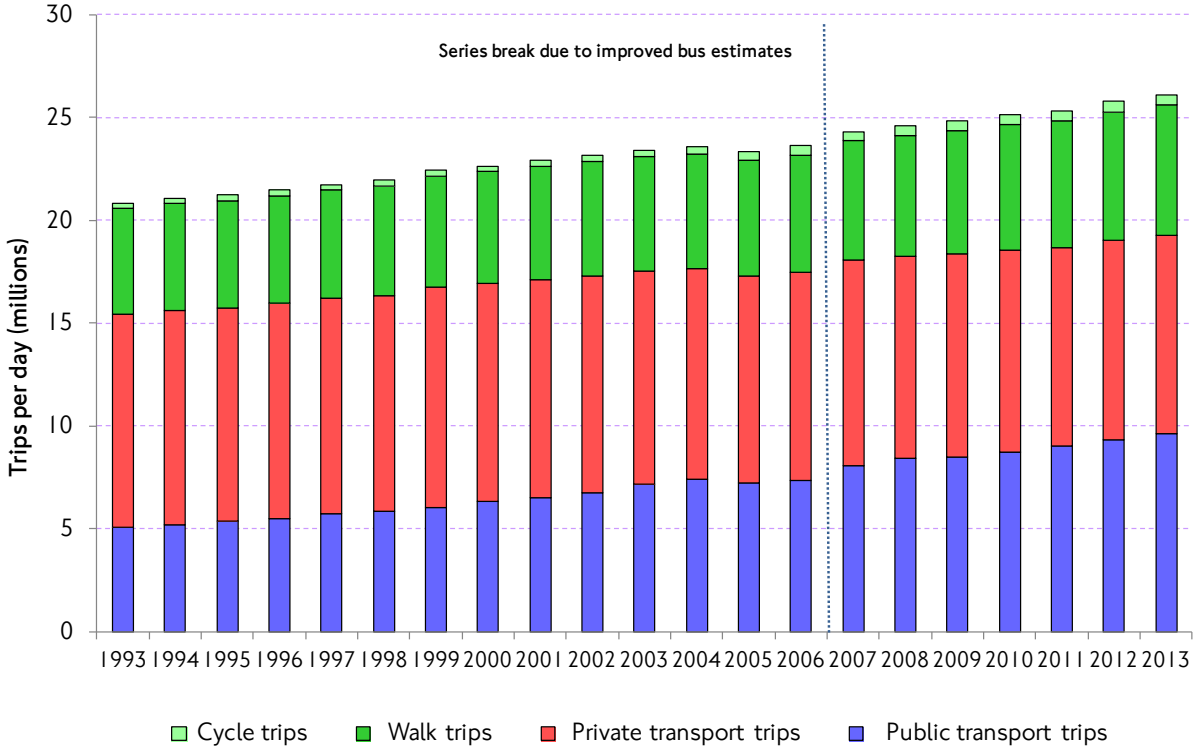
Table 2.2 Aggregate travel volumes in Greater London. Estimated daily average number of trips by main mode of travel, 1993 to 2013. Seven-day week.

	Millions of trips									
Year	Rail	Under-ground /DLR	Bus (including tram)	Taxi/ PHV	Car driver	Car passenger	Motor cycle	Cycle	Walk	All modes
1993	1.3	1.4	2.1	0.3	6.6	3.6	0.2	0.3	5.2	20.9
1994	1.3	1.5	2.1	0.3	6.7	3.6	0.2	0.3	5.2	21.1
1995	1.3	1.6	2.2	0.3	6.6	3.6	0.2	0.3	5.2	21.2
1996	1.4	1.5	2.3	0.3	6.7	3.6	0.2	0.3	5.3	21.5
1997	1.5	1.6	2.3	0.3	6.7	3.6	0.2	0.3	5.3	21.8
1998	1.5	1.7	2.3	0.3	6.7	3.6	0.2	0.3	5.3	21.9
1999	1.6	1.8	2.3	0.3	6.9	3.6	0.2	0.3	5.4	22.4
2000	1.7	2.0	2.4	0.3	6.8	3.6	0.2	0.3	5.5	22.7
2001	1.7	1.9	2.6	0.3	6.8	3.6	0.2	0.3	5.5	22.9
2002	1.7	1.9	2.8	0.3	6.8	3.5	0.2	0.3	5.6	23.2
2003	1.8	1.9	3.2	0.3	6.7	3.5	0.2	0.3	5.6	23.4
2004	1.8	2.0	3.3	0.3	6.6	3.4	0.2	0.3	5.6	23.6
2005	1.8	1.9	3.2	0.3	6.5	3.4	0.2	0.4	5.7	23.4
2006	1.9	2.0	3.1	0.3	6.4	3.5	0.2	0.4	5.7	23.6
2007	2.1	2.0	3.6	0.4	6.3	3.5	0.2	0.4	5.8	24.3
2008	2.2	2.1	3.8	0.3	6.1	3.5	0.2	0.5	5.9	24.6
2009	2.1	2.2	3.9	0.3	6.2	3.5	0.2	0.5	6.0	24.8
2010	2.3	2.1	4.0	0.3	6.1	3.6	0.2	0.5	6.1	25.1
2011	2.4	2.2	4.1	0.3	5.9	3.6	0.2	0.5	6.2	25.3
2012	2.6	2.4	4.1	0.3	5.9	3.6	0.2	0.5	6.3	25.8
2013	2.7	2.5	4.1	0.3	5.8	3.6	0.2	0.5	6.3	26.1
Percentage change										
2012 to 2013	*3.9*	*4.5*	*1.8*	*1.3*	*-0.6*	*0.0*	*-7.1*	*0.6*	*1.3*	*1.2*
2003 to 2013	*52.3*	*32.0*	*29.7*	*7.2*	*-12.7*	*3.9*	*-22.7*	*53.9*	*13.8*	*11.4*

Source: TfL Planning, Strategic Analysis.
1. Trips are complete one-way movements from one place to another.
2. Trips may include use of several modes of transport and hence be made up of more than one journey stage.
3. In tables 2.2 and 2.4 trips are classified by the mode that is typically used for the longest distance within the trip.
4. Round trips are counted as two trips, an outward and an inward leg.
5. Values for 'rail' include London Overground.

Over the most recent year there were again noticeable increases in patronage on rail and Underground, although there was slower growth in bus trips (table 2.2 and figure 2.2). Car driver trips decreased, by 0.6 per cent.

Figure 2.2 Trips in London – trend in total travel demand by principal mode. Estimated daily average number of trips by main mode of travel, 1993 to 2013. Seven-day week.



Source: TfL Planning, Strategy Analysis.

Trip rates

Trip rates (the average number of trips per person per day) have been noticeably stable over the whole period covered by table 2.2, at around 2.7 to 2.8 trips per person per day. These rates are calculated for the average daily population, which makes allowance for overnight visitors and commuters from outside London making trips in the Capital. This relative stability indicates that the increase in stages and trips in London is driven primarily by increases in population, both of London residents and visitors to the Capital, rather than individuals making more trips.

Looking specifically at London residents, using TfL's London Travel Demand Survey (LTDS), average trip rates in 2013/14 were 2.51 trips per person per day, lower than the average of 2.7 for all travellers in London. This difference is to be expected, given that the large majority of non-resident day visitors are already (by definition) in the course of making at least one trip on the day in question to get to or from London.

Further details of trends affecting specific modes of transport are given in chapter 3 of this report.

2.5 Mode shares in London

Journey stage based mode shares

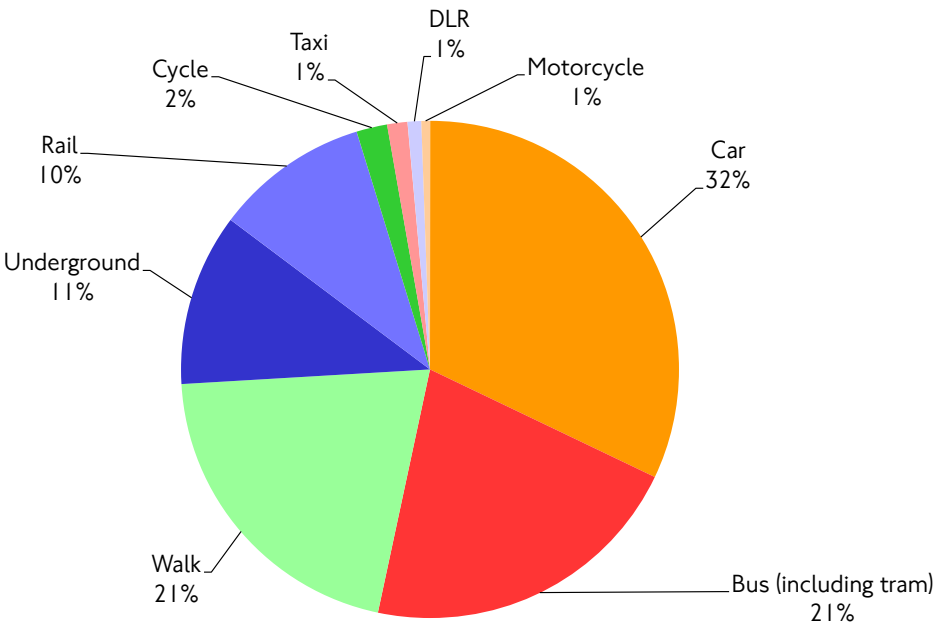
In 2013, 45 per cent of journey stages in London were made by public transport, compared with 33 per cent by private transport. This reflects and continues a now well-established trend of a net shift in London away from private motorised transport to the public transport modes. Since 2000 the public transport mode share for London has increased by 10.6 percentage points. In the latest year, the private transport mode share fell by a further 0.6 percentage points, while the public transport mode share increased by 0.6 percentage points. Cycling and walking mode shares remained at around 2 and 21 per cent respectively.

Table 2.3 Percentage shares of journey stages by type of transport, 1993 to 2013.

	Percentage of journey stages			
Year	Public transport	Private transport	Cycle	Walk
1993	30%	46%	1%	22%
1994	30%	46%	1%	22%
1995	31%	46%	1%	22%
1996	31%	46%	1%	22%
1997	32%	45%	1%	22%
1998	33%	45%	1%	22%
1999	33%	44%	1%	22%
2000	34%	43%	1%	21%
2001	35%	43%	1%	22%
2002	35%	42%	1%	21%
2003	37%	41%	1%	21%
2004	38%	39%	1%	21%
2005	38%	39%	2%	21%
2006	39%	39%	2%	21%
2007	41%	37%	2%	20%
2008	42%	36%	2%	21%
2009	42%	35%	2%	21%
2010	43%	35%	2%	21%
2011	43%	34%	2%	21%
2012	44%	33%	2%	21%
2013	45%	33%	2%	21%

Source: TfL Planning, Strategic Analysis.
Note: Mode shares are calculated from the consistent series for journey stages given in table 2.1. Totals may not add up to 100 per cent due to rounding.

Figure 2.3 Modal shares of daily journey stages in London, 2013.



Source: TfL Planning, Strategic Analysis.

Trip based mode shares

The decrease of 7.9 percentage points between 2003 and 2013 in the private transport mode share in terms of journey stages is equivalent to a decrease of 7.5 percentage points in terms of trips. Similarly, public transport mode share, which increased by 8.0 percentage points in terms of journey stages, increased by 6.4 percentage points in terms of trips since 2003 (note that public transport trips typically involve more than one stage). Public transport accounted for 36.9 per cent of trips in 2013, up from 36.3 per cent in 2012 and 30.5 per cent in 2003. Over the most recent year, private transport mode share decreased by 0.7 percentage points to 36.8 per cent.

This means that the mode share for public transport trips in London is now higher than for private transport – the first time that this has been recorded. This highlights the large shift in how people travel around London, given that in 1993 the public transport mode share was less than half the private transport mode share. Cycle and walk mode shares remained constant, at two per cent and 24 per cent respectively.

Table 2.4 Trip-based mode shares – public and private transport by main mode.

	Percentage of trips			
Year	Public transport	Private transport	Cycle	Walk
1993	24%	50%	1%	25%
1994	25%	49%	1%	25%
1995	25%	49%	1%	24%
1996	26%	49%	1%	24%
1997	26%	48%	1%	24%
1998	27%	48%	1%	24%
1999	27%	48%	1%	24%
2000	28%	47%	1%	24%
2001	28%	46%	1%	24%
2002	29%	46%	1%	24%
2003	30%	44%	1%	24%
2004	31%	43%	1%	24%
2005	31%	43%	2%	25%
2006	31%	43%	2%	24%
2007	32%	43%	2%	23%
2008	34%	40%	2%	24%
2009	34%	40%	2%	24%
2010	34%	39%	2%	24%
2011	36%	38%	2%	24%
2012	36%	37%	2%	24%
2013	37%	37%	2%	24%

Source: TfL Planning, Strategic Analysis.

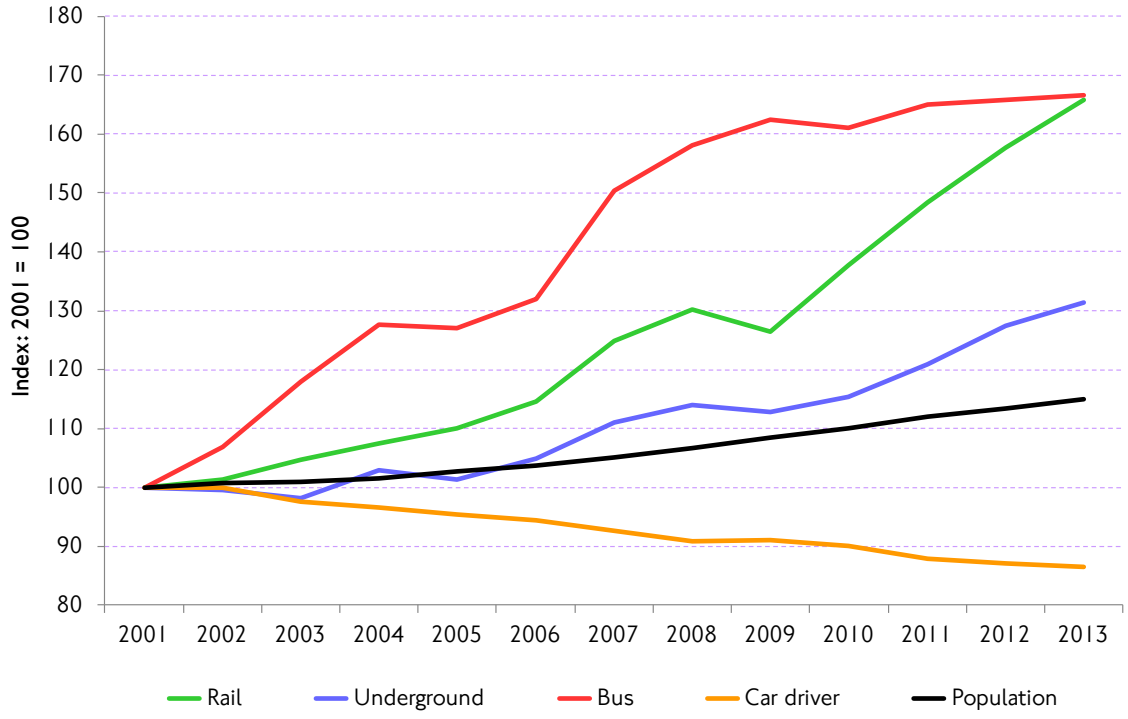
Trends in mode share

Figure 2.4 shows trends in relative mode share of the principal modes over the period since 2001. Public transport use has grown strongly over this period, with demand for all of the public transport modes growing faster than population. Initially, growth was strongest on the bus network, with a 27.6 per cent increase in bus journey-stages between 2001 and 2004, and despite a levelling off in growth in recent years, bus stages in 2013 were 66.6 per cent higher than in 2001.

Growth in National Rail usage (including London Overground) was initially slower than bus use up until 2009. Over the past four years, rail journey stages have increased by more than 30 per cent, partly helped by the opening of TfL's Overground network, with rail stages now 65.7 per cent higher than in 2001.

In contrast, Underground passenger growth closely followed population growth between 2001 and 2006, although usage has started to grow at a faster rate in recent years, reflecting completion of upgrades to several lines, which has added extra capacity to the network.

Figure 2.4 Growth in journey stages on selected modes, 2001 to 2013.



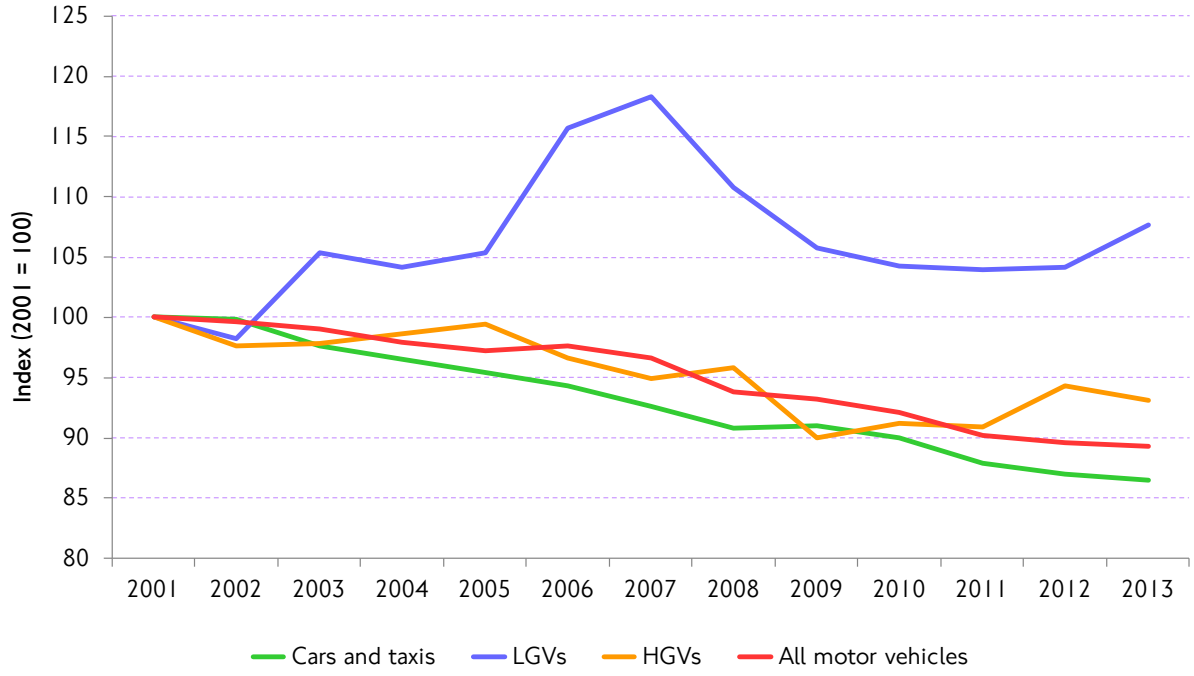
Source: TfL Planning, Strategic Analysis.

Mode shares for travel by road

In contrast to the strong growth in public transport use, travel by car has decreased since 2001. Car driver trips are now 13.5 per cent lower than in 2001, despite the 15 per cent increase in London's resident population over the same period. Figure 2.5 shows that the volume of road traffic in London has fallen by a similar amount, with traffic in 2013 10.7 per cent lower than in 2001. This is clearly driven by the decrease in car traffic, which makes up almost 80 per cent of all vehicular traffic on London's roads.

However, trends in other vehicle types have been different, particularly light goods vehicles (LGVs). LGV traffic was 7.6 per cent above 2001 levels, closely following patterns in London's economic growth. LGV and HGV traffic makes up around 17 per cent of traffic in London, and this proportion is growing year-on-year as car traffic continues to fall. However, the rate of decline in road traffic has slowed markedly in the most recent years (see also section 3.13 of this report).

Figure 2.5 Growth in road traffic in London, 2001 to 2013.



Source: TfL Planning, Strategic Analysis.

2.6 Focus on changing travel: The contribution of non-resident commuters and visitors to travel in London

Scope

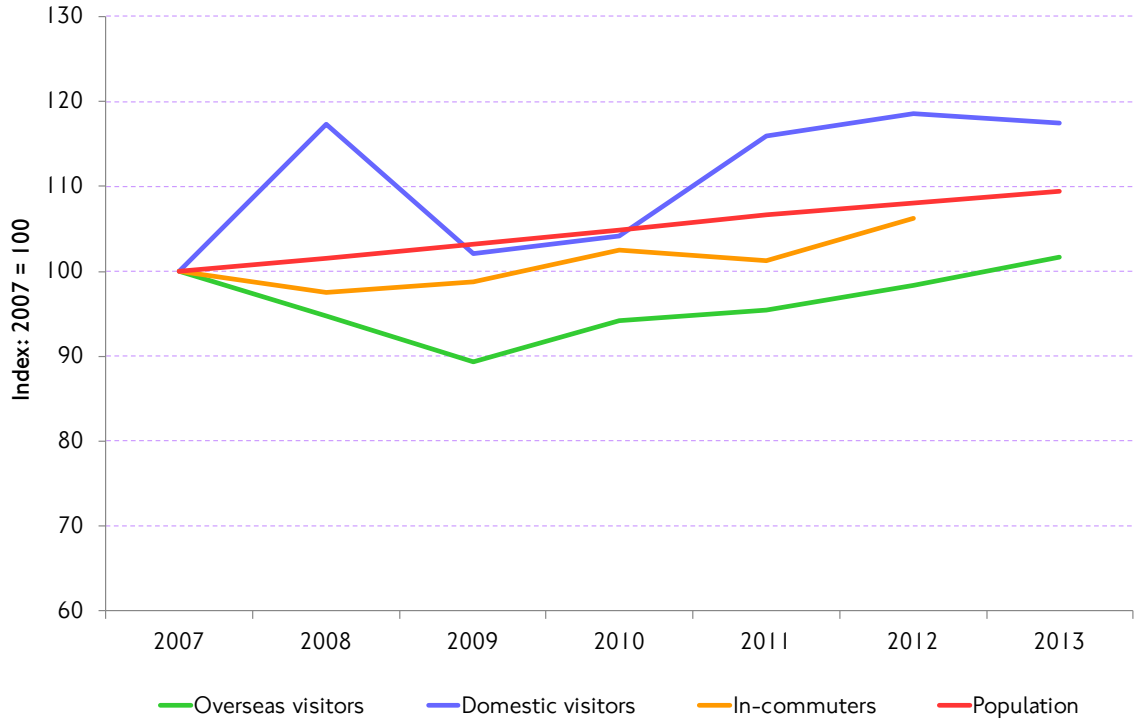
This section explores aspects of commuting and other non-resident visitor travel in London. While growth in both of these have contributed to the overall increase in travel demand in London over recent years, they collectively account for roundly 25 per cent of travel overall. The evidence also suggests that the rate of growth in both of these types of travel has been marginally less than that of the resident population. In general terms, therefore, travel by both of these groups is a secondary factor explaining recent travel trends, although they may be of particular significance on specific parts of the transport network, such as the Underground during off-peak periods and in central London.

Contribution of non-resident commuters and visitors to overall travel in London

While the rate of growth of London's resident population has been relatively stable year-on-year, the number of non-Londoners travelling within London has fluctuated more. Taking the period since 2007 (the first year for which consistent series are available – figure 2.6), London's population grew by 9.4 per cent. The number of people commuting into London that live outside Greater London has also increased, although at a lower rate. The number of international visitors to London in 2013 was just 1.6 per cent higher than in 2007, following falls between 2007 and 2009, although there has been very strong growth since 2009. However, total visitors to London make up around four per cent of London's 'daytime' population, with commuters making up eight per cent. Londoners make up 89 per cent of the 'daytime' population, a proportion that has remained the same since 2007.

It is therefore clear that increasing resident population has been the primary driver behind growing travel demand, and this is expected to be the case as London continues to grow strongly to 2031 and beyond. As is explained in section 2.4 above, the average 'trip rate' (trips per person per day) has remained remarkably stable at around 2.7 for all travellers and 2.5 for London residents. In simple terms, the average individual is making roughly the same number of trips as they did a decade ago – there are just considerably more of them.

Figure 2.6 Growth in population, visitors and in-commuters, 2007 to 2013.



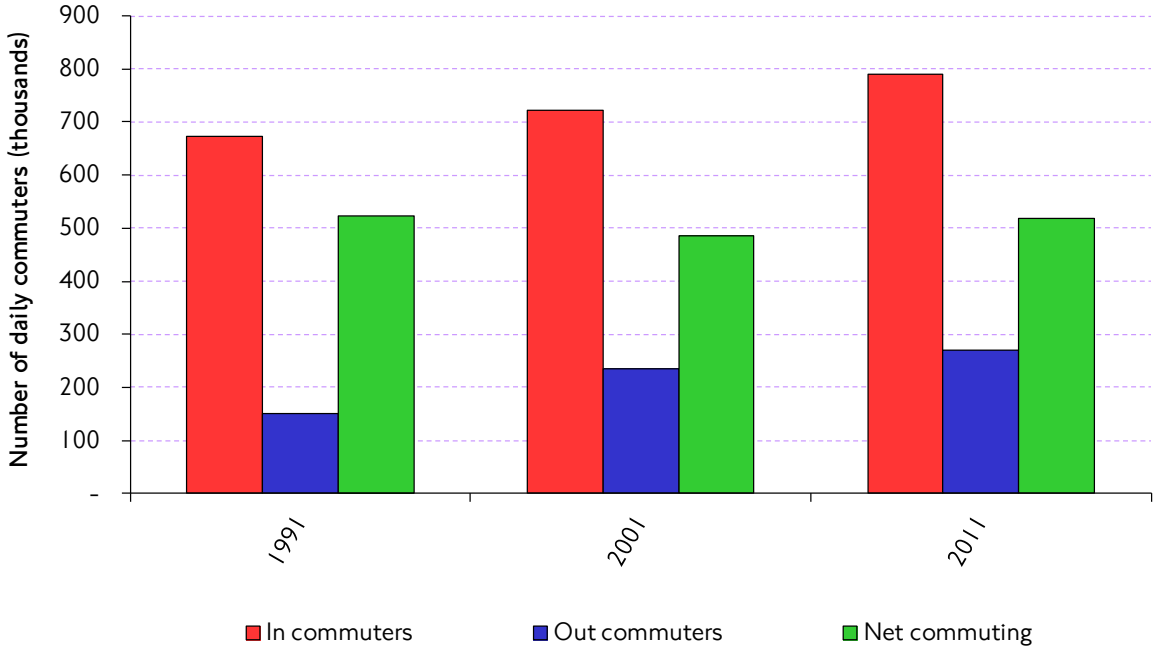
Source: TfL Planning, Strategic Analysis.

Long-term trends in commuting to and from London by non-residents

London, and central London in particular, has always attracted a large number of non-residents to jobs located in the Capital. However, because these commuters originate from across a wide geographical area, they are difficult to capture in traditional travel demand surveys. The latest release of Census workplace data [3] gives an opportunity to look at current commuting flows into and out of London, and at how these have changed over the past 20 years.

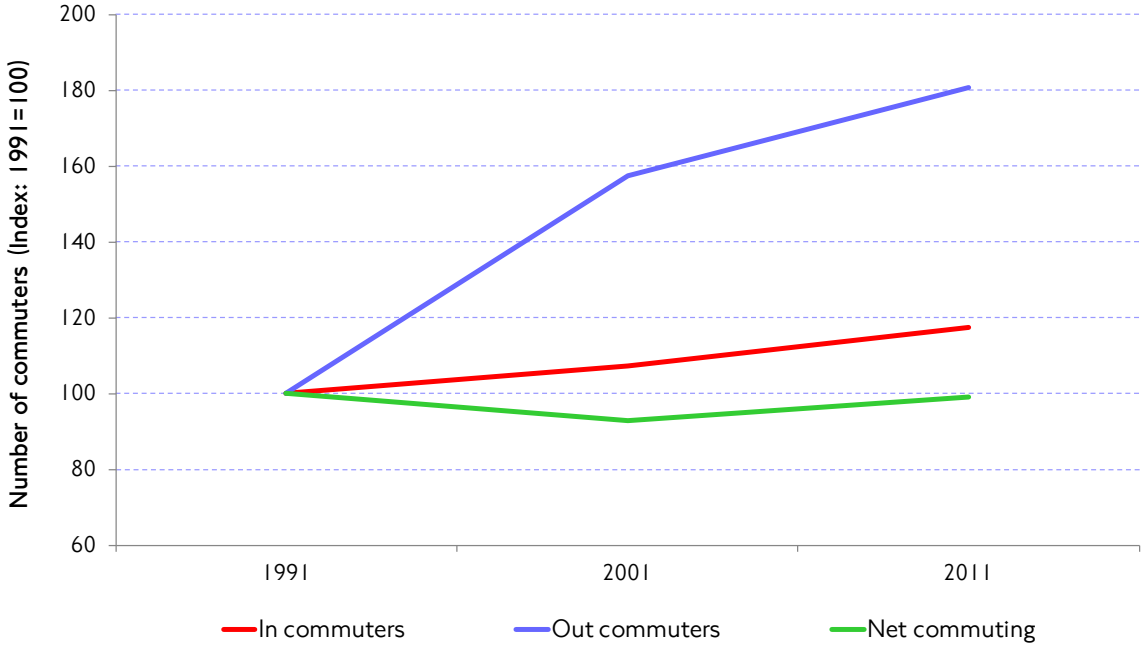
Figure 2.7 shows change in the main types of commuter travel. The number of non-residents working in London increased to 790,000 in 2011, up by 9 per cent on 2001, representing around 21 per cent of the total number of people working in London. However, the number of London residents travelling to work outside Greater London has increased at a greater rate, up by 15 per cent on 2001 to 271,000. This means that net commuting, the number of 'extra' people in London during the working day, has remained relatively stable, and is actually slightly lower than in 1991, despite London's population growing by more than 20 per cent over the same period (figure 2.7). Therefore, London's resident population has grown at a faster rate than the number of non-London residents commuting into London.

Figure 2.7 Long term trend in commuting to and from London.



Source: Census travel to work data.

Figure 2.8 Growth in commuting to and from London, 1991 to 2011.



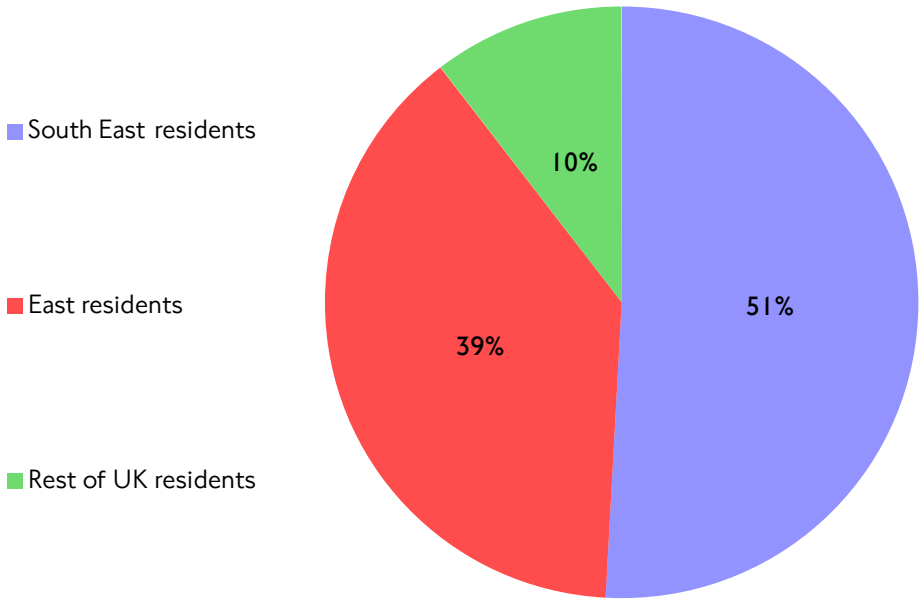
Source: Census travel to work data.

Regional commuting patterns to and from London

Half of all in-commuters to London come from the neighbouring South East region (404,000), with the majority of the rest coming from the East region (308,000). However, a sizeable minority of commuters travel from further afield each day, with 83,000 travelling from the rest of the UK (figure 2.9).

The majority of non-residents work in the City of Westminster and the City of London (241,000), although the boroughs of Camden, Tower Hamlets and Hillingdon all have more than 50,000 non-resident commuters, the former of these being close to central London, the latter two reflecting employment in Docklands and at Heathrow Airport.

Figure 2.9 Proportion of commuters into London by region of residence, 2011.



Source: Census travel to work data.

Unsurprisingly, the local authorities hosting the largest numbers of commuters into London are those closest to the London boundary, such as Epping Forest, Thurrock and St Albans. Outside of the South East and East regions, Wiltshire was the local authority with the highest number of commuters to London.

Commuters from outside London tend to be older on average than London workers – 44 per cent are aged 35 to 49 and more than 20 per cent are aged over 50. The vast majority also use one of two modes of transport to travel to London, with 45 per cent travelling by rail and 40 per cent by car. Commuting into London by train is much more common if the workplace is in inner (including central) London, whereas car predominates in outer London workplaces. For example, 85 per cent of (non-resident) commuters to the London borough of Hillingdon travel by car.

2.7 Focus on changing travel: Commuter travel in London between 2001 and 2011

Scope

This section looks comparatively at data describing travel to work from the Census of Population in 2001 and 2011. The 2001 Census showed that there were 3.5 million people who travelled to work in London, either from within the Greater London Authority (GLA) boundary or from beyond it. By 2011 this had increased to 3.7 million. Underlying this aggregate statistic, various different changes have taken place in the origins and destinations of people travelling to work in London.

Two major developments in patterns of travel to work over the 10 years between 2001 and 2011 go some way to explaining why public transport modes saw a greater increase than other modes over the period. First, more people now travel to a workplace outside their home borough, meaning it is likely that travel will be made by a mechanised mode. Second, employment became more focused on central London over the period, and public transport is generally the most appealing among the mechanised modes for travel to central London due to preferable journey times as well as absence of constraints such as parking.

Changes in commuter travel to central, inner and outer London

While the number of people travelling to workplaces in London increased overall between 2001 and 2011, the number of people travelling to jobs in outer London decreased by 6 per cent, or about 90,000 people on an average day. This figure masks an even greater decrease in outer London residents travelling to jobs in outer London, which fell by 113,000, with an increase in inner London residents travelling to outer London workplaces resulting in the net figure.

Car driver trips make up a larger proportion of trips within outer London than they do in other areas of London, and the large decrease in commuting trips made wholly within outer London has therefore been a contributing factor to the reduced mode share of car driver trips overall.

Travel to workplaces in central and inner London has seen the opposite trend to outer London. The number of people travelling to jobs in central London increased by 13 per cent (105,000 people), while travel to jobs in inner London saw even higher growth at 15 per cent (187,000 people).

While in 2001 inner London residents accounted for 35 per cent of central London's workforce, around 60 per cent of the jobs added in central London by 2011 were taken by residents of inner London. This means that in 2011 inner London residents accounted for 38 per cent of central London workers. In contrast, the number of outer London residents travelling to work in central London increased by only 10,000 people on an average day, resulting in the share of central London's workforce made up of outer London residents falling from 33 to 31 per cent.

Table 2.5 Number of people travelling to workplaces in London by area of workplace.

Area of workplace	2001	2011
Central London	812,000	917,000
Inner London	1,246,000	1,433,000
Outer London	1,460,000	1,371,000

Source: Census travel to work data.

Volumes of travel from within and beyond London

The number of residents of London travelling to all workplaces (either within or outside London) increased by 177,000 between 2001 and 2011. Almost all of this was accounted for by growth in workers resident in inner London of 16 per cent (170,000 people). At the same time, outer London saw virtually no change in the number of people resident there who travelled to work, remaining at around 1.9 million people.

In-commuting to London from outside London increased by 9 per cent, (73,000 people). This increase means that a disproportionate amount of the growth in travel to workplaces in London was made up of people who are not London residents.

Even despite the overall increase in commuting to London by non-London residents, the number of non-Londoners travelling to jobs in outer London decreased. The number of non-Londoners travelling to workplaces in central and inner London increased by 15 and 23 per cent respectively. This pattern shows that the growth in travel to workplaces in London from outside London was made up of relatively long distance trips with a radial focus toward central London. These trips are much more likely to be made by rail modes rather than by car than would be short commuting trips across the GLA boundary to workplaces in outer London.

Table 2.6 Number of people travelling to workplaces in London by area of residence.

Area of residence	2001	2011
Central London	79,000	87,000
Inner London	1,014,000	1,167,000
Outer London	1,704,000	1,672,000
Outside London	722,000	795,000

Source: Census travel to work data.

Modes used to travel to work

The Census travel to work statistics show the same general pattern of mode shift from private motorised transport toward public transport, walking and cycling that has been observed in London more generally.

The proportion of London residents travelling to work as a car driver decreased from 34 per cent to 25 per cent between 2001 and 2011. Meanwhile the shares of travel to work by Underground, bus and bicycle increased by 4, 3 and 2 percentage points respectively.

Table 2.7 Mode shares for travel to workplaces in London among London residents.

Mode of journey to work	2001 mode share	2011 mode share
Underground, metro, light rail or tram	22%	26%
Train	14%	14%
Bus, minibus or coach	13%	16%
Taxi	1%	<1%
Motorcycle, scooter or moped	2%	1%
Driving a car or van	34%	25%
Passenger in a car or van	3%	2%
Bicycle	3%	5%
On foot	10%	10%

Source: Census travel to work data.

A similar pattern of mode shift occurred among people resident outside London who travel to workplaces in London. Travel by motorised road transport (of which around 87 per cent is made up of car drivers) fell from 55 to 46 per cent. The share of in-commuting by rail modes increased from 43 to 50 per cent, while the share of people travelling to work across the London boundary by bicycle or on foot also increased. This growth in rail travel and fall in car travel is consistent with the changes in workplace destinations of in-commuters to London that was seen above.

Table 2.8 Mode shares for travel to workplaces in London among non-London residents.

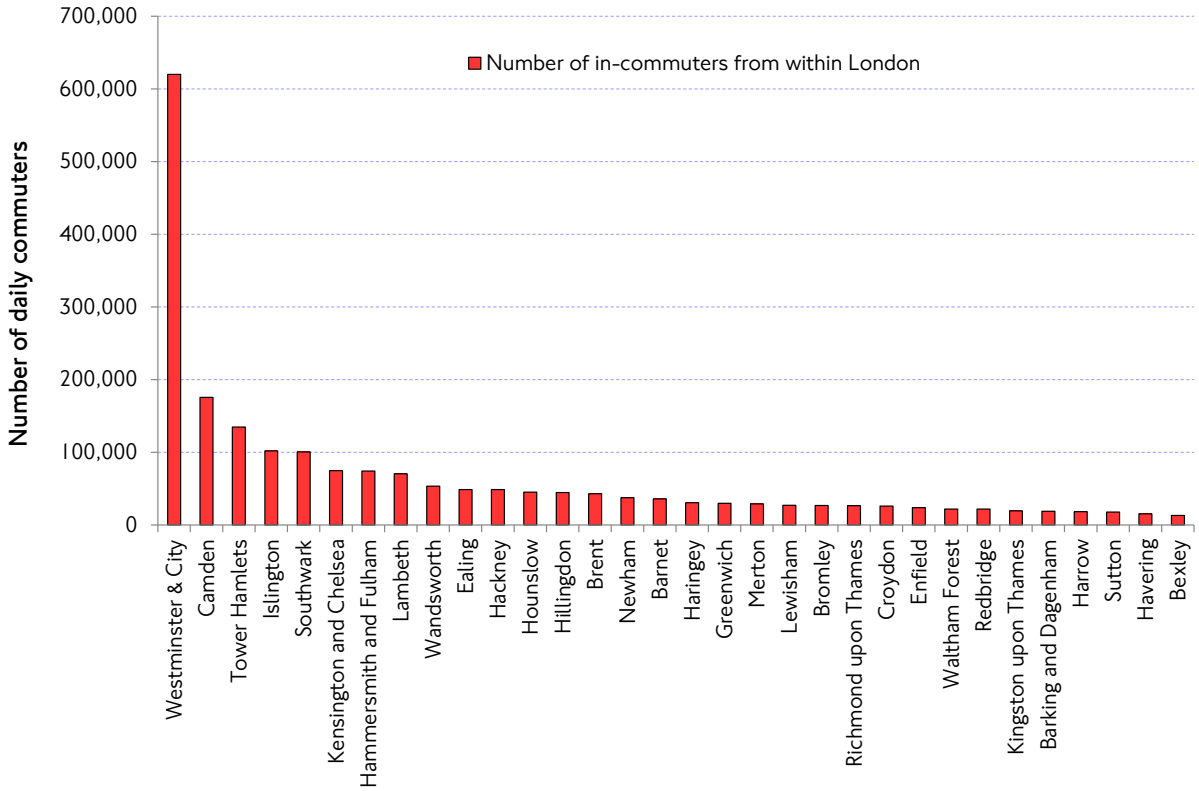
Mode of journey to work	2001 mode share	2011 mode share
Rail modes	43%	50%
Motorised road transport	55%	46%
Walk or cycle	2%	3%
Other	1%	1%

Source: Census travel to work data.

Distribution of commuting between boroughs

The Census workplace data also covers London residents commuting within London. The majority of London residents that work in London are employed in a different borough to where they live – just over 71 per cent. Almost 400,000 London residents commute into the City of Westminster from the rest of London, more than three times the number of non-London-residents that commute into Westminster. More than 240,000 Londoners commute into the City of London, with the boroughs of Camden, Tower Hamlets, Southwark and Islington all receiving more than 100,000 daily commuters from within London (figure 2.10).

Figure 2.10 Commuting inflows within London by borough, 2011. London residents only.



Source: Census travel to work data.

Most boroughs saw a decrease in intra-borough commuting between 2001 and 2011, with an average decrease of 5,000 residents per borough travelling to a workplace in that same borough. Croydon and Bromley saw the greatest decreases in intra-borough commuting both with a reduction of more than 10,000 resident workers.

In contrast, every borough experienced an increase in out-commuting to workplaces elsewhere in London. The average increase across the boroughs was around 10,000 residents commuting to workplaces elsewhere in London.

These opposing trends in intra-borough and inter-borough commuting show that the period between 2001 and 2011 saw a substantial change in the structure of London's labour market.

The City of Westminster, the City of London and Tower Hamlets, each home to one of London's three primary business centres, were notable exceptions to the trend for decreasing intra-borough commuting, gaining 8,500 resident commuters among them in addition to the 160,000 they gained from other boroughs.

Meanwhile, some of the boroughs that are home to London's metropolitan town centres were the only areas that did not see an increase in the number of in-commuters from other boroughs. Croydon, Harrow and Hillingdon all saw decreases in the number of people commuting in from other boroughs, with the decrease in Hillingdon the highest at 14,000 people.

The trends for increasing commuting to central London and decreasing commuting to other places – and perhaps particularly outer London town centres – show that

central and inner London became relatively even more important as London's centres of employment between 2001 and 2011, drawing on a wider labour pool from across the rest of London, perhaps partly drawing on employees that would previously have travelled to outer London town centres.

2.8 Focus on changing travel: Time of day of travel

Scope

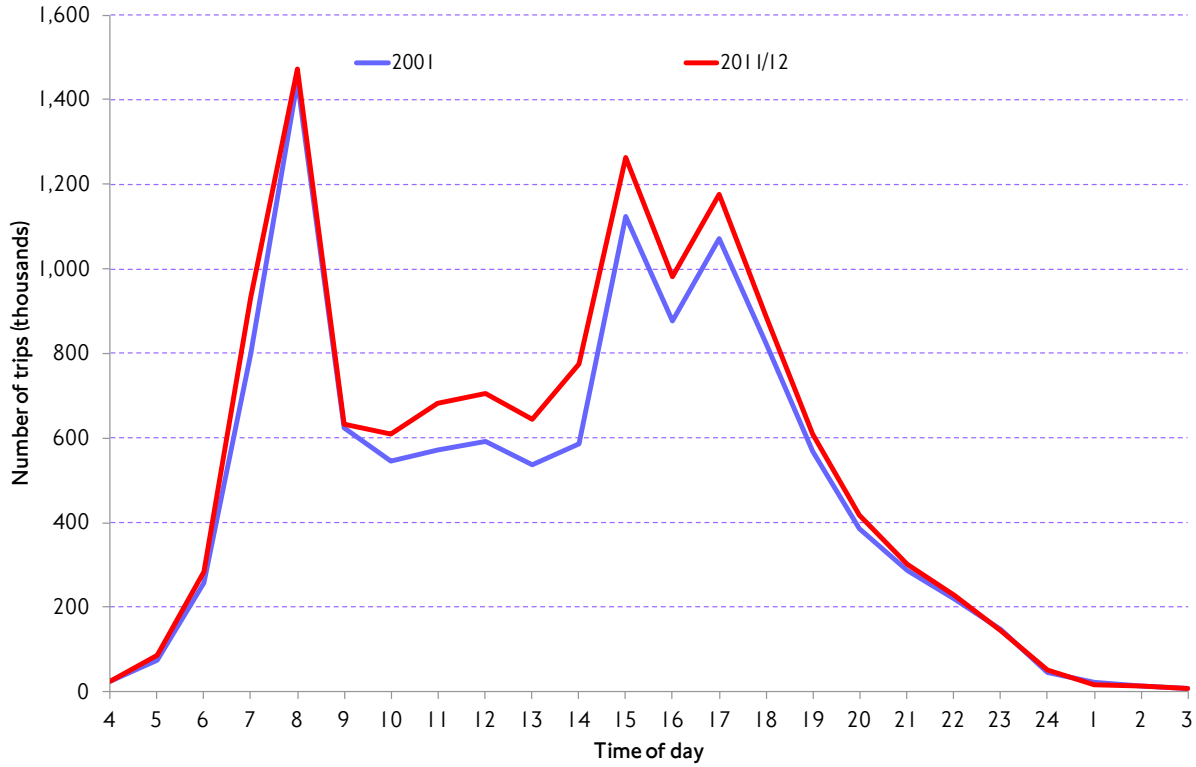
Anecdotal evidence suggests that growing overall travel might be accompanied by proportionate shifts in the times of day at which people travel, reflecting the avoidance of congested peak times, for example, as well as perhaps wider factors such as increased informality of daily working times and locations (also known as 'peak spreading'). Furthermore, evidence points to a general increase in travel for non-work purposes, such as leisure. There are also acknowledged to have been wider structural changes, for example, changes to the ways in which people do their shopping, that would have been expected to impact on travel patterns at some level.

This section explores these aspects looking for evidence of these changes, using data for London residents. Although some pronounced shifts are evident in the data, it should be borne in mind that the overall amount of travel undertaken by individuals has, on average, been broadly stable. In 2001 London residents made an average of 2.8 trips per person per weekday. This value was 2.7 for the average weekday in 2013/14, recovering from 2.5 trips per person in 2009/10. The impact of these shifts on total travel has therefore been small at the aggregate level, with increasing resident population being by far the most significant factor driving increased demand.

Travel by time of day – 2001 and 2011/12 compared

Figure 2.11 shows the time of day profile for travel by London residents, comparing data from 2001 with comparable data from 2011/12 (categorised by trip start time). Although total travel demand increased between 2001 and 2011, the increase is not evenly spread throughout the day. Trips starting in the AM peak period have increased very little, with only around 30,000 more trips in 2011 at the height of the morning peak period. In contrast, between 11:00 and 14:00 in 2011 there were more than 100,000 extra trips per hour than in 2001. Interestingly, there is little evidence of change from these data in the number of trips starting in the mid-late evening period, although this relates to weekdays only and as is explained below this net outcome for all trips disguises some substantial changes at the modal level.

Figure 2.11 Total trips by start time, 2001 and 2011/12, residents only, average weekday.



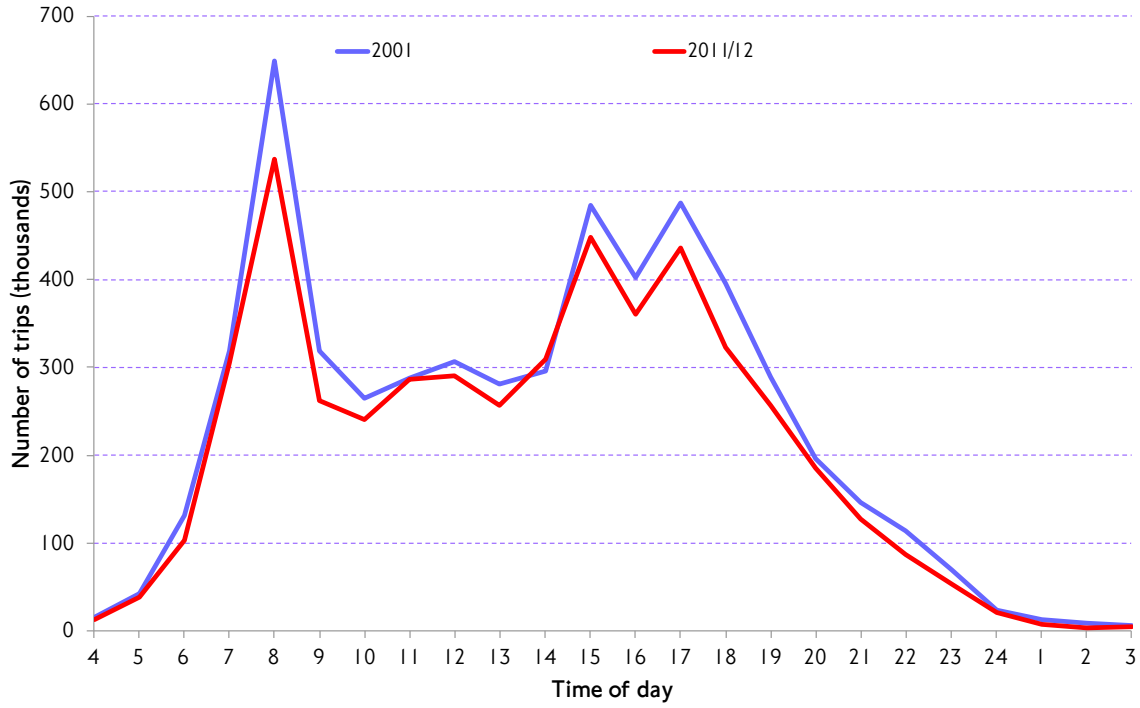
Source: TfL Planning, Strategic Analysis.

Closer examination of these trends by mode is instructive, although it should be borne in mind that trips are assigned a 'main mode' based on the distance travelled on each mode of a multi-stage trip (the mode assigned being the greatest of these).

In line with the general reduction in car use, car driver trips have dropped throughout the day, comparing 2001 with 2011/12, but particularly during the two peak periods (figure 2.12).

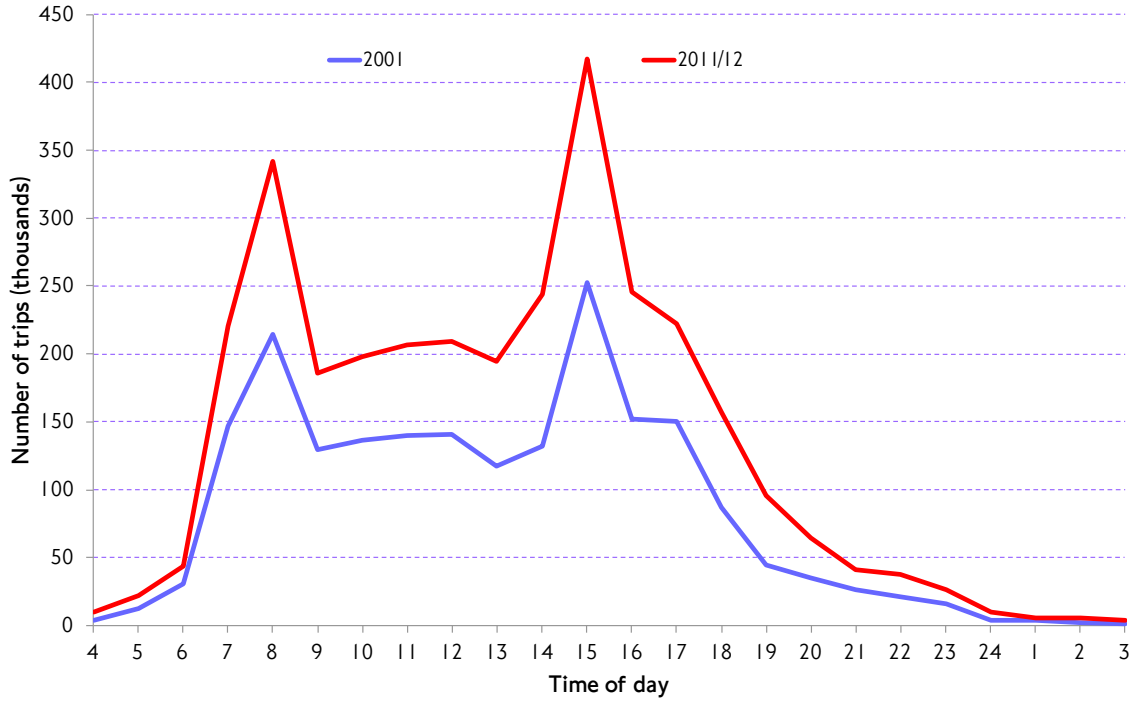
In contrast, travel by bus has increased throughout the day, with particularly strong growth in the AM and early PM peak periods, partly reflecting the introduction of free and reduced rate travel on the bus network for younger London residents. There are now 165,000 more trips starting between 15:00 and 16:00 on London's buses on an average weekday, an increase of 66 per cent on 2001 (figure 2.13). In contrast to figure 2.12, there is evidence of increasing use of buses during the evening and overnight period, reflecting the growth of the Night bus network, although clearly from a small base in 2001.

Figure 2.12 Total car driver trips by start time, 2001 and 2011/12, residents only, average weekday.



Source: TfL Planning, Strategic Analysis.

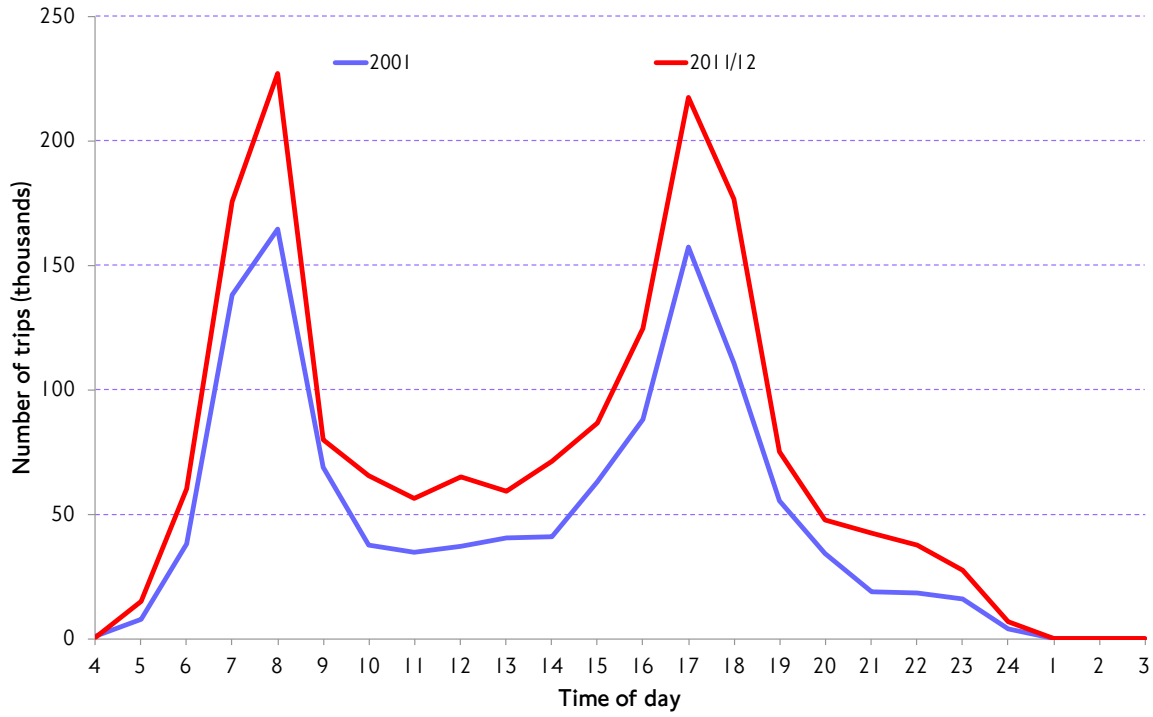
Figure 2.13 Total bus trips by start time, 2001 and 2011/12, residents only, average weekday.



Source: TfL Planning, Strategic Analysis.

Trips on the Underground network have increased dramatically and relatively consistently across the day, particularly in the morning and evening peak periods, with a noticeably longer evening peak period in 2011. There has also been a large increase in evening and night-time trips, with more than twice as many trips starting between 21:00 and 23:00 than in 2001. This is explored further in section 3.7 of this report, which looks at TfL's proposals for the 'Night Tube', which is due to start in September 2015.

Figure 2.14 Total Underground trips by start time, 2001 and 2011/12, residents only, average weekday.

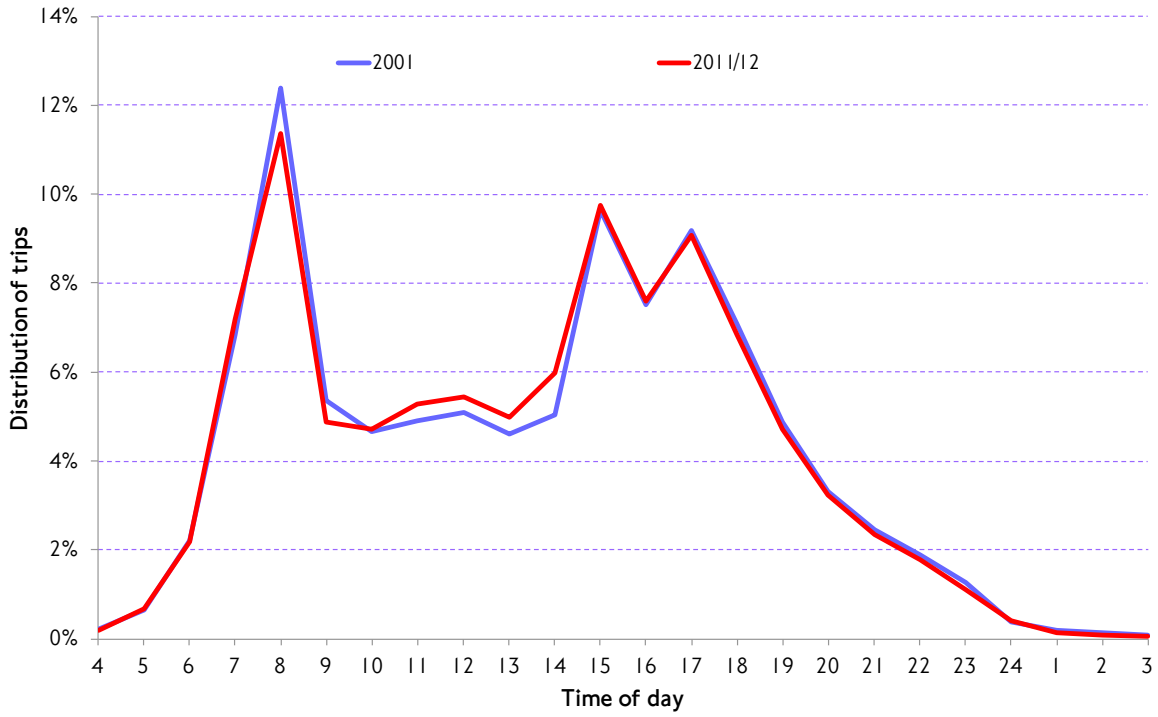


Source: TfL Planning, Strategic Analysis.

Peak spreading?

'Peak spreading' would be visible as a differential increase in the proportion of total daily travel undertaken outside of the peaks. Looking at London residents only, however, figure 2.15 shows only a slight net shift of this type between 2001 and 2011/12. Travel in the inter-peak period has increased in proportionate terms, in simple terms at the 'expense' of the morning peak, although it should be remembered that this small proportionate change is in the context of growing overall volumes of travel – the absolute number of people travelling on the transport networks has increased across all periods of the day (see also figure 2.11).

Figure 2.15 Distribution of trips by start time, 2001 and 2011/12, residents only, average weekday. Percentage of all trips starting in hour.



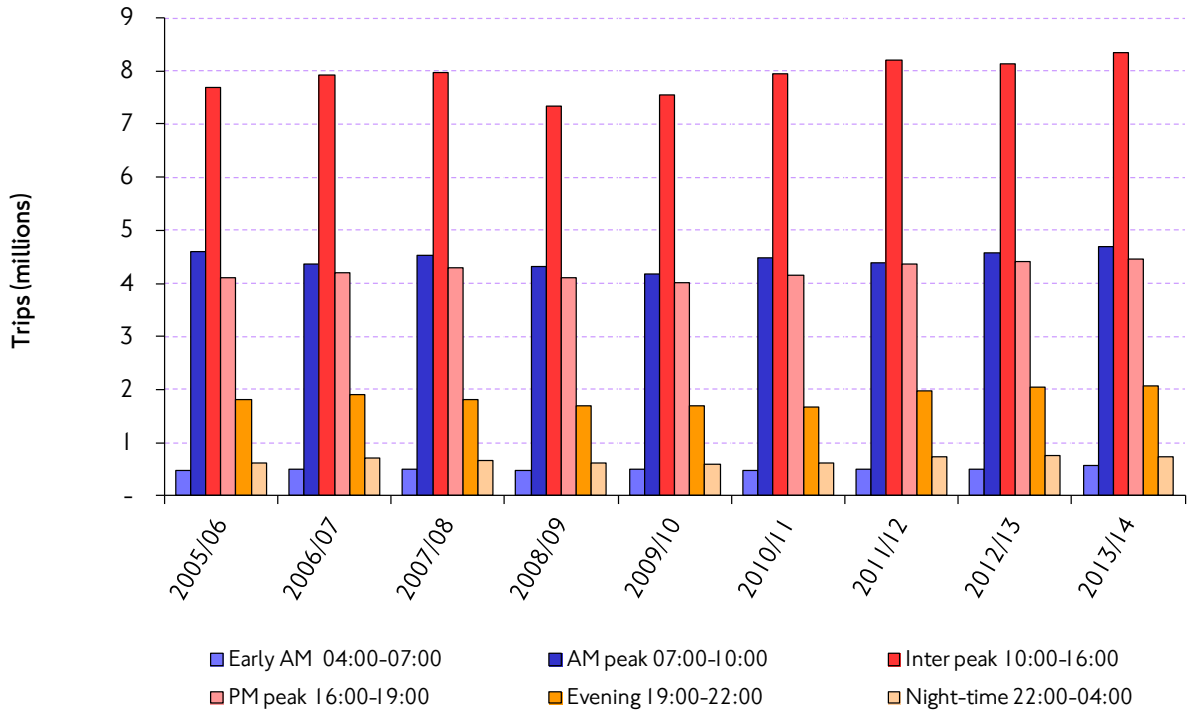
Source: TfL Planning, Strategic Analysis.

Timing of travel – trends between 2005/06 and 2013/14

Figure 2.16 looks in more detail at year-by-year trends in travel by time of day between 2005/06 and 2013/14, using data from TfL's London Travel Demand Survey (LTDS). Key observations from the figure are that:

- The number of trips made late at night has grown strongly over the period, dipping back during the recession but also recovering strongly in more recent years – indicative of the growth of the night-time economy.
- Morning and evening peak hour trips fell during the recession, but have recovered since. Noticeable however is a relative lag in the rate of growth of morning peak hour trips compared to those in the evening peak, which may also be indicative of a growth in evening/night-time leisure activity.

Figure 2.16 Trends in trips made by London residents by trip start hour.



Source: TfL Planning, Strategic Analysis.

2.9 Focus on changing travel: Journey purposes – shopping and leisure travel

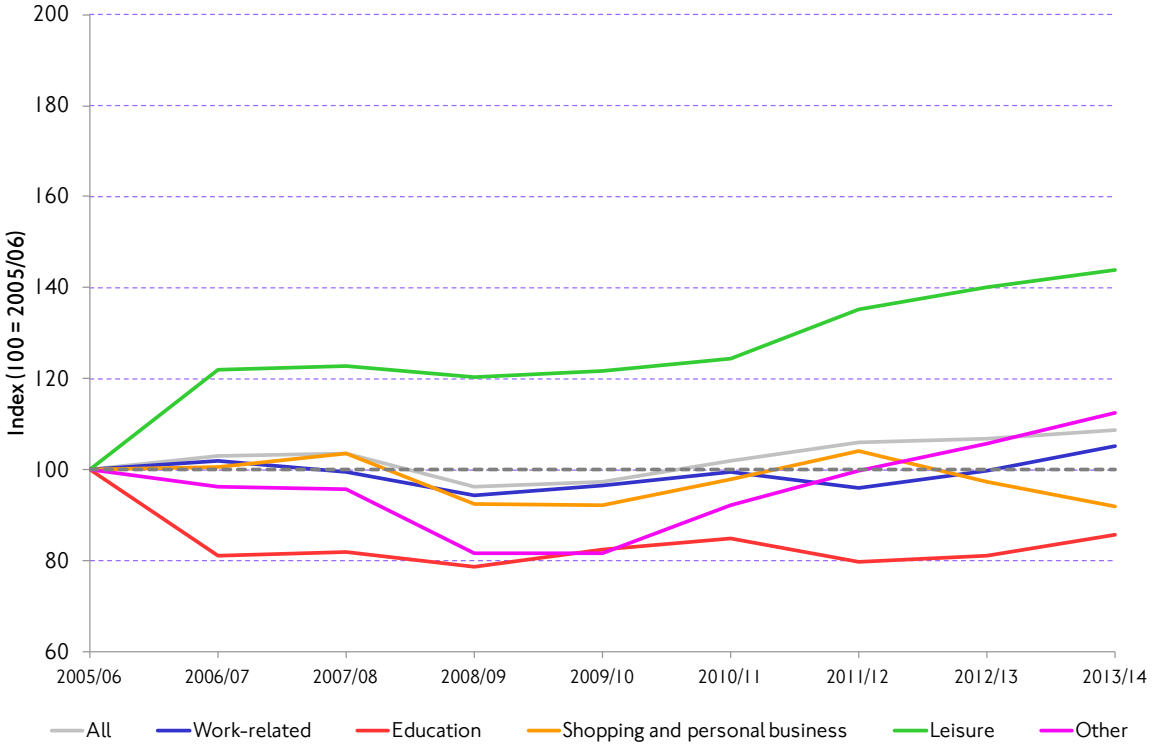
Scope

Evolving social and economic trends, such as the growth in the night-time economy and changes to patterns of working may be expected to be reflected in changes to journey purposes. This section reviews trends in the purposes for which London residents travel, as revealed by the LTDS between 2005/06 and 2013/14.

Changes in journey purpose among London residents

Figure 2.17 shows change in the principal journey purposes over the nine-year period of consistent data for London residents currently available from LTDS. The first point to make is that travel has increased over the period. This reflects increasing population, up by 12 per cent over the period. However, it is apparent that leisure trips have increased substantially more than trips for other purposes – up by 44 per cent over the period.

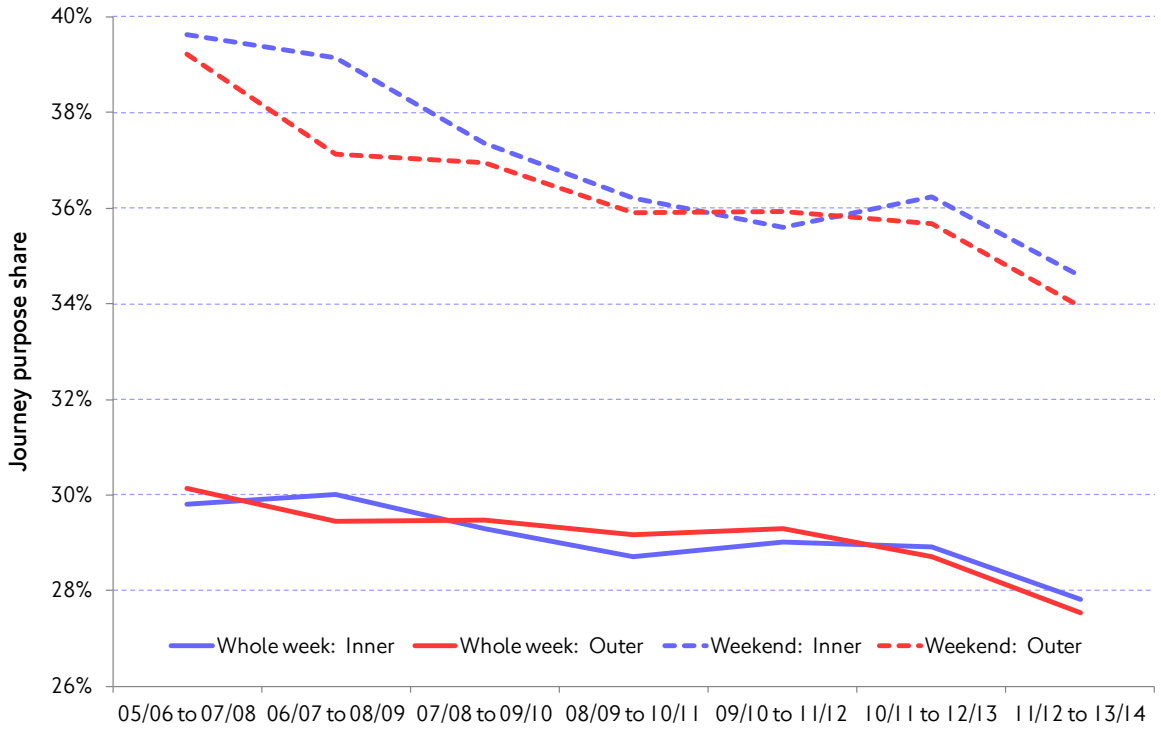
Figure 2.17 Trends in journey purpose for London residents. Index: 2005/06 = 100.



Source: TfL Planning, Strategic Analysis.

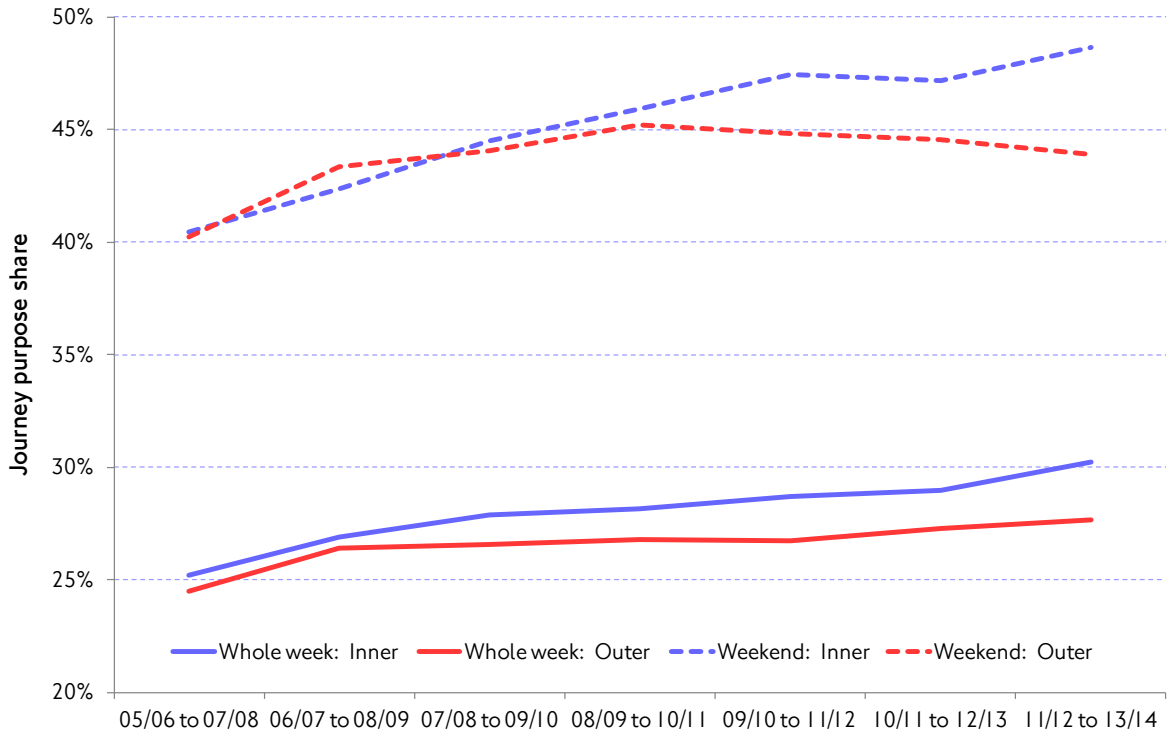
Figures 2.18 and 2.19 show the trend in purpose share for shopping trips (including personal business) and leisure purposes. Looking first at shopping (including personal business), there has been a proportionate decline from around 30 per cent of all trips in 2005/06 to 2007/08, to 27.7 per cent in 2011/12 to 2013/14. The decline in share of shopping trips is greater when looking at weekends only (where the share of shopping trips is higher), with a corresponding fall from 39.4 per cent to 34.2 per cent in the latest three years. This decline has been similar amongst inner and outer London residents, with inner London residents making a slightly higher proportion of shopping trips, particularly at weekends.

Figure 2.18 Purpose share of trips for shopping (including personal business) by inner/outer London residents.



Source: TfL Planning, Strategic Analysis.

Figure 2.19 Purpose shares of leisure trips by inner/outer London residents.

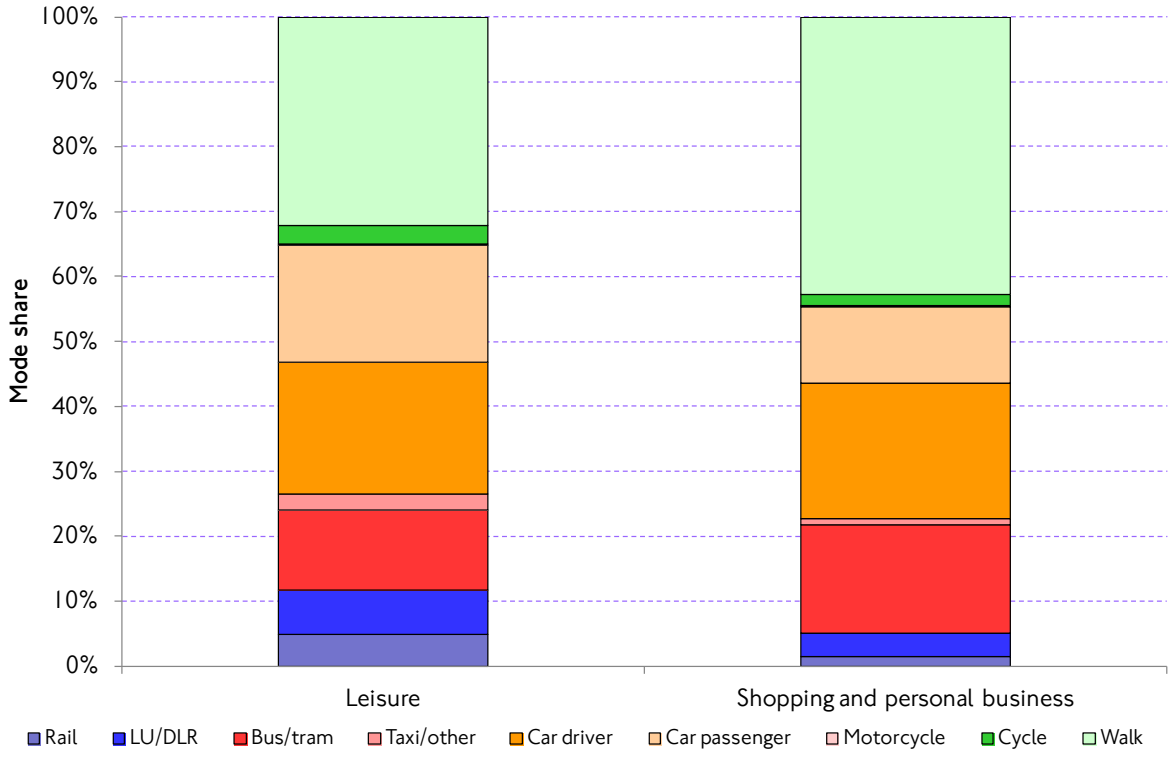


Source: TfL Planning, Strategic Analysis.

There is some evidence to suggest that these shopping trips have been replaced by leisure trips. Over the same time period, the share of all trips made for leisure purposes has increased from 24.8 per cent to 28.7 per cent, with an even greater increase at weekends – almost 50 per cent of trips by inner London residents on weekends are for leisure purposes (figure 2.19).

This shift in purpose could have implications for modal travel demand – figure 2.20 shows that mode shares for leisure and shopping trips are subtly different, with shopping trips having a higher share of walk trips. Public transport shares are similar, although leisure trips are more likely to be made by Underground or National Rail, whereas bus use is greater for shopping trips.

Figure 2.20 Mode shares of shopping and leisure trips, LTDS 2011/12-13/14.



Source: TfL Planning, Strategic Analysis.

2.10 Focus on changing travel: Gender, mode shares and travel in inner and outer London

Scope

This section looks at selected aspects of travel change by London residents over the period since 2005/06, based on consistent data from TfL's LTDS survey.

Mode and gender

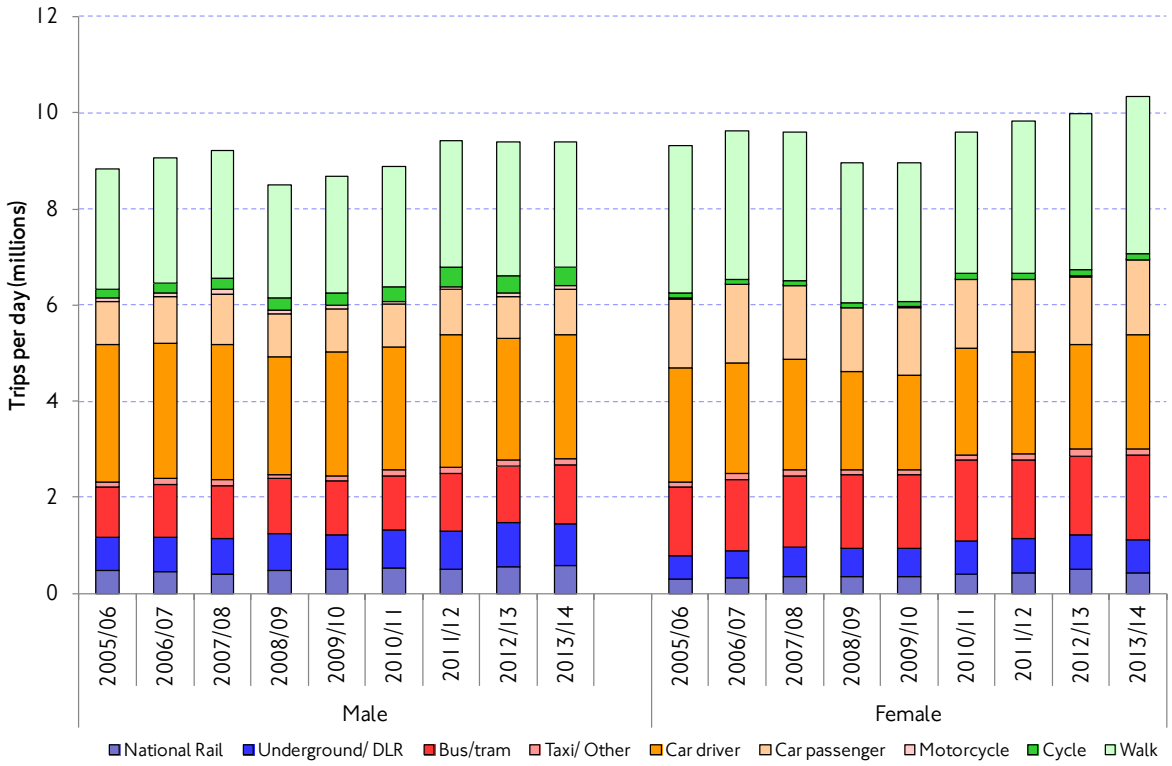
Figure 2.21 shows gender shares by mode, within the context of total travel. It is clear that the total number of trips per day in London by residents has generally increased since 2005/06, reflecting an increase population over this period; albeit with a decrease around 2008/09, largely as an effect of the recession.

In 2013/14, women made 10 per cent more trips per day than men (10.3 million trips versus 9.4 million), and it is clear from figure 2.21 that women's total travel

tends to be somewhat more 'dynamic' than that of men This is particularly visible in the rate of recovery from the recession of 2008/09.

Women make fewer National Rail and cycle trips than men, but more car passenger and walking trips, while the distinguishing feature for men is the growth in cycle trips over the period.

Figure 2.21 Trips by gender and main mode of transport (average day, seven day week).



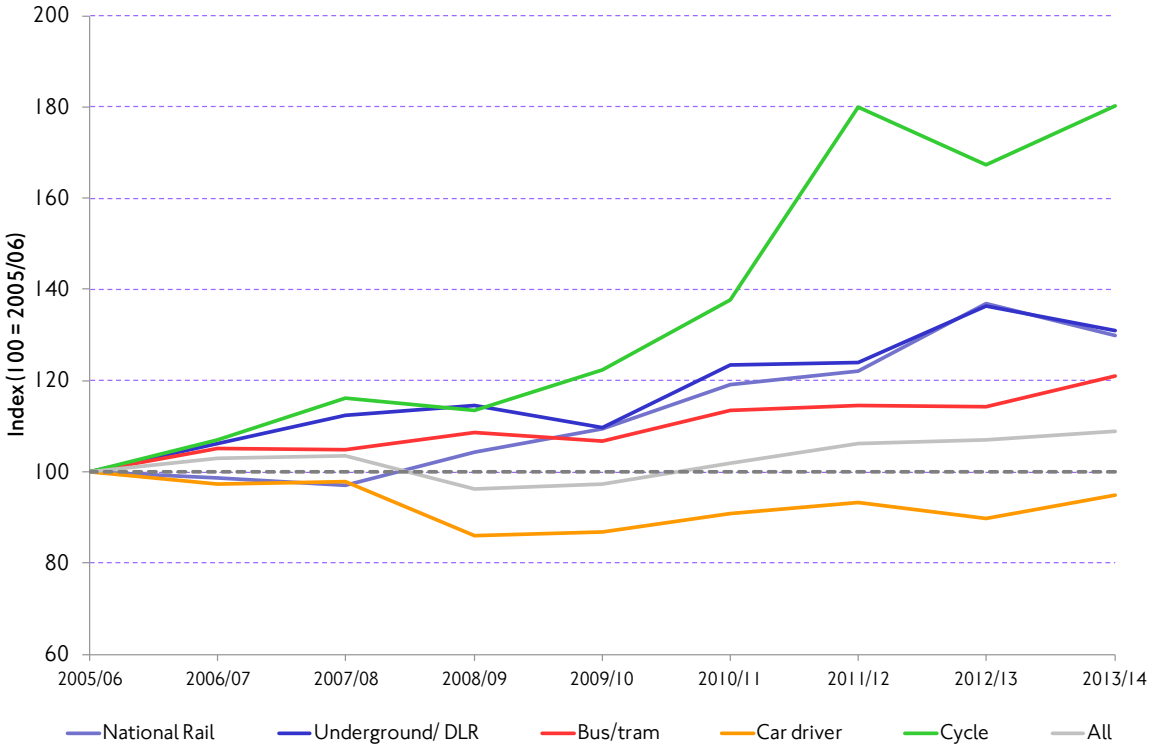
Source: TfL Planning, Strategic Analysis.

Mode share

Figure 2.22 shows indexed change by mode for all personal travel by London residents. Cycling mode share has increased at the fastest rate since 2005/06, with particularly high levels from 2011/12 onwards, coinciding with the London 2012 Games. Public transport mode shares have been gradually rising since 2005/06, including National Rail, Underground/DLR and bus/tram.

Car driver mode share has fluctuated but has generally decreased since 2005/06. The mode share was lowest in 2008/09, most likely from the effects of the recession.

Figure 2.22 Trends in mode share for London residents. Index: 2005/06 = 100.



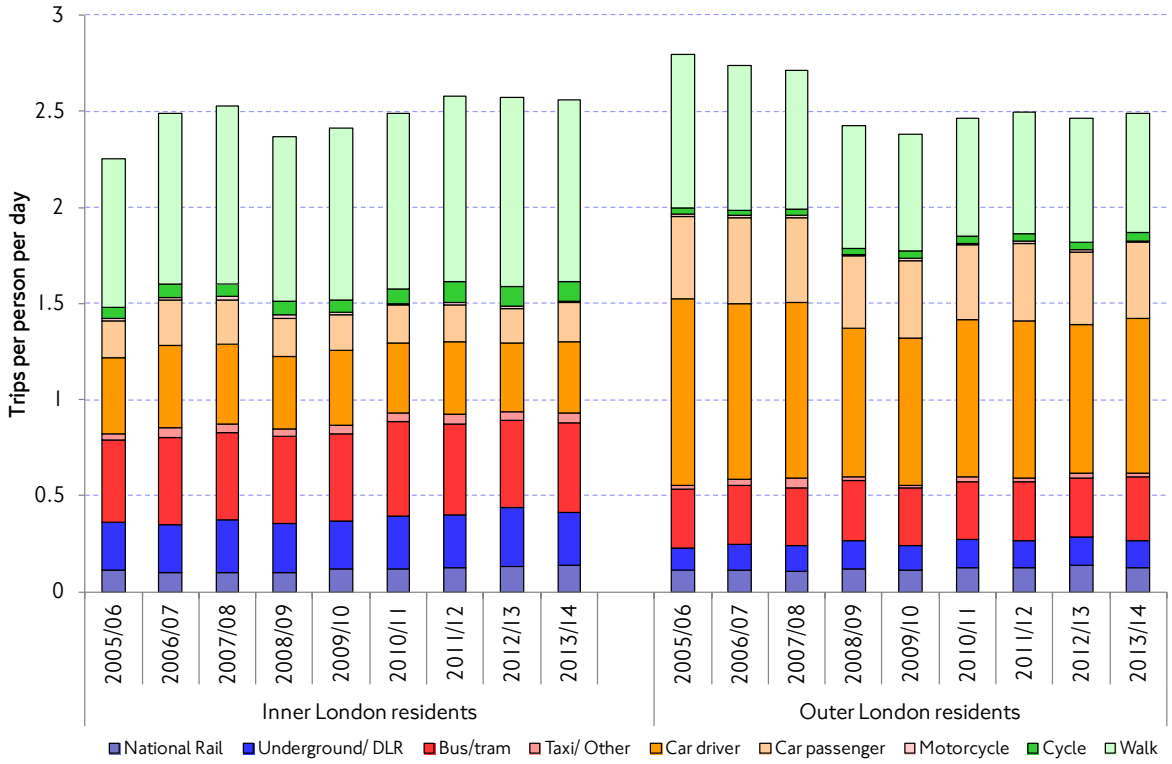
Source: TfL Planning, Strategic Analysis.

Residents of inner and outer London – trip rates and mode shares

Despite quite different urban characteristics, the trip rates of residents of inner and outer London are similar (figure 2.23), particularly for more recent years, although there does appear to have been a relative increase in average trip rates for inner London residents, and a relative decrease for outer London residents, over the review period.

In terms of travel modes, the most obvious feature of the figure is the much higher mode share for car travel among outer London residents, with correspondingly lower mode shares for public transport, walking and cycling.

Figure 2.23 Personal trip rates by residency of inner and outer London and main mode of transport (average day, seven-day week).



Source: TfL Planning, Strategic Analysis.

2.11 Focus on changing travel: Travel time and travel distance

Scope

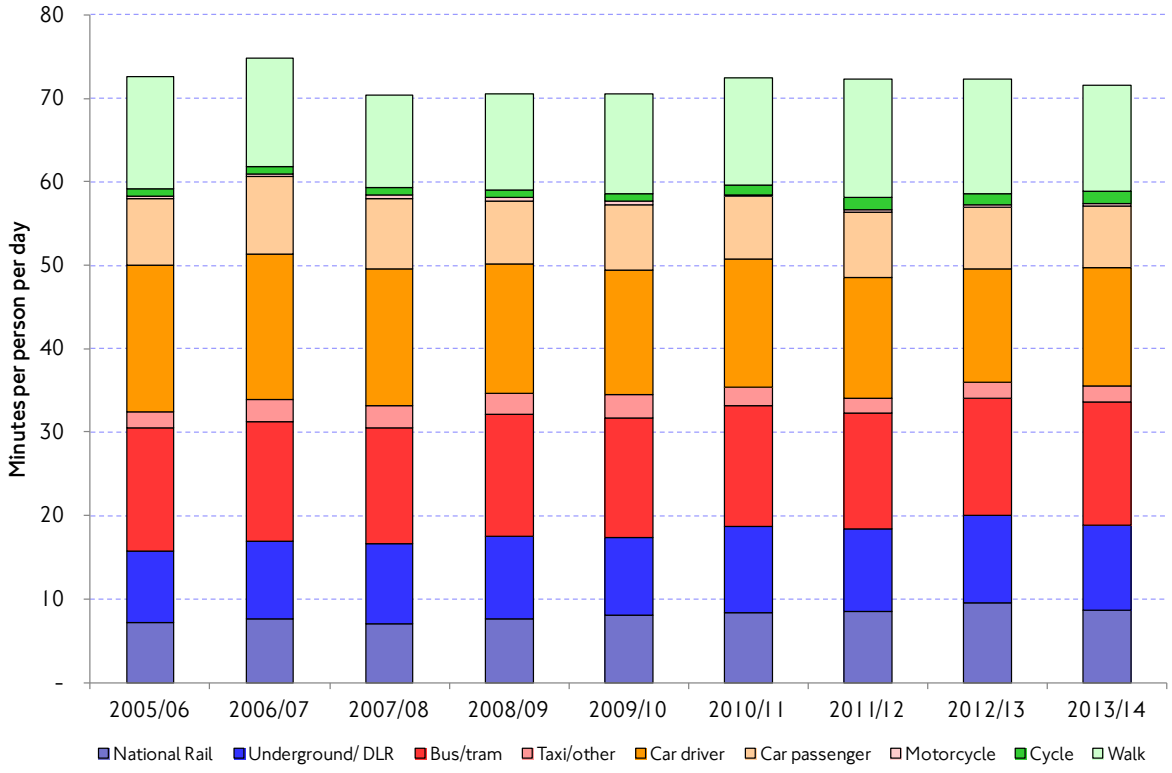
Repeated observations have led to the general proposition that people, on average, have a relatively fixed 'budget' in terms of the total time per day they spend travelling. Historic increases in travel speeds have allowed the average distance travelled to increase within this relatively stable overall travel time budget. Given the nine-year timescale of LTDS, dramatic change in these indicators is therefore not expected, although it is nevertheless useful to see if the nine-year LTDS series reveals any evidence of 'directional' change in these indicators.

Average daily travel time per person

Looking at figure 2.24, average total travel times by London residents have indeed been quite stable at (typically) just over 70 minutes per day.

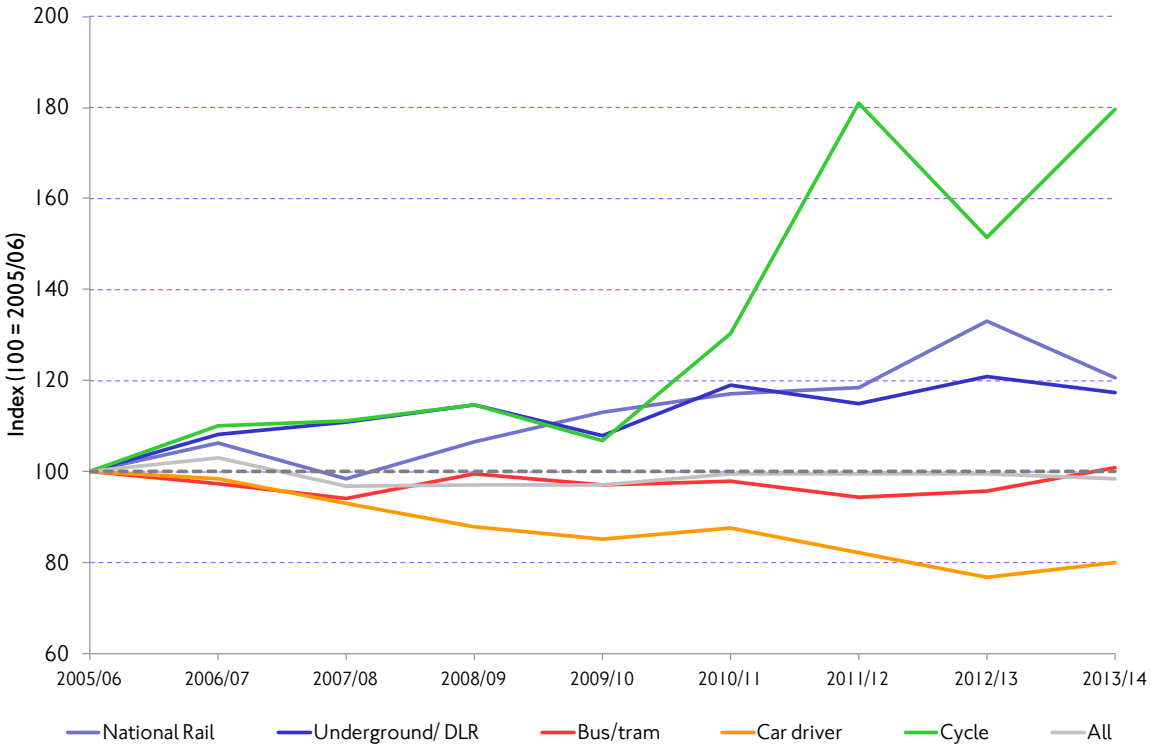
When looking more closely at change in travel time by mode (figure 2.25), the broad shifts in mode share described above are evident, with noticeable reductions in the average time spent travelling by car daily, and corresponding increases for public transport. Although not immediately visible from the figure, given the small base, there was an 80 per cent increase in the average time spent cycling by London residents since 2005/06.

Figure 2.24 Average daily travel time. LTDS average day, seven-day week.



Source: TfL Planning, Strategic Analysis.

Figure 2.25 Average daily travel times by mode. LTDS average day, seven-day week.



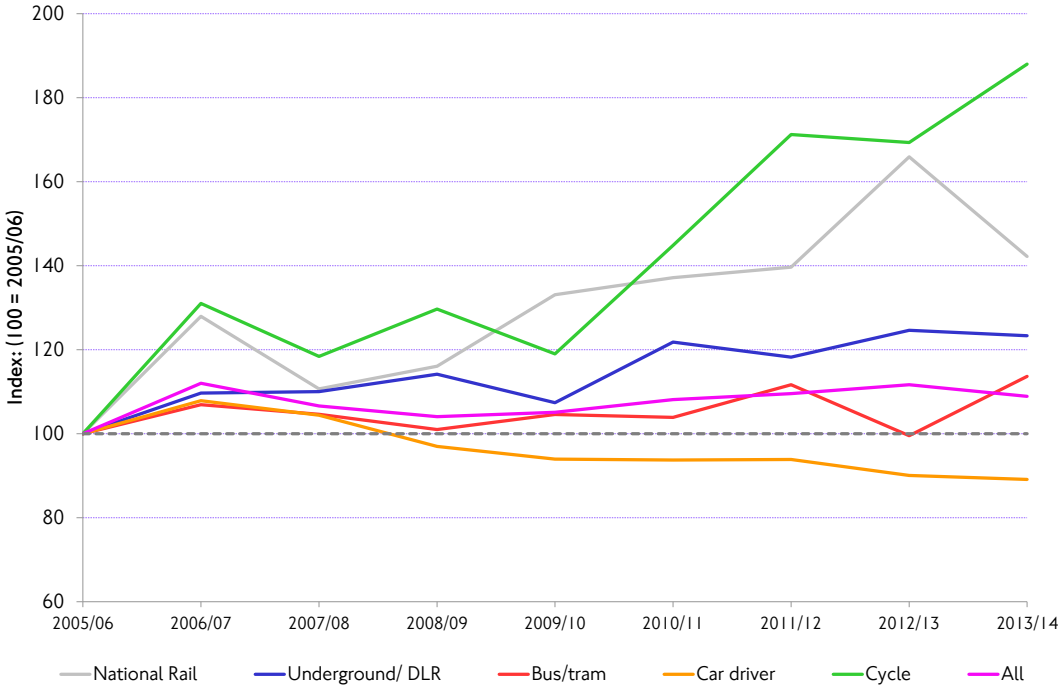
Source: TfL Planning, Strategic Analysis.
Please note that 'All' considers all modes, including those not listed.

Average daily distance travelled per person

Just as time spent travelling has not changed substantially over the last nine years, the average distance travelled has also remained relatively constant, at around 15 km per day, discounting an apparent increase between 2005/06 and 2006/07.

There are, again, some interesting patterns at the modal level. The average distance cycled per day has almost doubled (up by 88 per cent) over the period, whilst there was a 42 per cent increase in the average distance travelled by National Rail. The former case reflects the general increase in cycling (see section 3.15 of this report); the latter partly reflects the growth of the London Overground network (considered, for this purpose, as part of the National Rail network). A similar pattern is evident for the Underground, although to a lesser extent, given the general stability of the network, whilst the average distance travelled by car has reduced, by 11 per cent, reflecting falling car use over the period.

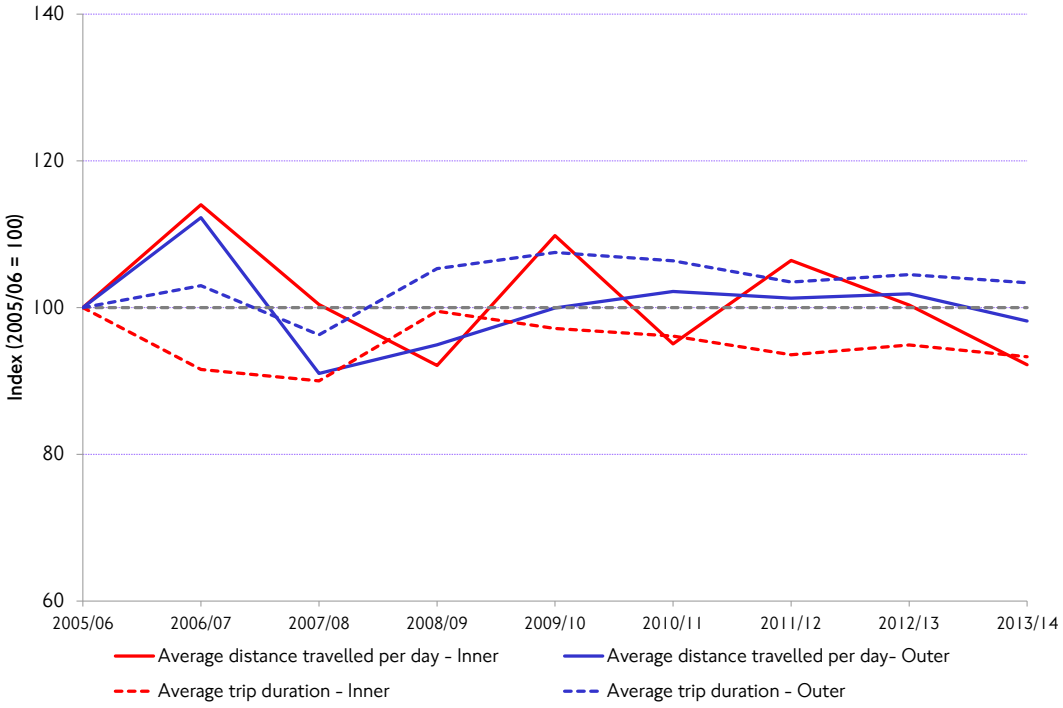
Figure 2.26 Average daily travel distances by mode. LTDS average day, seven-day week.



Source: TfL Planning, Strategic Analysis.
Please note that 'All' considers all modes, including those not listed.

Figure 2.27 compares average travel time and travel distance for residents of inner and outer London. The overall trend of stability over the review period is clearly evident, although there are fluctuations from year to year – of typically plus/minus 10 per cent. In terms of 'directional' change, it is perhaps evident from the figure that average travel times and distances by inner London residents have fallen relative to residents of outer London, which would be a logical consequence of the increasing 'densification' of inner London – a phenomenon that is also recognised elsewhere in this report.

Figure 2.27 Trends in daily travel distance and trip duration among inner and outer London residents. All modes. Index: 2005/06 = 100.



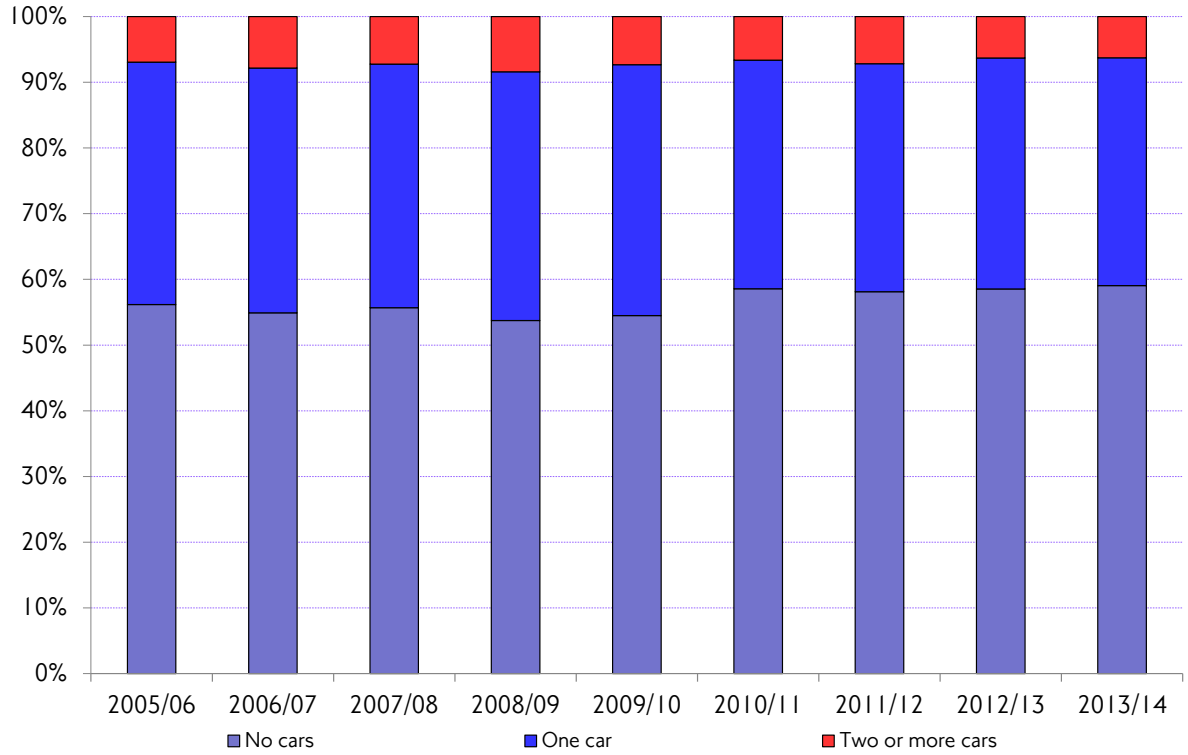
Source: TfL Planning, Strategic Analysis.

2.12 Focus on changing travel: Household car availability and income

Car availability

Access to cars among Londoners has not substantially changed since 2005/06 (figures 2.28 and 2.29), although some interesting features are apparent. Looking first at inner London, the proportion of households without access to a car was at its lowest during the recessionary years of the last decade. However, it is noticeable that the proportion of non-car-owning households has increased year-on-year since then, this clearly not being a recessionary effect per se, and perhaps reflecting a wider trend away from car ownership, which would be in line with trends such as the increased 'densification' of parts of London, demographic changes (for example to household size), and the wider growth of public transport mode share. The proportion of multi-car households in inner London has also decreased since the recession.

Figure 2.28 Household car ownership among inner London residents.

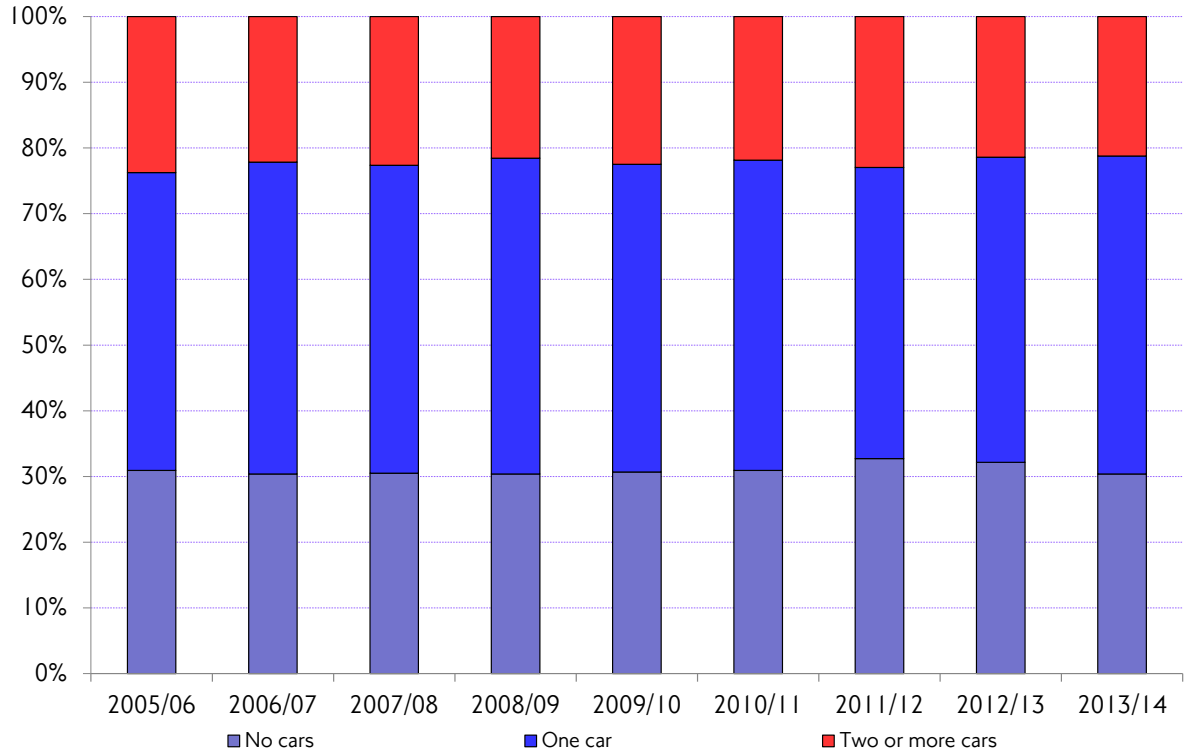


Source: TfL Planning, Strategic Analysis.

Car ownership is higher in outer London compared to inner London, although it has not changed substantially since 2005/06 (figure 2.29). Approximately 30 per cent of outer London households do not have access to a car, compared to 55 per cent of inner London households. Fifty per cent of outer London households have access to one car and 20 per cent have access to two or more cars. The number of households who have access to two or more cars has declined by 11 per cent since 2005/06. The number of households who have access to one car has increased by 7 per cent and the number of households who do not have access to a car has decreased by 2 per cent. Again there is a slight suggestion from the graphic that the proportion of multi-car households has reduced over more recent years, and some evidence of a slight increase in the proportion of non-car households between 2011/12 and 2013/14.

Household car availability data from the National Travel Survey (NTS) for England in 2013 shows that nationally, 25 per cent of households do not have access to a car, 43 per cent have access to one car and 32 per cent have access to two or more cars [4]. This shows that inner London has much lower levels of car availability than the national average. Outer London is more in line with national levels of car availability; however, it has a slightly higher percentage of households without access to a car and fewer households with access to two or more cars.

Figure 2.29 Household car ownership among outer London residents.



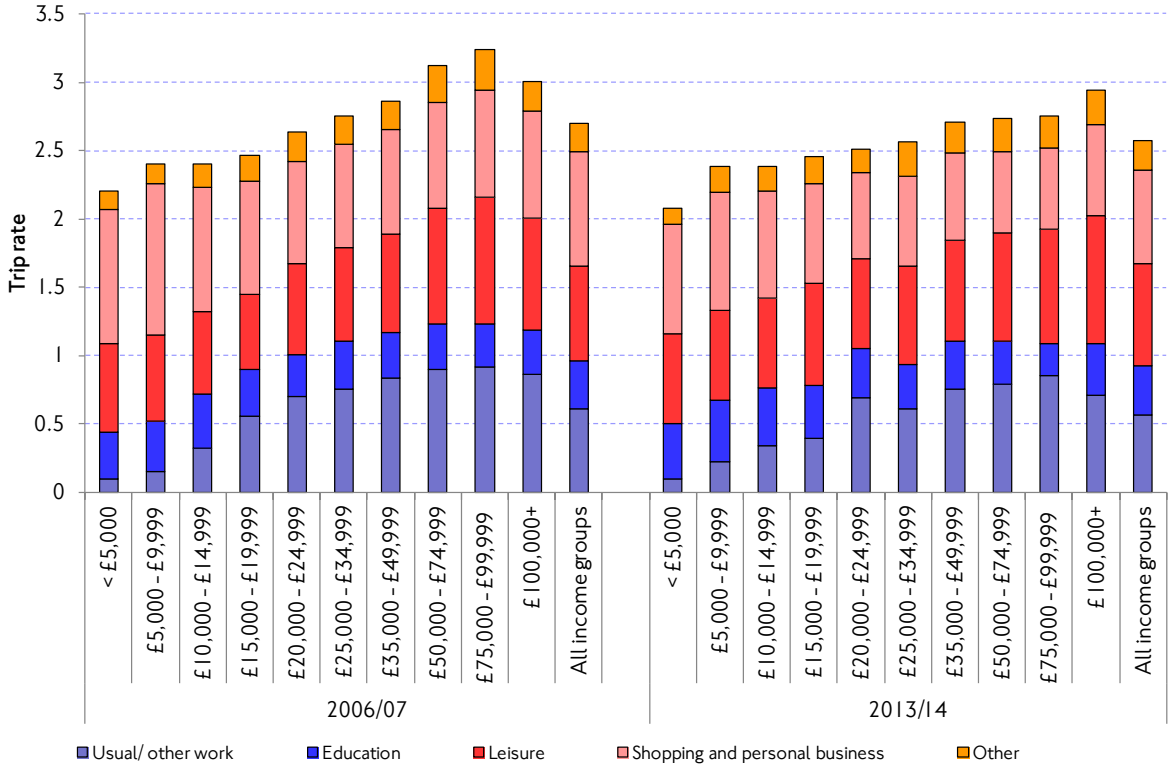
Source: TfL Planning, Strategic Analysis.

Travel and household income

Figure 2.30 shows that the journey purpose split does not vary significantly according to household income, however the overall trip rate does increase gradually as household income increases. This is partly caused by the increase in work trips made by individuals in households with higher incomes. Also worth noting is the increase in leisure trips as household income increases – most likely explained by a higher disposable income available to spend on leisure. In households with lower incomes, a higher proportion may be spent on essential goods and trips rather than leisure trips.

The number of education, shopping and other trips do not show a relationship to household income. It is also clear that trip rates are lower in 2013/14 across all income groups compared with 2006/07, particularly for individuals in higher income households. However, this is primarily a difference between the two years considered – trip rates tend to be more stable over the longer term (see figure 2.23 above).

Figure 2.30 Trip rates per person by household income and main purpose. 2006/07 and 2013/14.



Source: TfL Planning Strategic Analysis.

2.13 Focus on changing travel: 'Generational' changes in travel behaviour among London residents

Scope

In 2014, TfL published a paper entitled 'Long-term trends in travel behaviour: Cross-sectional cohort analysis of London residents' trip rates, car ownership and work-related travel', forming one of a series of Travel in London Supplementary Reports that explore the drivers of demand for travel in London [5]. This section looks at selected findings from this analysis.

Drawing on data from three large-scale surveys of personal travel in London, spanning the period 1991-2011, the paper identifies and considers longer-term trends in travel behaviour that have occurred in London. It includes analysis of changes in trip rates by mode, car ownership, driving licence holding and work-related travel and focuses on the following two themes:

- The ways in which travel behaviour has changed between **age groups** over time, for example changes between 20-29 year olds in 2001 and 20-29 year olds in 2011.
- The ways in which travel behaviour has changed within **cross-sectional cohorts** over time, for example people who were aged 20-29 in 1991 will have been 30-39 in 2001 and 40-49 in 2011, so it is possible to see the way in which travel behaviour changes over the course of a lifetime among people (equivalent cohorts) of these age groups.

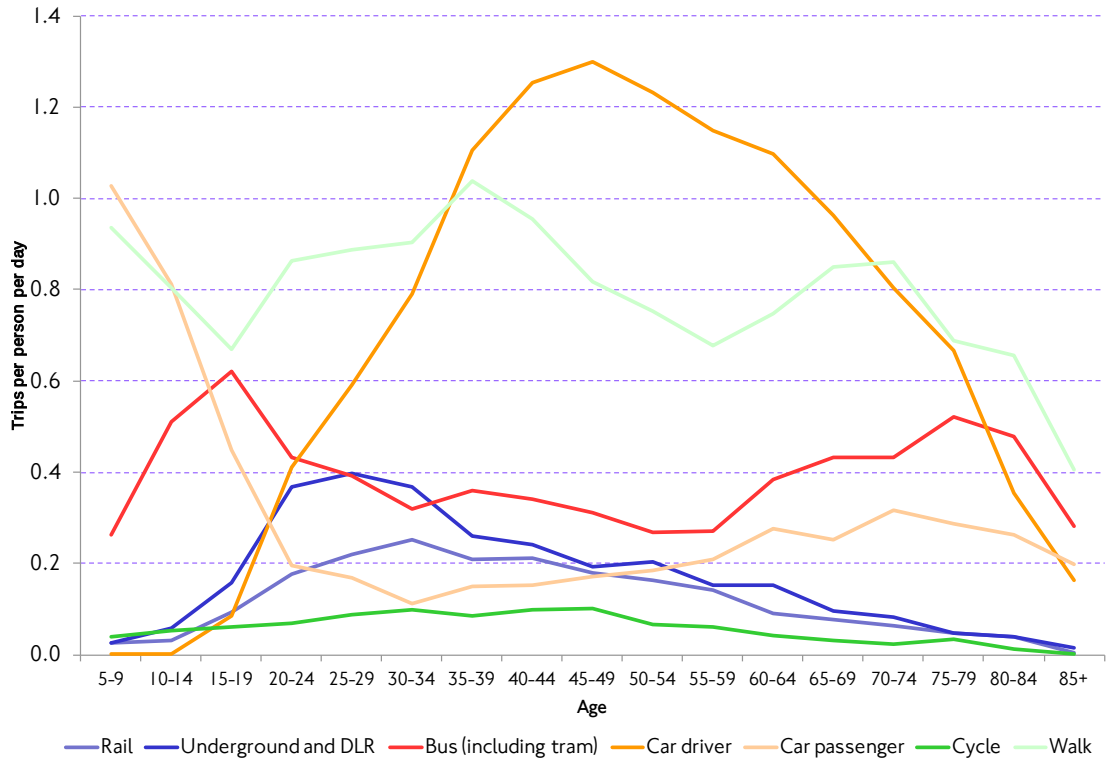
Changes in trip rates – all modes

One notable change that occurred between 2001 and 2011 was a change in the pattern of trip rates by age, these differing for each mode.

Figure 2.31 shows London residents' trip rates (average day, seven-day week) by age, for each of the principal modes, for 2011 (only). All modes show a strong relationship between age and trip rates; for car driver trip rates, this represents the form of an inverted U-shaped curve, peaking in the 45-49 age group. Bus trip rates are highest among teenagers and people of retirement age, while rail-based trip rates peak for young adults in their late 20s and early 30s before a steady decline.

By looking at each mode individually across each of the three cross-sections it is possible to draw out more detail of these aggregate patterns and begin to explain the reasons behind them.

Figure 2.31 London residents' trip rates (average day, seven-day week) by mode and age, 2011.



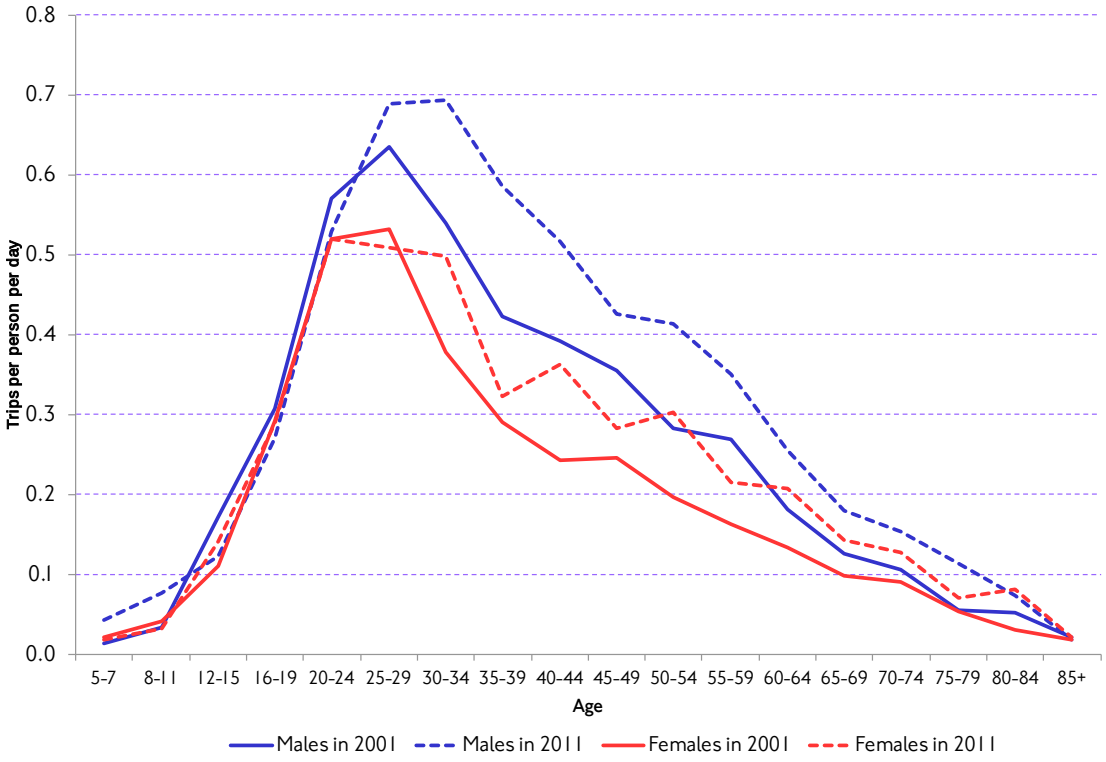
Source: TfL Planning, Strategic Analysis.

Rail: Trip rates

Figure 2.32 shows rail-based trip rates for an average weekday by age and gender, comparing 2001 and 2011. The 'rail-based' modes in figure 2.32 comprise of National Rail, the Underground and DLR. Both genders show an inverse U-shaped relationship between age and rail-based trip rates, with a peak among younger adults. Men and women have both shown sharp increases in trip rates between 2001 and 2011 but with slightly different peak age groups and patterns: in 2001, 25-

29 represented the peak age group among both men and women. By 2011, this had moved forward to the 20-24 age group for women and lagged to the 30-34 age group for men.

Figure 2.32 Rail-based trip rates (average weekday) for London residents, by age and gender, for the years 2001 and 2011.



Source: TfL Planning Strategic Analysis.

It is possible to look into the changes that have occurred over time in more detail by applying cross-sectional 'cohort analysis'.

Figure 2.33 shows how changes in behaviour of specific cross-sectional cohort groups contribute to these overall changes in age-related behaviour for National Rail (excluding the Underground and the DLR). Each figure takes eight 10-year age bands, 10 years apart, and traces their behaviour (in terms of trip rates) as they age over a 20-year period, from 1991 to 2011.

This means that each line on figure 2.33 represents the same cross-sectional cohort as they age, and each data point represents the behaviour of an age group at a given time. For example, people who were aged 20-29 in 1991 will have been 30-39 in 2001 and 40-49 in 2011, so it is possible to see both the way in which travel behaviour changes over the course of a lifetime, as well as whether the travel behaviour of people in a given age group, for example 20-29, has changed between the years 1991, 2001 and 2011.

National Rail: Age groups

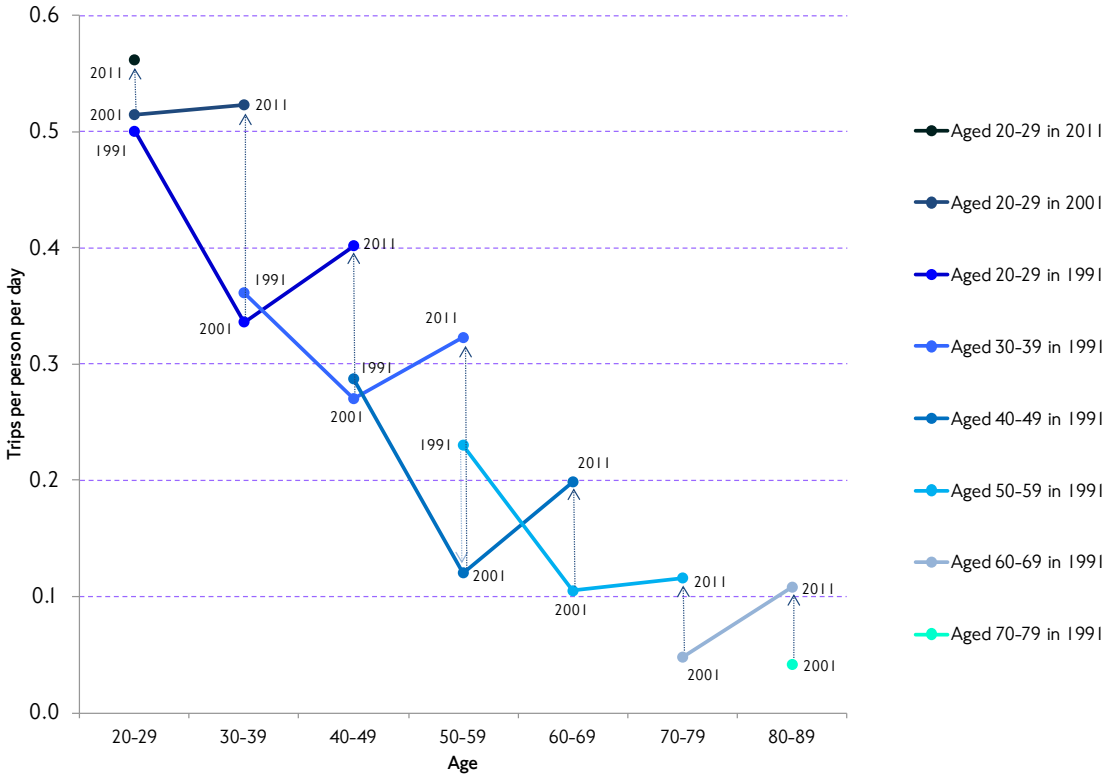
Figure 2.33 shows that all age groups had a higher National Rail trip rate in 2011 than either 1991 or 2001; however, while National Rail trip rates increased between

1991 and 2001 for the 20-29 age groups, they decreased for people aged 30-39, 40-49 and 50-59.

National Rail: Cross-sectional cohorts

Figure 2.33 shows that, for all cross-sectional cohorts that include three data points, National Rail trip rates decreased between 1991 and 2001 and increased between 2001 and 2011. No cohort shows a higher National Rail trip rate in 2011 than in 1991, however, while people aged 20-29 and 30-39 and 40-49 in 1991 show substantial increases in National Rail trip rates between 2001 and 2011, people aged 50-59 in 1991 show only a modest increase between 2001 and 2011 – this reflects the fact that older people have less propensity to travel by National Rail.

Figure 2.33 National Rail trip rates (average weekday) for London residents, by cross-sectional cohort, for the years 1991, 2001 and 2011.

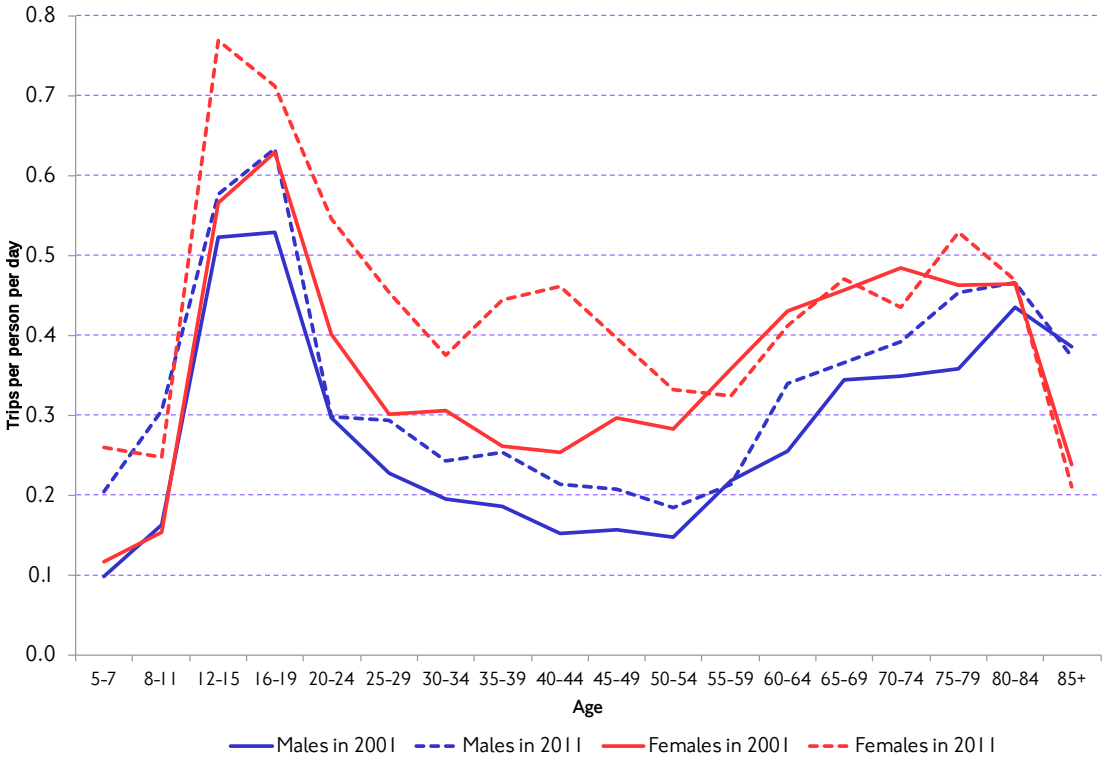


Source: TfL Planning Strategic Analysis.

Bus: Trip rates

Figure 2.34 shows bus trip rates for an average weekday by age and gender, comparing 2001 and 2011. The figure shows that teenage children and young adults as well as people of retired age generally show higher bus trip rates than those aged between 30 and 60. Bus trip rates increased significantly for both men and women between 2001 and 2011, while women had a higher bus trip rate than men in both years. Generally women are more likely to use buses than men, unlike rail-based modes, as described previously.

Figure 2.34 Bus trip rates (average weekday) for London residents, by age and gender, for the years 2001 and 2011.



Source: TfL Planning Strategic Analysis.

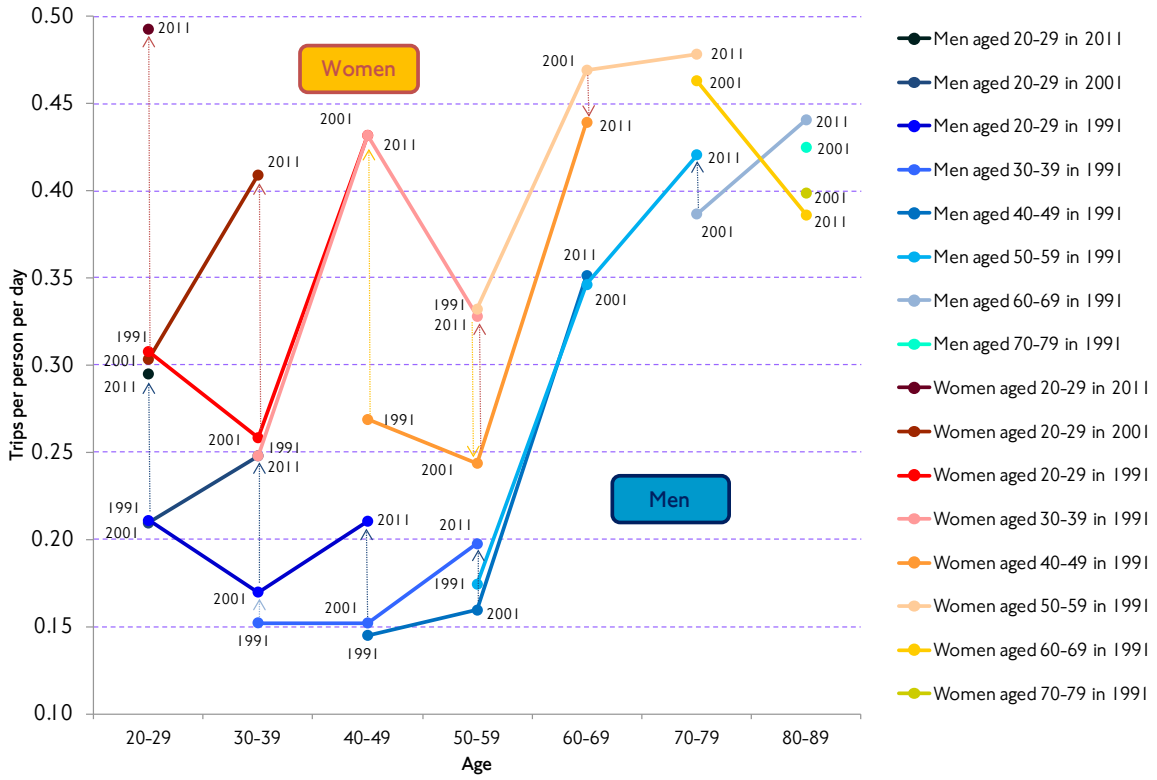
Bus: Age groups

Figure 2.35 shows changes in bus trip rates by men and women as they get older, for the years 1991, 2001 and 2011. For men, the largest increases within age groups occurred within the 20-29, 30-39 and 40-49 age groups, while for women the greatest increases in bus trip rates between 2001 and 2011 were among within the 20-29 and 30-39 age groups, while the 50-59 age groups showed a decrease in bus trip rate between 1991 and 2001, followed by an increase up to 2011.

Bus: Cross-sectional cohorts

For men, every cross-sectional cohort had a higher bus trip rate in 2011 than in 1991, although there was only a marginal increase for men aged 20-29 in 1991, with this cohort also showing a dip in 2001. Figure 2.35 shows that bus trip rates for men increase dramatically for all cohorts once they reach their 60s, reflecting concessionary travel benefits such as the Freedom Pass. For women, every cross-sectional cohort had a higher bus trip rate in 2011 than in 1991, although women aged 70-79 in 2001 showed a decreased trip rate by 2011.

Figure 2.35 Bus trip rates (average weekday) for London residents, by cross-sectional cohort and gender, for the years 1991, 2001 and 2011.

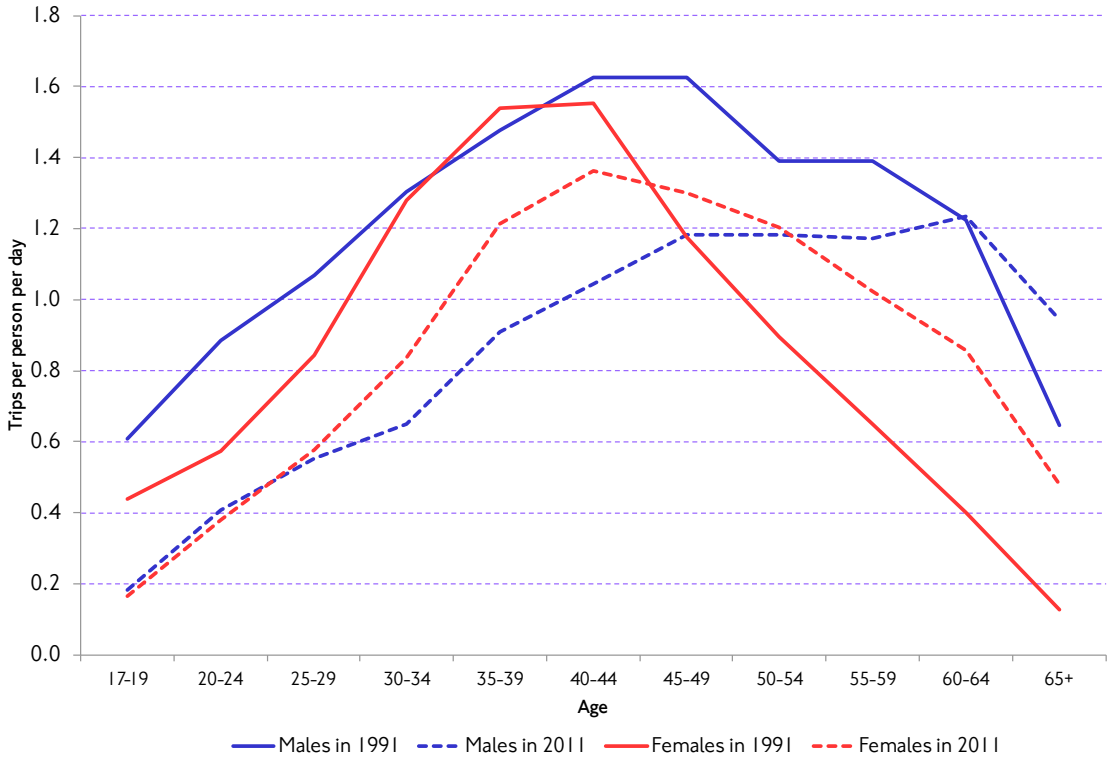


Source: TfL Planning Strategic Analysis.

Car driver: Trip rates

Figure 2.36 shows car driver trip rates for an average weekday by age and gender, comparing 1991 and 2011. The relationship between age and car driver trip rates takes the form of an inverted U-shaped curve for both men and women. In 1991, both genders show peak car driver trip rates in their 40s, which is also the case for women in 2011. However in 2011, car driver trip rates for men peak at 60-64. The figure demonstrates a general lag effect, where the highest car driver trip rates are drifting towards older age groups.

Figure 2.36 Car driver trip rates (average weekday) for London residents, by age and gender, for the years 1991 and 2011.



Source: TfL Planning Strategic Analysis.

Car driver: Age groups

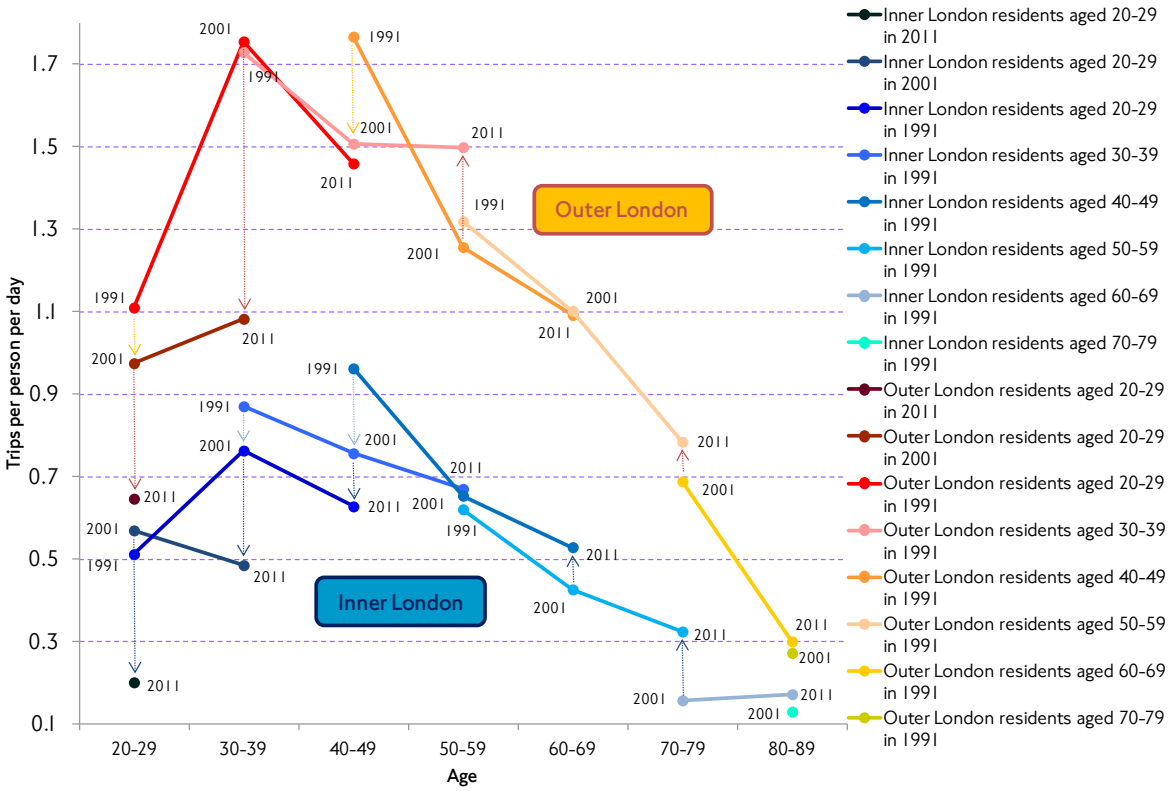
Figure 2.37 looks at these differences in more detail, displaying changes in car driver trip rates for residents of inner and outer London by age. For inner London residents, car driver trip rates decreased for the 20-29, 30-39 and 40-49 age groups between 1991 and 2011, while for those in older age groups (50+), trip rates increased.

The general pattern for outer London residents in figure 2.37 is similar, albeit with substantially higher car driver trip rates for all ages. Again, car driver trip rates for people in their 20s, 30s and 40s decreased between 1991 and 2001, while there was an increase for the 50-59 age groups and the 70-79 age groups, between 2001 and 2011.

Car driver: Cross-sectional cohorts

Cohorts aged 30-39, 40-49 and 50-59 in 1991 proceeded to show reductions in car trip rates through 2001 and 2011. The only cohort to show a substantial increase between 1991 and 2011 were those aged 20-29 in 1991, though this includes a decrease between 2001 and 2011, and this would not be unexpected given the increase in road traffic through the 1990s.

Figure 2.37 Car driver trip rates (average weekday) for London residents, by cross-sectional cohort and inner/outer London, for the years 1991, 2001 and 2011.

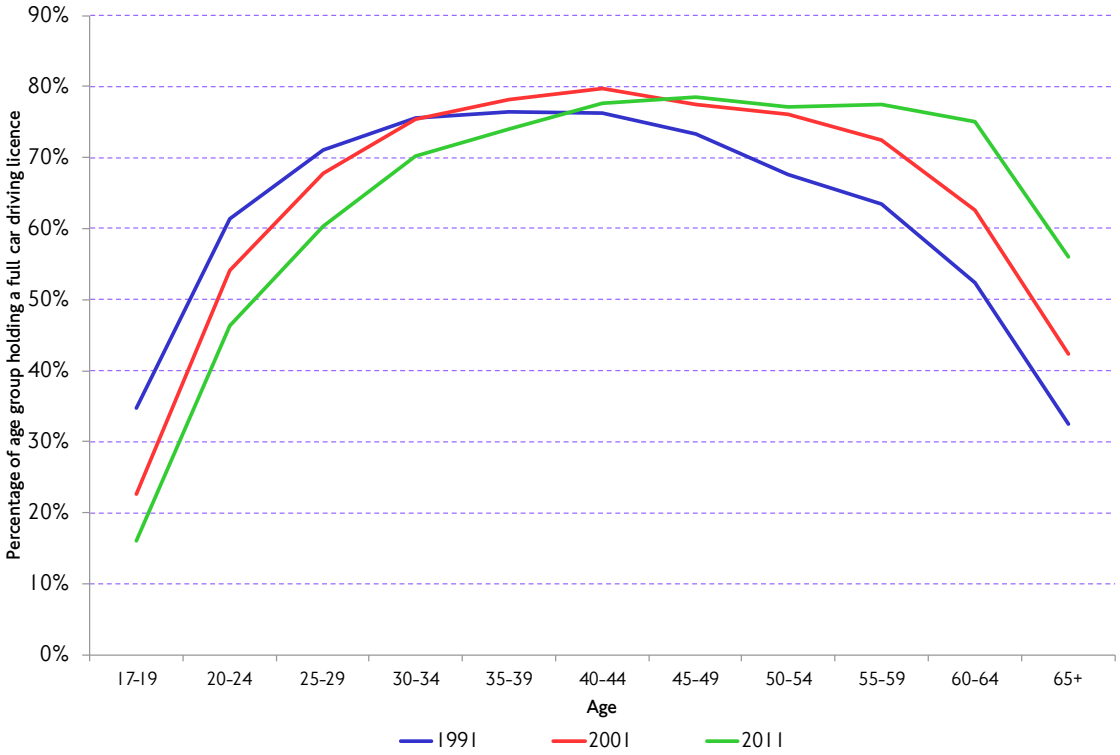


Source: TfL Planning Strategic Analysis.

Changes to driving licence holding

The report also considers changes in driving licence holding. Figure 2.38 illustrates trends in full car driving licence holding by age, for the years 1991, 2001 and 2011. It shows that the peak age for ownership is drifting to the right, as younger people in previous generations have retained their licence as they age, but current young people in their late teens and 20s are less likely to hold a driving licence than their predecessors.

Figure 2.38 Percentage of London residents with full car driving licences, for the years 1991, 2001 and 2011.



Source: TfL Planning Strategic Analysis.

Looking forward

The trends identified in 'Long-term trends in travel behaviour' have a strong relationship to transport policy; it is likely that a detailed understanding of the way in which people change their travel patterns across generations and within their own generation over time will provide a useful tool to consider future demand of the transport system, and help to better assess where investments should be focussed.

For example, is car ownership and driving licence holding among younger people simply being delayed, reflecting contemporary economic and social circumstances, with a convergence towards rates of their older peers to be expected as they age, or are they likely to retain this behaviour into older life? This phenomenon has become known in the literature as 'behavioural memory', and better understanding this in the London context will be a focus for TfL going forward. Ultimately, what the (younger) people do next, and identifying the opportunities to influence their decisions, will be a major factor influencing travel demand patterns in London in future years.

References

(1) Travel in London report 5. http://www.tfl.gov.uk/cdn/static/cms/documents/travel-in-london-report-5.pdf. See section 2.3, pages 19-20.

(2) Travel in London report 5. http://www.tfl.gov.uk/cdn/static/cms/documents/travel-in-london-report-5.pdf. See section 2.4, page 20.

(3) Census workplace data. See

2011 Census, Origin-destination Statistics on Migration, Workplace and Students for Local Authorities in the United Kingdom - ONS

(4) National Travel Survey.
See https://www.gov.uk/government/collections/national-travel-survey-statistics.

(5) Long-term trends in travel behaviour: Cross-sectional cohort analysis of London residents' trip rates, car ownership and work-related travel.

https://www.tfl.gov.uk/cdn/static/cms/documents/long-term-trends-in-travel-behaviour-cross-sectional-cohort-analysis.pdf

3. Travel trends by mode

3.1 Introduction and contents

Chapter 2 of this report looked at trends in aggregate travel demand and mode shares in London, and considered some of the factors underlying recent changing travel patterns. This chapter looks more specifically at travel demand trends as they have affected each of the principal modes of transport. Chapter 4 of this report then looks at corresponding trends in service supply and operational performance for each of these modes. This chapter covers trends updated to the 2013 calendar year or the 2013/14 financial year, with consideration given to more recent data where this is of particular interest.

The chapter works systematically through each of the main modes of transport in London, with six focus topics this year looking at: The 'Year of the Bus' (2014), reviewing the history and contemporary role of buses in London; reviewing and disaggregating the principal factors underlying the growth in bus demand in London over the last 15 years; reviewing the development of the Night Tube proposal; giving TfL's interpretation of recent trends in road traffic volumes in London, looking at TfL's emerging proposals to monitor the impacts of the Mayor's Vision for Cycling in London and, finally, exploring the potential role of car clubs in London.

3.2 Key modal trends (demand)

- On the **Underground**, patronage grew once again, although at a somewhat slower level than in recent years, with 3.2 per cent more passenger kilometres travelled and 2.9 per cent more journey stages compared with 2012/13 – following growth around the 5 per cent mark for each of the three immediately-preceding years. The annual total of 1,265 million journeys for the year was the highest ever recorded on the Underground. It is particularly noteworthy that this exceeded even the levels of patronage seen during the 2012/13 Games year, highlighting the very strong rate of growth in overall demand for travel by Tube, accompanied by increased service levels.
- **Bus patronage** also grew, with 2,382 million bus journey stages made in 2013/14, 3.1 per cent more than 2012/13. Over the past five years the historic high rates of growth in bus travel have tended to level off, this also reflecting a period of relatively slow growth in bus service provision, although reliability of the network remains at best-ever levels.
- On the TfL rail modes 2013/14 was marked by continued growth. On the **Docklands Light Railway** there was an increase of 1.1 per cent in journey stages and 5.3 per cent in kilometres travelled over the previous year, a relatively more modest rate of growth in journey stages following double-digit levels seen during the Games year, and also indicating a general increase in average trip length. **London Overground** continued the pattern of strong growth seen since the establishment of the network in 2007. Despite no significant extensions to the network this year, there was an 8.9 per cent increase in journey stages. Meanwhile, **Tramlink** saw its strongest growth since 2007/08, with 3.8 per cent more journey stages than 2012/13.
- Patronage of **National Rail** services serving London (London and South East Operators) continued to grow strongly, with a 7.2 per cent increase in journey

stages compared to 2012/13. Journeys on National Rail totalled 1,107.1 million in 2013/14, an increase of 31.5 per cent on the recessionary dip of 2009/10.

- Levels of **Road traffic** in London continued to fall in 2013, with 0.3 per cent fewer motor vehicle kilometres in 2013 compared with 2012 at the Greater London level. However, this rate of annual decline was slower than has been typical of the last decade, continuing an apparent slowdown in the established rate of decline first observed in 2011. Latest information suggests that this turnaround has continued in 2014, with absolute increases in the volumes of traffic observed in all parts of London in the first half of the year. While occurring against the backdrop of continued recovery from the recession and strong annual population growth, the future implications of such a trend – if it proves to be sustained – are significant.
- **Cycling** levels continued to increase in 2013, with cycle journey stages 0.5 per cent higher than in 2012, which itself was an exceptional year with the London 2012 Games. On the Transport for London Road Network (TLRN), cycling grew by 176 per cent between 2000/01 and 2012/13, with a further growth of 7 per cent between 2012/13 and 2013/14 (financial year).

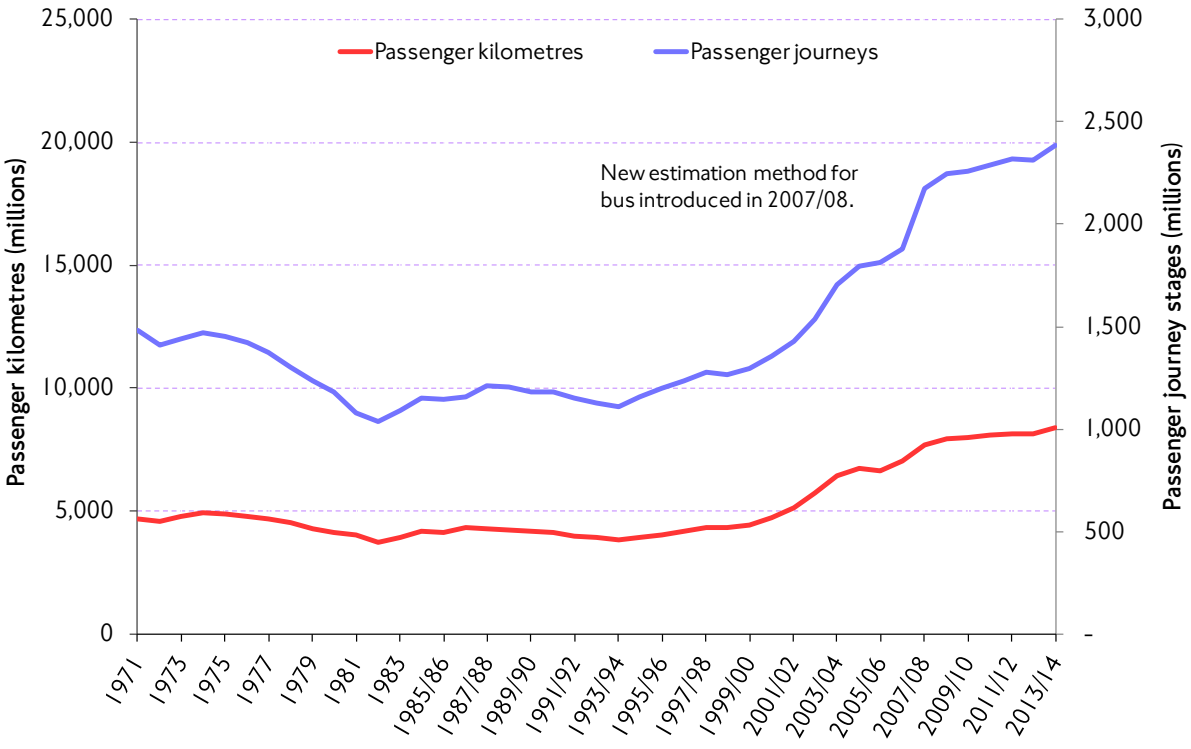
3.3 Modal trends - bus

Figure 3.1 shows the long-term trend for bus patronage in London. The bus has been one of London's transport success stories, with the historic pattern of slowly declining patronage being dramatically reversed in the late 1990s to one of strong growth. Over the 13 years from 2000/01 to 2013/14, the number of bus journey stages in London increased by 59.9 per cent, and passenger-kilometres grew by 73.8 per cent.

The rate of growth has levelled out in more recent years; corresponding to a slowing of the rate of increase in bus service provision. The factors contributing to the growth in bus demand in London over the last 15 years are considered in more detail in section 3.5 below.

For the most recent year, bus journey stages increased by 3.1 per cent to 2,382 million. Passenger kilometres also increased by just over 3 per cent, increasing to 8,411 million in the latest year.

Figure 3.1 Passenger kilometres and journey stages travelled by bus.



Source: TfL Service Performance data.

3.4 Focus: 'The Year of the Bus' – the history and contemporary role of the bus in London's transport system

During 2014, TfL celebrated the 'Year of the Bus', this marking a number of significant milestones for buses in London. In 1914, the B-type bus carried troops to the front line at the start of the First World War; 75 years ago the first RT-type bus was launched, and in 1954 the Routemaster was unveiled for the first time.

London's buses in numbers.

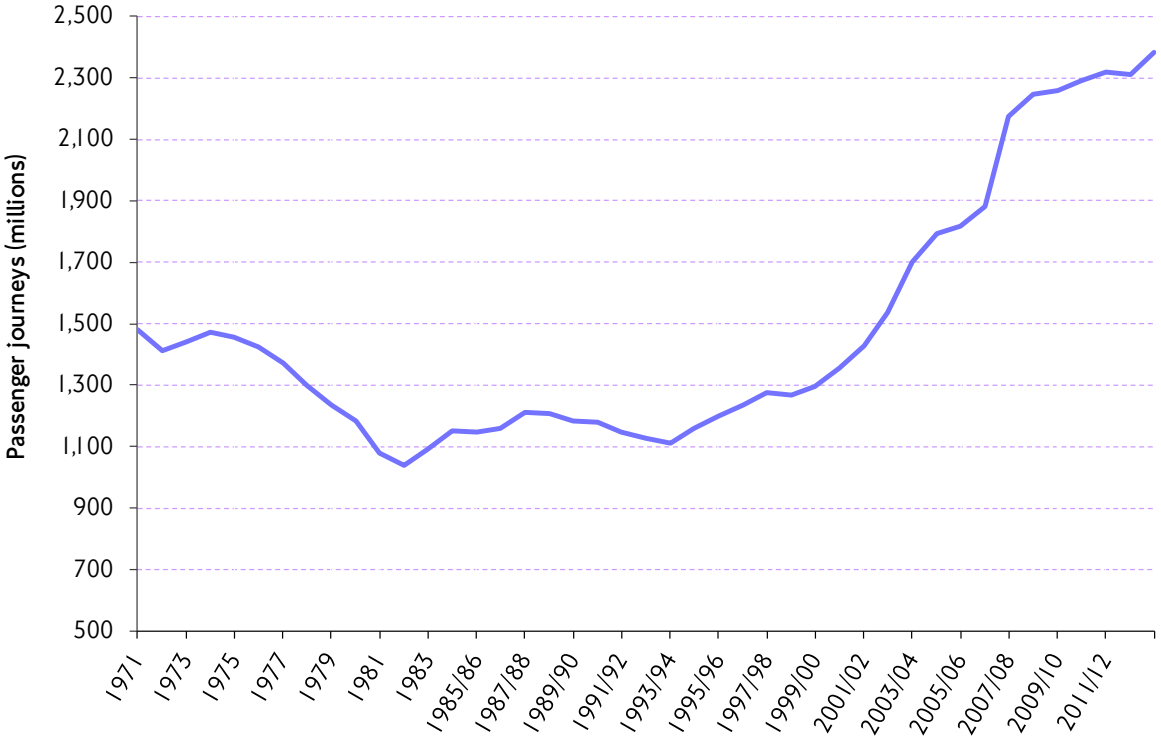
- Each year, 491 million bus kilometres are operated in London, the equivalent of 621 return trips to the moon.
- There are almost 700 bus routes in London, with the number 25 the most used route - carrying around 64,000 passengers per day.
- London's buses carry 2.4 billion passengers per year, the equivalent of a third of the world's population.
- There are 8,700 buses operating in the Capital, with 19 heritage Routemasters still operating along routes 9 and 15.
- 96 per cent of households in London are within 400 metres of a bus stop.
- The busiest bus station in London is at Victoria, while Tenison Way at Waterloo is the busiest single stop.
- Half of all bus journeys in England take place in London.

Figure 3.2 B-type bus, used to take troops to the front line in the First World War.

London's bus network first began in 1829 when George Shillibeer started operating his horse-drawn omnibus service between Paddington and the City. In 2013/14, 185 years later, the network carried more passengers than in any year since 1963, with almost 2.4 billion journeys made. Half of all bus journeys in England take place in London, with the Capital's buses travelling 491 million kilometres in passenger service in 2013/14. Network coverage is increasing, with (in 2014) 96 per cent of households in London within a 400 metre walk of a bus stop.

Between 1999/00 and 2013/14, bus ridership grew by 69 per cent (figure 3.3), with further growth of around 6 per cent expected by 2020/21. During the 1980s and early 1990s, bus patronage had fallen to around 1.1 billion journeys per year. Strong growth in the early part of the last decade saw bus journeys increase to more than two billion per year in 2007/08, and despite the economic recession, bus use has continued to grow. Tuesday 29th April 2014 saw a record 7,961 buses operating on London's roads, the highest number since 1953 (figure 3.3).

Figure 3.3 Growth in bus passenger journeys, 1971 to 2013/14.



Source: TfL Service Performance data.

The London Assembly Transport Committee's report 'Bus Services in London' [1] recognised that the Capital's bus network is 'world class', and is ranked top for size, frequency, reliability and accessibility when compared to other world cities such as New York and Paris. To continue to improve the network, TfL have committed to:

- Increase capacity on the bus network to ensure it keeps pace with expected growth in demand.
- Introduce a new approach to engagement to capture the views of stakeholders and passengers on changes to bus services.
- Work more closely with the London boroughs to increase bus priority on borough roads.
- Publish annually the number of passenger journeys and bus kilometres operated on each of nearly 700 bus routes.

'Year of the Bus' events

A number of events have taken place throughout 2014 to celebrate the vital role that buses play in keeping the Capital moving. These have included:

- Heritage buses on route 22 between Piccadilly and Homerton, and on route 11, to celebrate the 75th anniversary of the RT-type bus.
- Open days at a number of bus garages across London, including Catford, Alperton, Stockwell and Fulwell.
- The first ever photographic exhibition on the roofs of bus stop shelters in London by Juergen Teller along the Strand, featuring well-known faces such as Kate Moss, Björk and Dame Vivienne Westwood (aimed at top-deck travellers).

- A number of bus sculpture trails have brought businesses and artists together to create a series of free and accessible sculpture trails across London's streets, parks and public spaces.
- A bus cavalcade on Regent Street showcasing how London's buses have evolved since 1829.

Figure 3.4 'Year of the Bus' branded bus stop.

Technology improvements

A number of technological improvements have been made in recent years, to try to make catching a bus in London even easier. The Oyster card system was launched in 2003, letting customers store cash and season tickets on their cards, with more than 90 per cent of bus journeys in London paid for using an Oyster card in 2013/14.

Information on bus arrival times is also important for passengers, and TfL's Countdown is the largest real-time bus arrival information system in the world. An improved Countdown system was launched three years ago, with 2,500 new on-street LED Countdown signs at key bus stops, as well as online access. Passengers that access Countdown information account for over 13 per cent of all weekday journeys. Customers can also subscribe to the bus alert Twitter service to find out if there are any incidents causing delays on the network.

Another important innovation has been the introduction of iBus, which uses enhanced GPS technology to pinpoint the precise location of every bus in London. The on-board visual displays and audio announcements mean that passengers now know exactly where their bus is, where it will stop next, and where it will terminate.

Selective Vehicle Detection by GPS is also being used to prioritise the buses through approximately 6,000 sets of traffic signals.

Cash-free buses and 'one more journey'

From Sunday 6th July 2014, cash fares were no longer accepted on London's buses, following a considerable drop in the number of people paying their bus fare in cash. In 2000, around 25 per cent of journeys were paid for with a cash fare – the figure had dropped to just one per cent by 2014. Accepting cash on London's buses costs around £24m annually, so removing cash fares is expected to generate savings of around £130m to 2022/23, which will be reinvested in the transport network.

Since December 2012, contactless payment cards have been accepted on London's buses, with just over 20 million journeys made by mid-September (when contactless payment was accepted on all public transport modes) using this form of payment, accounting for more than one per cent of all bus journeys.

To ensure a smooth and trouble-free transition, a number of initiatives were put in place by TfL, including:

- Increasing the number of Oyster Ticket Stop locations, particularly in Outer London.
- Refreshing guidance on how to engage with vulnerable passengers regarding ticketing.
- Launching a major public information campaign.
- Introducing a new 'One More Journey' (OMJ) feature on Oyster, allowing passengers with a positive credit, but not enough credit for a bus fare, to make one more bus journey.

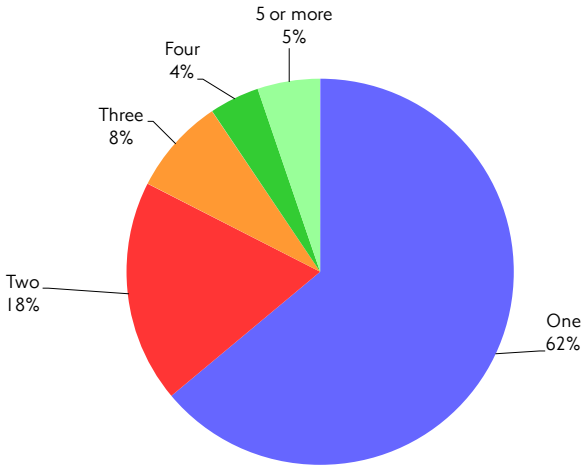
The OMJ facility went live across the bus network on June 8th 2014 after a successful trial period on 500 buses. In the first six weeks of operation, almost two million OMJs were made, accounting for around 0.7 per cent of all relevant Oyster journeys, averaging around 48,000 per day. Detailed analysis of the first six weeks of operation suggest that 89 per cent of Oyster cards making an OMJ were subsequently topped up, with 6 per cent not yet seen again and 5 per cent not topped up and having subsequent 'bad' taps.

Out of all Oyster cards that have used the OMJ facility, 62 per cent have only used OMJ once, 18 per cent twice and 17 per cent three or more times (figure 3.5). This confirms the expectation that OMJ is primarily being used by passengers as an emergency measure.

In conclusion, the transition to cash-free operation has been relatively smooth, due to mitigation measures such as 'One More Journey', the extensive public information campaign and work by operators to ensure drivers and other staff are fully aware of the changes.

A small number of complaints have been received, with the main issues being: passengers travelling late at night and unable to find an outlet to top-up; visitors to London who are unaware of the change in policy; and family groups who have access to a contactless payment card, which can't be used to pay for more than one journey. Particular areas of London have also been identified, such as Heathrow, Euston and other mainline termini, where there are higher proportions of passengers without access to either Oyster or contactless payment cards.

Figure 3.5 Frequency of OMJ use.



Source: TfL Oyster data

London's bus network post-2014

London's bus network will continue to be a very important part of London's transport network, with passenger journeys expected to grow by a further 6 per cent up to 2020/21. Buses in London already carry almost twice as many passengers per year as the London Underground, with further advances in technology and ticketing helping to make travel by bus even easier.

3.5 Focus: Resurgence of the bus - what has driven the recent strong rise in bus demand?

Scope

This section reviews and quantifes the factors underlying the growth in bus travel in London over the past 15 years – a time which has seen a reversal of the long-term decline in bus use dating from the 1950s. It concludes that the principal factors underlying this growth have been economic and population growth combined with a sharp rise in the supply and quality of bus services in London. Fares and ticketing changes, and an element of mode shift from the Underground, have been secondary contributing factors.

Long-term trend in bus use in London

People in London make almost 2.4 billion bus journeys a year – more than are made in the whole of the rest of England. Bus demand in London is approaching the previous highs of the late 1950s. Crucial to this resurgence in bus travel has been a 77 per cent increase in patronage over the last 16 years, largely coinciding with the period of TfL's existence.

In the early 1950s, bus demand stood at about three billion journeys per year – around eight million journeys per day. Bus use then suffered a long term decline to the mid 1980s, reflecting increasing economic prosperity and the rise of car ownership. Another important factor is that London's population contracted over

the same period. Within this picture of overall decline to the mid 1980s, there were short periods when bus use increased. These coincided with global economic events such as the recessions of both the mid 1950s and early 1980s, and the OPEC oil embargo related recession of the early 1970s (figure 3.6).

Figure 3.6 Long term trend in bus demand – showing recent resurgence.

Source: TfL Service Performance Data.

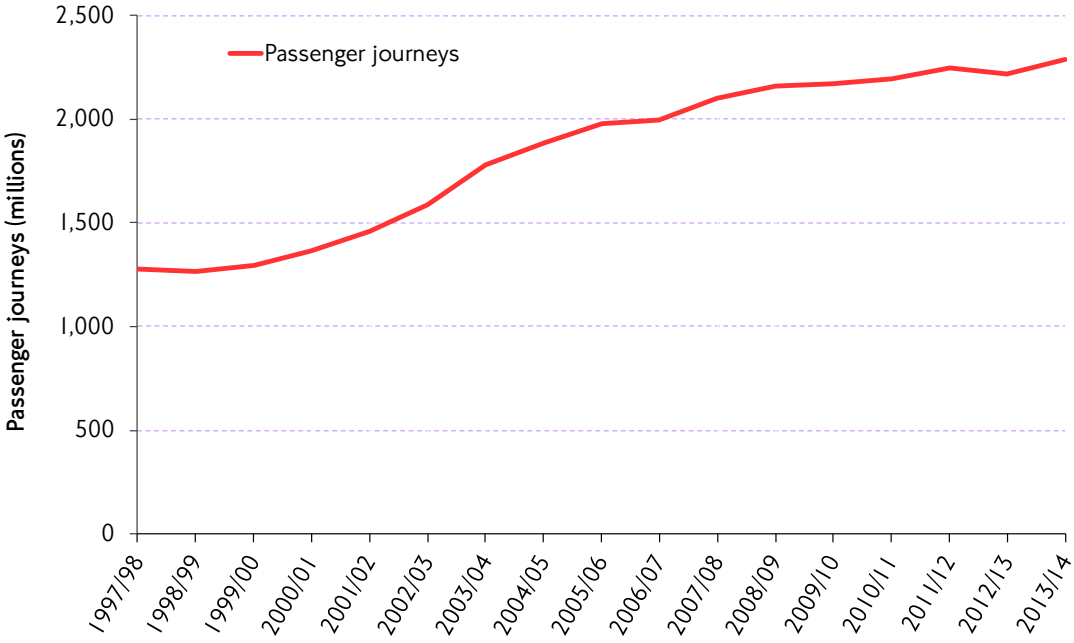
Analytical goals and approach

The specific objective of this analysis is to explore the relationships between bus travel demand and the various potential causal factors and to attribute historical growth in bus travel demand to the identified causal factors. The method is based on demand elasticities derived from well-founded empirical econometric research. The analysis uses elasticity-based forecasting techniques to 'back-cast' observed bus journeys against trends in the relevant demand drivers. The analysis not only attempts to disentangle the main drivers, albeit within a limited universe of possible causes considered, but also to quantify their individual impacts.

Bus patronage trend – 1998/99 to 2012/13

This analysis focuses on the 15 year period between 1998/99 and 2012/13, during which time bus journeys in London increased by 77 per cent. There have been many changes to bus fares and ticketing over that time, which have affected how accurately bus journeys have been recorded, but a consistent series has been derived for this entire period (figure 3.7). It includes all patronage, including that reflecting concessionary, staff and child travel.

Figure 3.7 Growth in bus patronage between 1998/99 and 2012/13.



Source: TfL Service Performance Data.

Trend in exogenous demand drivers

Figure 3.8 shows the equivalent trend in the (for this purpose) hypothesised exogenous demand drivers (namely those factors not controlled by TfL) over the same period. Key highlights are:

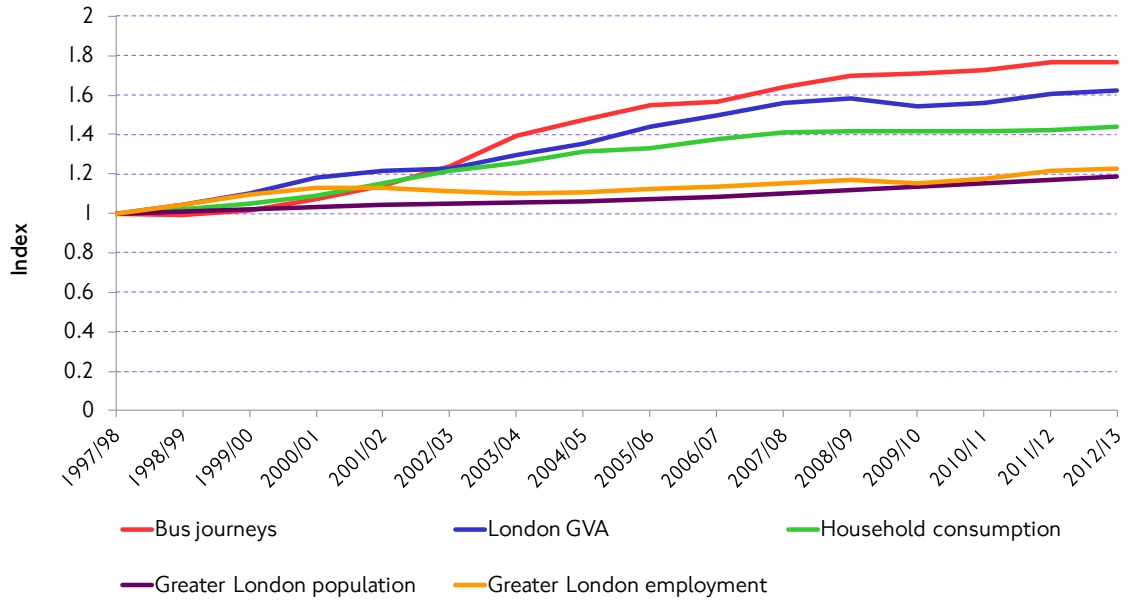
- A 62 per cent overall growth in London's economy, despite two recessions.
- Household consumption, a measure of general prosperity and a strong determinant of off-peak and weekend travel, grew by 44 per cent.
- A 19 per cent growth in London's population in 15 years.
- Over 20 per cent growth in London employment in 15 years.

Trend in endogenous demand drivers

Endogenous factors are those that are, in general terms, controlled by TfL. Figure 3.9 shows the main trends over the 15 year period, which have included:

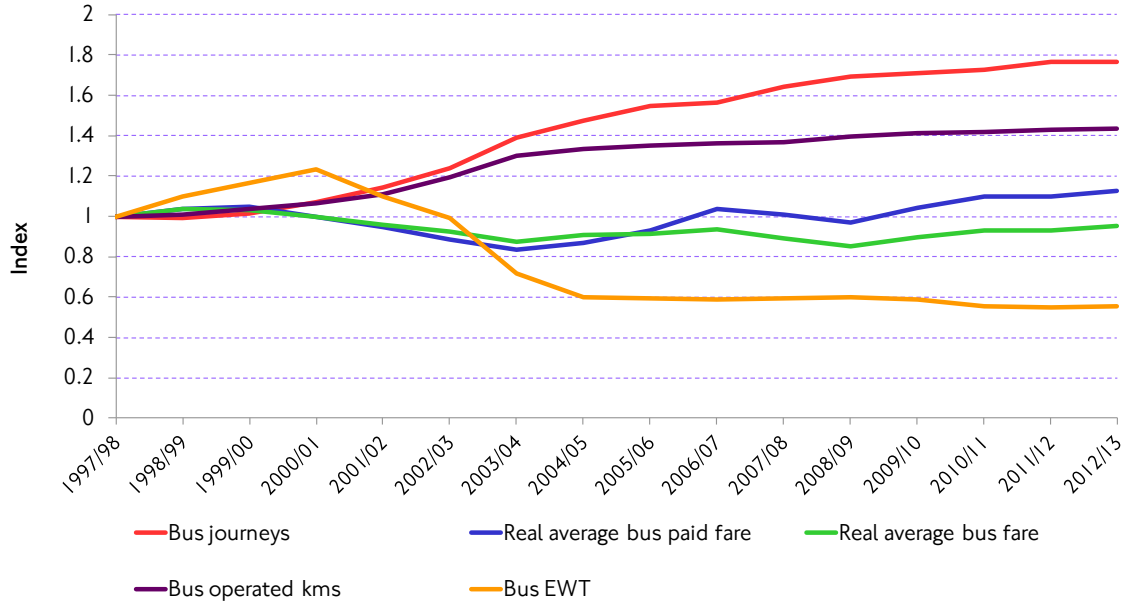
- A 13 per cent rise in real bus fares paid – a real fares increase of less than one per cent per annum. This is the average bus fare paid (by actual fare payers only) deflated by inflation.
- A net reduction of four per cent in the average real bus fare. This is the total bus fare income divided by the total number of journeys, deflated by inflation. This measure therefore includes concessionary journeys.
- A 43 per cent increase in operated bus kilometres. These increased from 340 million to 490 million over this period.
- A 45 per cent reduction in bus excess wait time (EWT). EWT is a key measure of bus service reliability, reflecting the 'excess' time a user has to wait for a bus (that is above schedule) owing to service unreliability. In this regard the positive influence of the introduction of Congestion Charging in central London, the associated bus service improvements and the introduction of Quality Incentive Contracts for bus operators is clearly visible.

Figure 3.8 Trend in exogenous demand drivers for bus travel, 1998/99 and 2012/13.



Source: TfL Revenue Policies, Marketing and Communications.

Figure 3.9 Trend in endogenous demand drivers for bus travel, 1998/99 and 2012/13.

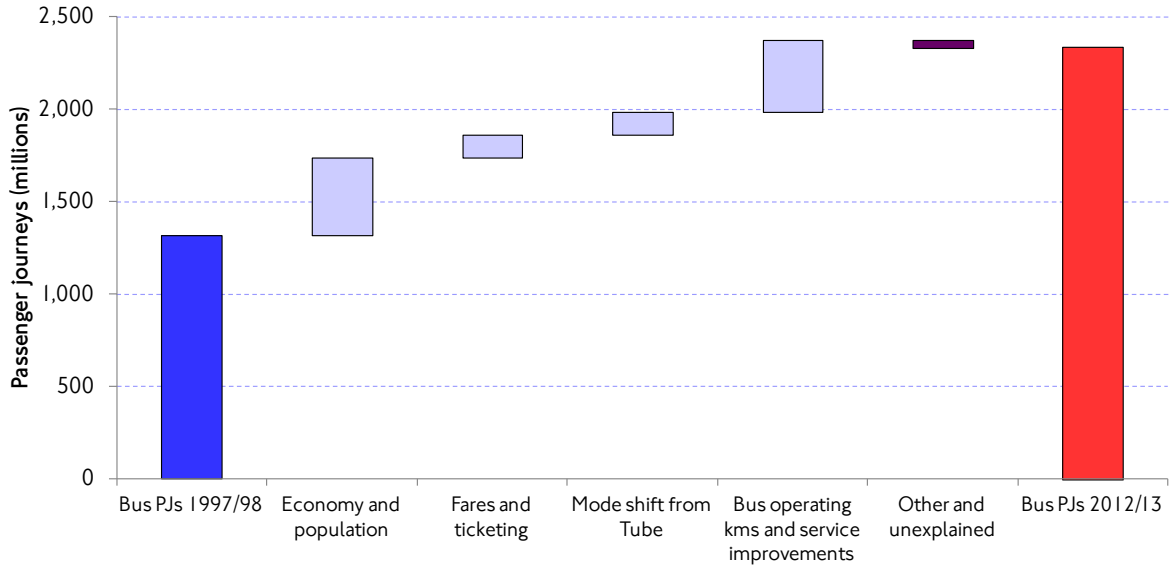


Source: TfL Revenue Policies, Marketing and Communications.

Apportioning the impacts

It is possible to quantify the impact by applying empirically-derived elasticities to historic trends in these key drivers of demand. This quantifies the main factors contributing to the 77 per cent growth in patronage (figure 3.10).

Figure 3.10 Proportional contribution of main drivers of demand to overall 77 per cent growth in bus patronage.



Source: TfL Revenue Policies, Marketing and Communications.

This analysis indicates that:

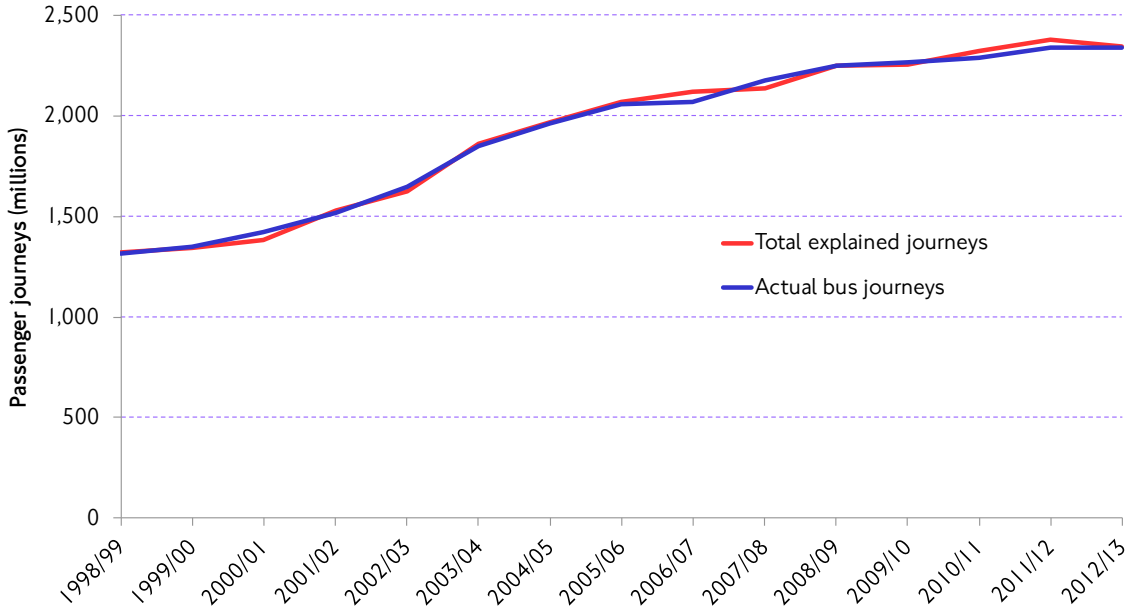
- An estimated 32 per cent of bus passenger demand growth has been driven by population growth, which has grown by nearly a fifth over the period, alongside an estimated 60 per cent growth in the economy.
- Increased bus operated kilometres and improvements in service quality, such as reduced EWT, were responsible for an estimated 30 per cent of the overall 77 per cent growth in demand.
- Fares and ticketing changes contributed 9 per cent (allowing for a 6 per cent reduction in demand from real fare increases) this being mainly due to the introduction of free child travel and Oystercard pay as you go.

Goodness of fit and forecasting accuracy

The degree to which the forecast bus demand trend, using the elasticities to estimate growth (see methodological note below the figure), matched with actual demand is shown by figure 3.11. The goodness of fit is generally very close, with 'residuals' (statistically unexplained portions of the variance) largely within the range +/- two per cent (nine out of the 15 years are within +/- one per cent).

This shows that the analysis approach adopted provides a robust explanation for the growth in bus demand, within the universe of causative variables considered. The applicability of this approach in the future will depend on the extent to which these relationships hold true, given the scale of changes in public transport (non-bus) capacity that are expected from Crossrail and the Tube upgrade programme.

Figure 3.11 Goodness of fit – actual and 'explained' bus demand.



Source: TfL Revenue Policies, Marketing and Communications.
Methodological note. *Forecast bus journeys are derived by applying the bus demand elasticity to the actual annual change in the respective bus demand driver. So, as an example, the Greater London employment elasticity relative to bus demand of 0.53 is multiplied by the annual growth in employment in London to derive the annual change in bus journeys from higher London employment. Similarly, the bus demand fares elasticity is applied to the annual real change in bus fares and so on until all the demand drivers contributions have been attributed accordingly. The total annual change in a particular year is then the sum of all the demand driver impacts. This total change is added to the previous year's actual journeys to derive the explained or forecast journeys in a particular year.*

Conclusions

Principal conclusions from this analysis are that:

- After allowing for population and economic growth, service provision and improvements to the quality of that service are key to increasing use of the bus. Together these have accounted for 30 per cent of the total bus growth over the 15-year period.
- As service improvements have levelled off, average loads have continued to increase on buses and are projected to continue to increase – broadly in line with increasing population.
- This has clear implications for future levels of bus service provision given the rapid growth that is expected in London's population over the next 20 years, and TfL's 2014 Business Plan proposes an increase in bus services of around six per cent between 2014/15 and 2020/21 to help close the gap between supply and demand.

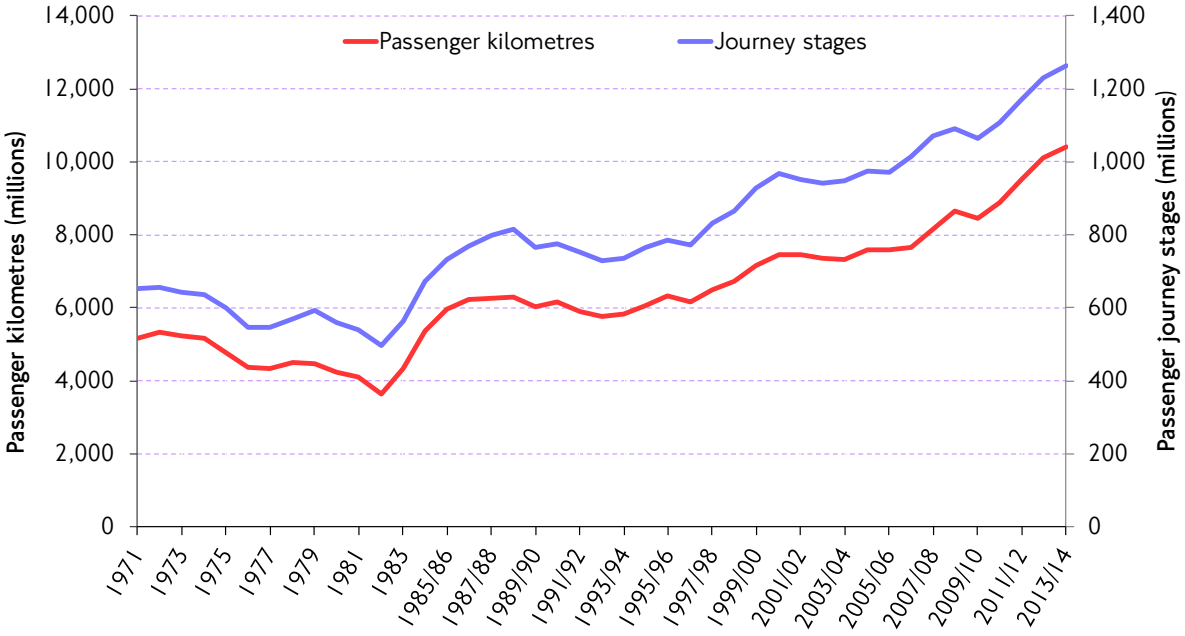
In the context of current funding levels and future pressures on the road network, the following are the key operational priorities for London's bus network:

- To keep the service operating reliably. Targeted bus priority will be important in delivering reliable journey times and protecting the bus network from worsening traffic congestion.
- Ensuring that customer satisfaction remains high, with further investment in customer-care focused training for bus drivers and other staff.
- Continuing to keep the network under review to meet changing demand and customer requirements.

3.6 Modal trends: Underground

The number of people using the Underground in 2013/14 was the highest ever (figure 3.12), with 1,265 million passenger journeys (journey stages), a 2.9 per cent increase on the previous year. Passenger kilometres increased by 3.2 per cent over the past year. The continued growth in 2013/14, following an exceptional year in 2012/13 (due in part to the 2012 Games) emphasises the strength of the long-term upward trend in Underground patronage.

Figure 3.12 Passenger kilometres and journey stages by Underground.



Source: TfL Service Performance data.

London's population is continuing to grow and urban densities are increasing, which drives demand for high capacity rail modes. Furthermore, Tube upgrades are still ongoing on some lines and the resulting increase in capacity and improvement to reliability can be expected to have some further impact on demand, as has been seen following the completion of upgrades on several lines in the run-up to the London 2012 Games. This is discussed in more detail in section 4.6 of this report, looking at the Tube upgrade programme using the example of the Victoria line.

3.7 Focus: Night Tube

Scope

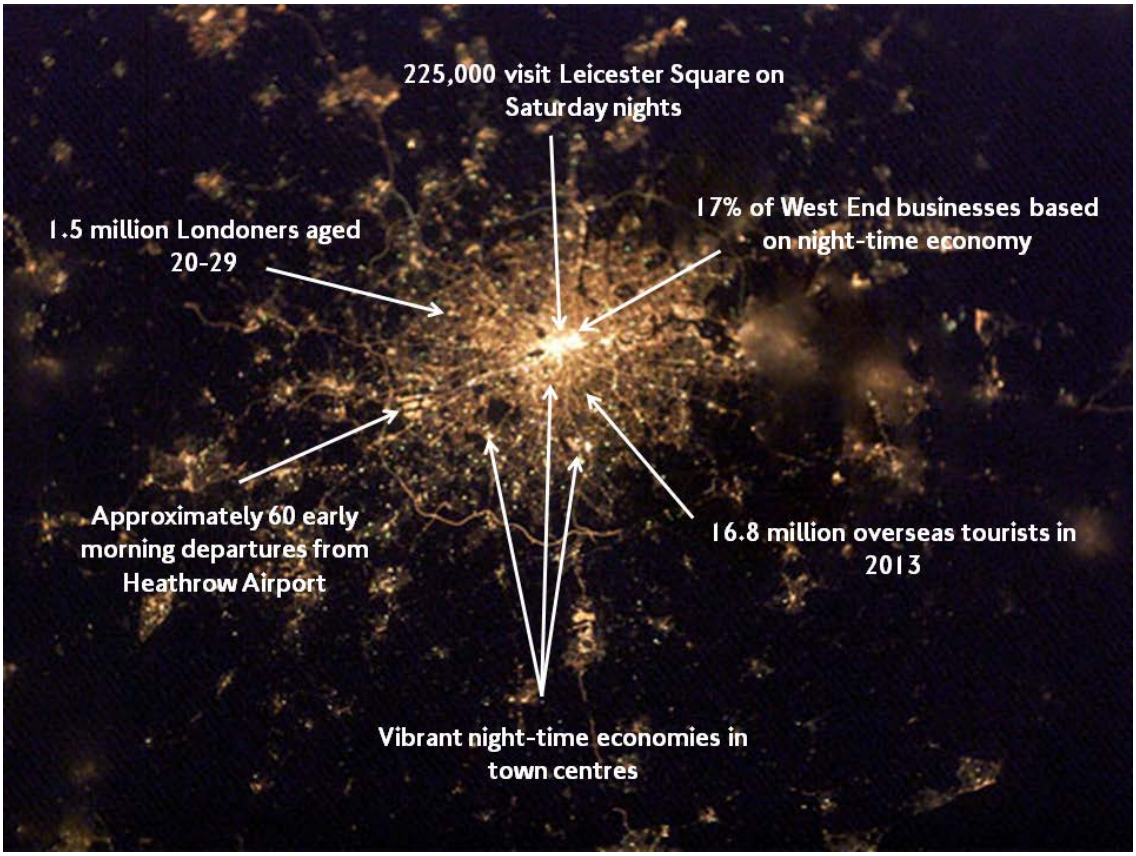
London is a 24-hour city with an increasingly important night-time economy. Around 14 per cent of London businesses are based on the night-time economy, rising to 17 per cent of businesses in the West End. Londoners make approximately one million trips between 22:00 and 05:00 on Friday and Saturday nights. TfL has announced that London Underground will run trains on selected lines on Friday and Saturday nights from September 2015. This section describes trends in late night travel demand and the nature and objectives of the proposed new service.

London's night-time economy

The term 'night-time' economy is widely used but loosely defined. Here it is considered as economic activity taking place between the hours of 22:00 and 05:00. While restaurants, bars and clubs make up a substantial proportion of this in most localities, there are also other activities such as cleaning and property maintenance which can take place during night-time hours. The importance of the night-time economy is recognised in the London Plan, which notes in particular that the Covent Garden/Soho area makes an important contribution to London's standing as a world city [2].

This is reflected by the estimate that 225,000 people visit Leicester Square on a Saturday night. The core industries supporting the West End's night-time economy are continuing to grow, with theatre receipts up 11 per cent in 2013 and food and beverage sales up by 5.4 per cent [3].

Figure 3.13 Visualisation of London's night-time economy.



Source: West End Commission, Office for National Statistics (ONS), GLA, London Underground. Image courtesy of the Earth Science and Remote Sensing Unit, NASA's Johnson Space Center.

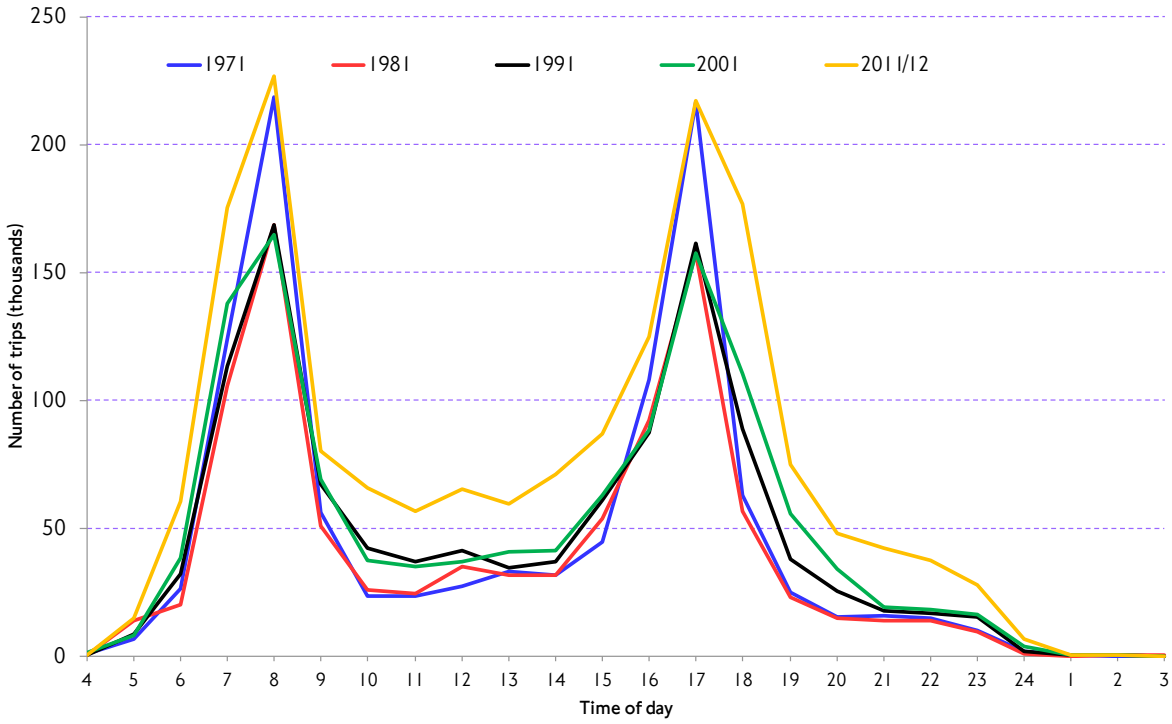
The value and footprint of London's night-time economy extends beyond the West End. Around 1.5 million Londoners are in their 20s, an important source of demand for the night-time bar, club and entertainment industries across Greater London, including the West End, inner London entertainment hubs (for example Clapham and Dalston) and outer London town centres (for example Croydon and Romford). In addition to residents, 16.8 million tourists visited London in 2013. These visitors provide a source of demand for theatres, bars, clubs and restaurants both in the West End and other globally recognised night-time destinations such as Brixton and Shoreditch. Tourists also generate demand for access to airports and other

transport hubs in the early hours. It has been estimated that 500,000 young people visit London's late bars and clubs on a Saturday night.

The growth of late night travel demand for public transport in London

Changes in the temporal patterns of travel demand in London were investigated in Travel in London report 6. Figure 3.14 shows the number of Underground trips made by London residents by hour of day on an average day as surveyed in 1971, 1981, 1991, 2001 and 2011/12. Note that trips are categorised by their start time and that the values relate to weekdays only.

Figure 3.14 Absolute number of trips made by London residents by hour of day. Underground trips only (as main mode), trips categorised by start time.

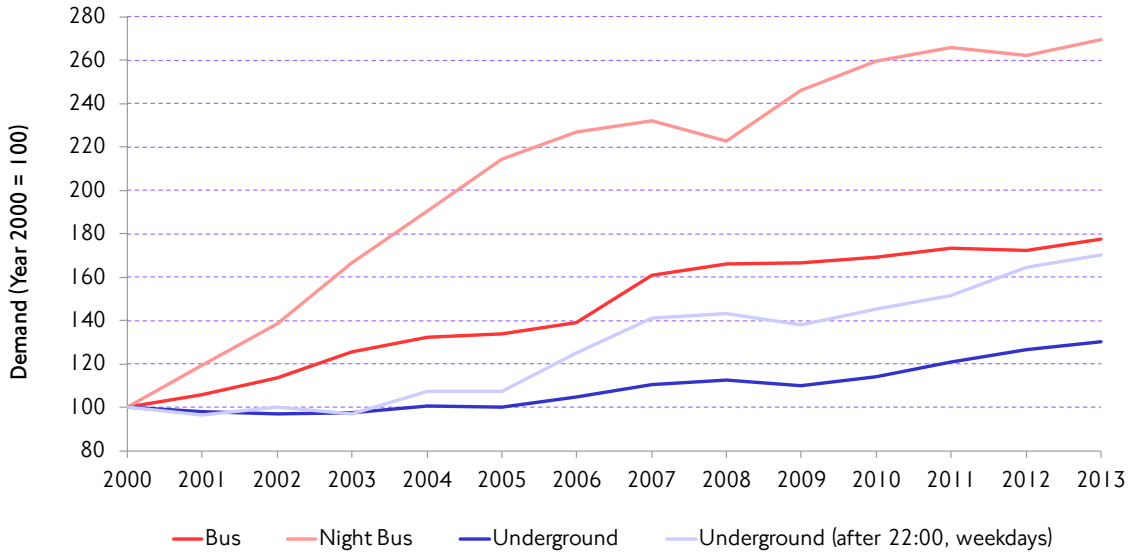


Source: TfL Planning Strategic Analysis.

In the last decade there has been a substantial increase in travel demand in the late evening. There has also been a smaller increase in demand in the early morning. This has occurred against the backdrop of increased demand outside of the peaks throughout the day, as well as a widening of the peaks themselves.

Looking at the period since 2000 in more detail, it becomes clear that the demand for late night public transport in London has grown considerably relative to overall demand. This has occurred against the backdrop of widespread increases in public transport supply more generally. Figure 3.15 shows the change in demand for bus and Underground over this period.

Figure 3.15 Indexed annual travel demand: Bus, Night bus & Underground.



Source: TfL Planning Strategic Analysis.

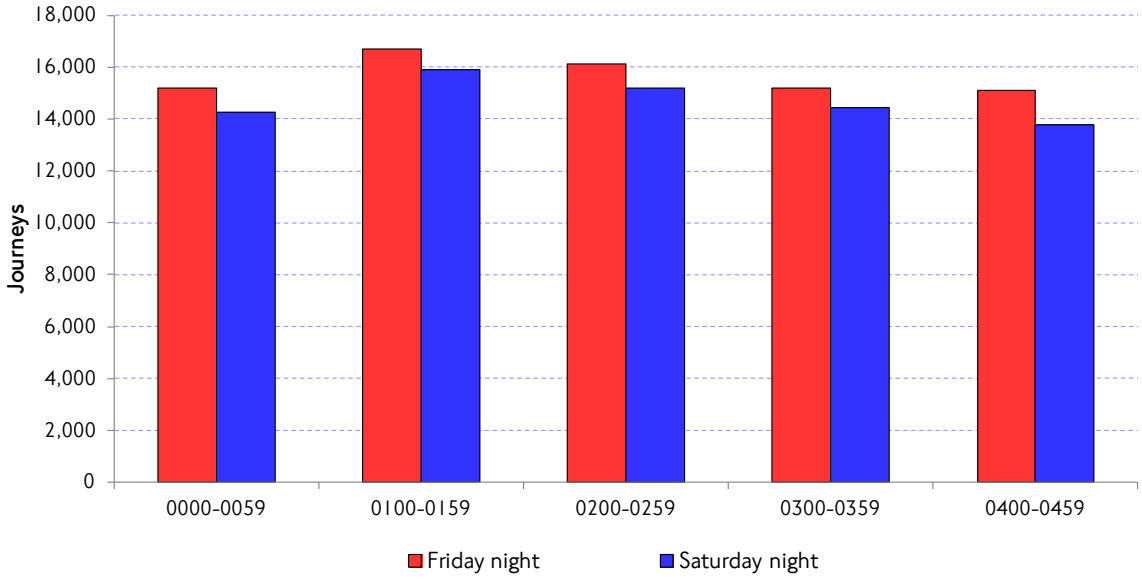
The upward trends in both bus and Underground patronage since 2000 are well understood. Interestingly, Night bus patronage has grown at a much faster rate than overall patronage. Demand for TfL's night-time services has more than doubled since 2000. Night bus patronage now stands 170 per cent higher than it did at that time, exceeding by far the significant growth in overall bus and Underground demand. The growth in Night bus demand has corresponded with an unprecedented increase in supply, with operated kilometres having doubled since the year 2000. The Night bus network now consists of more than 100 routes, operated by over 800 buses at its peak. Several routes operate at a peak frequency comparable to that of daytime services. The growth in late evening Underground demand has also been greater than the overall change, although of course there has historically been no service in the overnight period.

The case for Night Tube

There are 42 Night bus services running parallel to London Underground lines for a significant proportion of their route with more than 70,000 trips on these routes on Friday and Saturday nights. The hourly demand for these routes is shown in figure 3.16 below.

While it may be expected that demand would peak immediately after the last Tube departs (to cater for those who missed their train) and immediately after pubs and clubs close (to cater for those going home afterwards), demand on these routes is in fact spread quite evenly across the night. When viewed in the context of rising demand for late night public transport, it becomes apparent that some of this growth could be catered for by an overnight Tube operation, albeit at a lower frequency than daytime services.

Figure 3.16 Night bus journeys parallel to London Underground lines.



Source: London Underground.

London Underground has operated later hours in the past in special circumstances. The Tube has run a 24-hour service on New Year's Eve, and service hours were extended for the duration of the 2012 Games to allow attendees at evening sessions at Games venues to complete their return journeys by public transport. However, the requirement for track closures to facilitate maintenance work has limited overnight service to special cases only. Following recent upgrades to the London Underground network, the requirement for overnight track closures for maintenance has now significantly reduced.

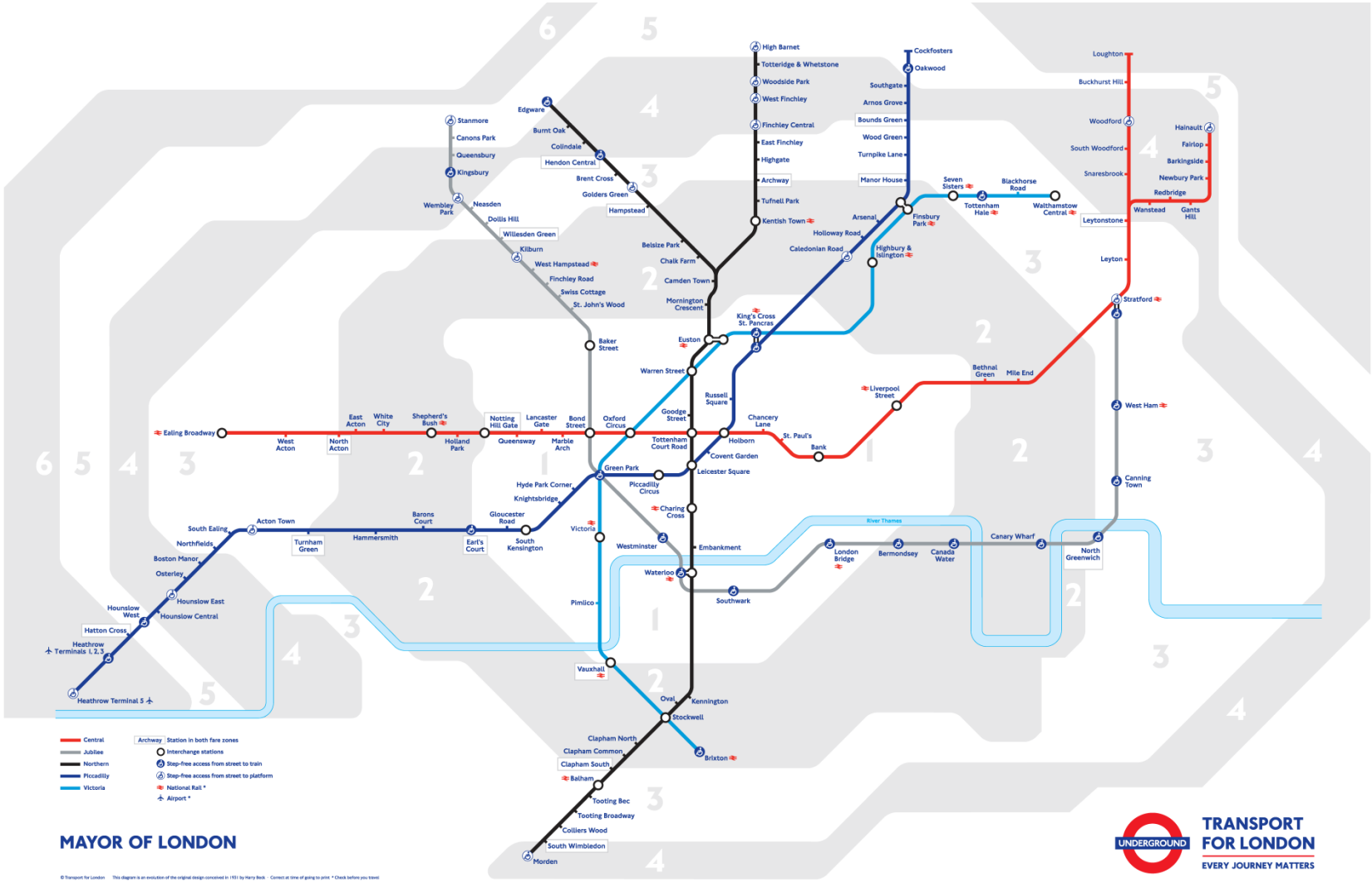
There has also been growing political and business backing for extended London Underground operating hours at weekends. Support for late-running services was voiced by the West End Commission in 2013:

"TfL should be invited to examine even later running Underground services on Fridays and Saturdays to meet demand peaks, if possible extended post-3am to meet the night club exodus. This would most likely mean operation on a sub-set of routes. For night-time and evening visitors, the positive potential impact of later running Underground services should not be underestimated."

The Night Tube from September 2015

The combination of growing demand, upgraded infrastructure and political will means that for the first time it has now become feasible to consider a Night Tube operation. Phase one of Night Tube involves five lines. Services are planned to begin at a six trains per hour frequency in September 2015 along sections of the Central, Jubilee, Piccadilly and Victoria lines. On the Northern line, Charing Cross branch trains will run at an eight trains per hour frequency, with four trains per hour serving each of the High Barnet and Edgware branches (figure 3.17).

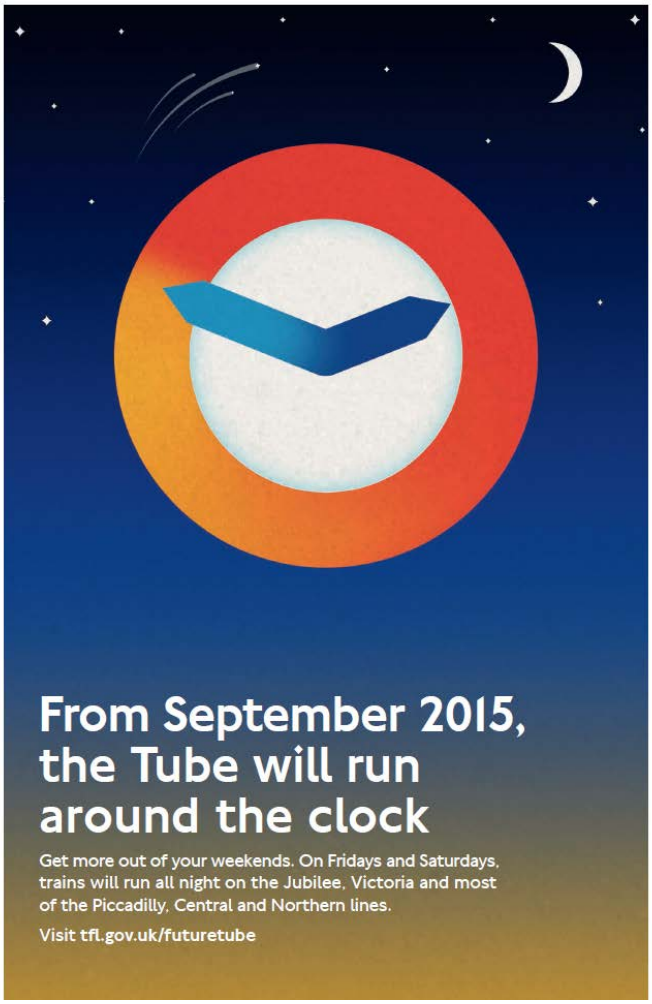
Figure 3.17 Night Tube network (Phase one).



Source: London Underground.

Where there are multiple branches, these were considered on their individual merits. The proposed network is based on lines and branches where there is proven demand for overnight travel with additional consideration of any operational constraints (for example train depot location). It is expected that Night Tube will expand to include parts of the Hammersmith & City, District, Metropolitan and Circle lines once the upgrade of those lines is complete.

Figure 3.18 Example of TfL publicity for the launch of the Night Tube.

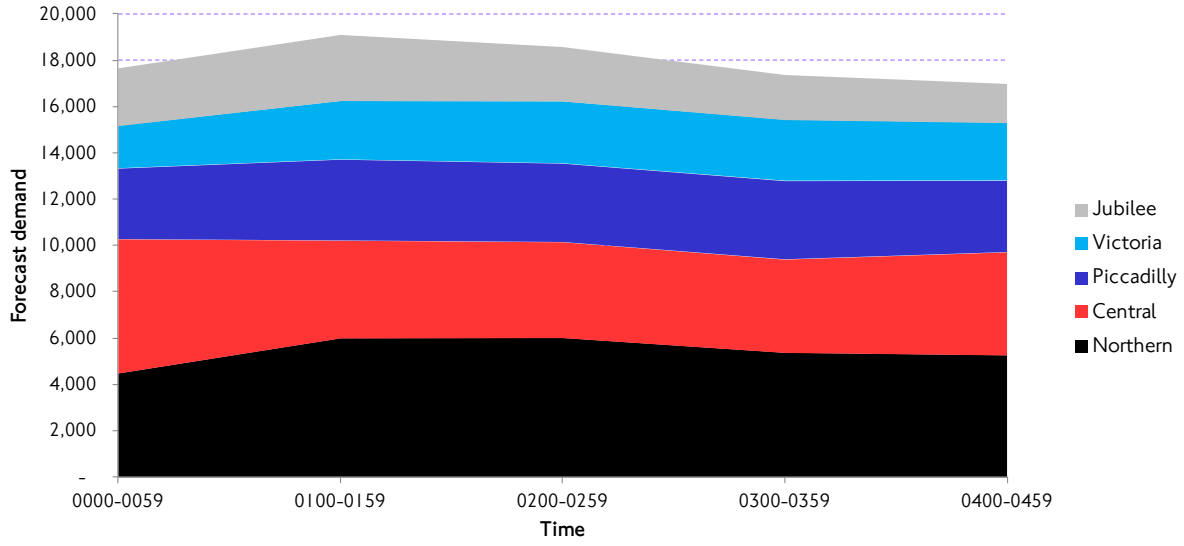


Source: TfL Marketing and Communications.

Demand for Night Tube Phase one network

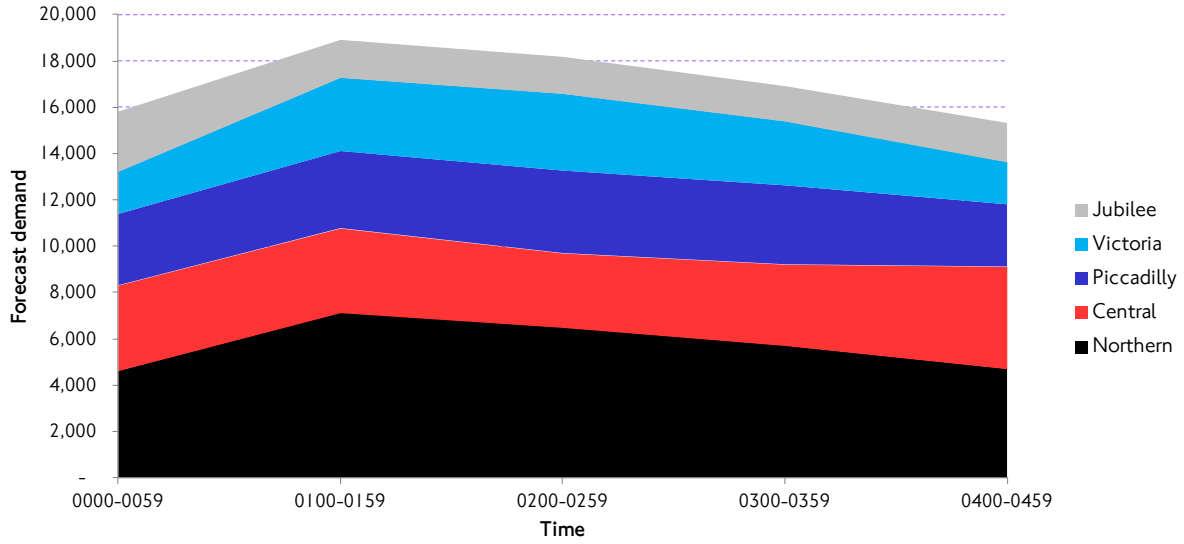
Demand for Night Tube along lines included in Phase one was assessed by considering modal shift from parallel bus services, as well as assuming some shift from other modes (including taxi) and the generation of new trips. Figures 3.19 and 3.20 show the forecast demand for Night Tube for Phase one lines over the course of a typical night.

Figure 3.19 Night Tube forecast demand (Friday night/Saturday morning).



Source: London Underground.

Figure 3.20 Night Tube forecast demand (Saturday night/Sunday morning).



Source: London Underground.

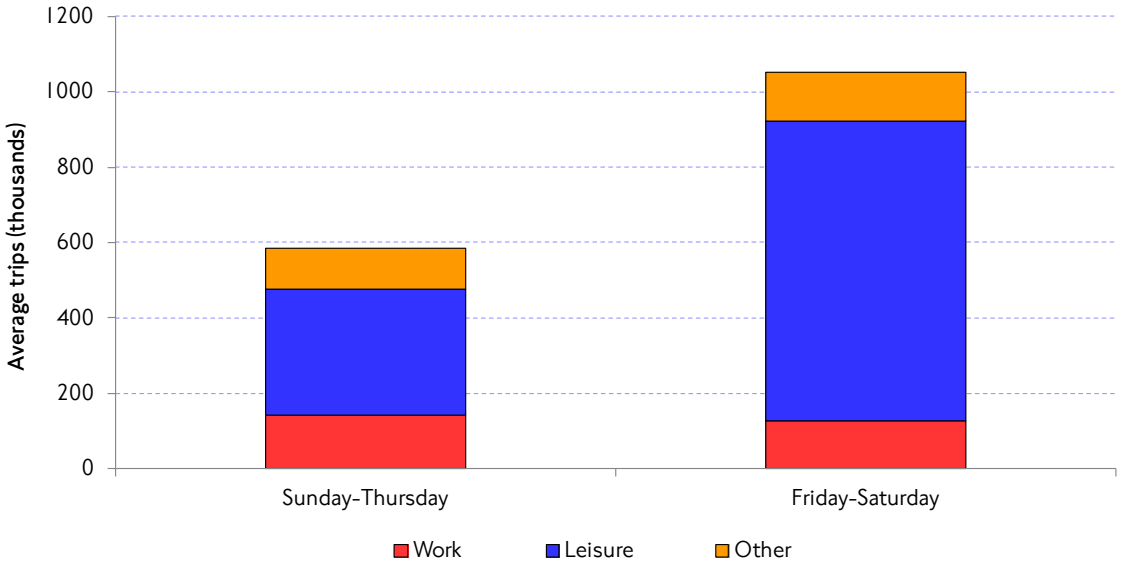
In total, more than 170,000 journeys are forecast to be made on Night Tube services between 00:00 and 04:59 on a typical weekend. The demand profile is mostly flat across both nights with peak demand occurring between 01:00 and 02:00 in both cases. At current planned frequencies the service would provide an hourly capacity of 28,000 passengers out of Zone 1 (the links where demand is expected to be highest), comfortably accommodating the forecast demand.

Monitoring the impact of Night Tube: Deriving a baseline for night-time travel

The nature of night-time travel demand for London residents can already be analysed using data from TfL's LTDS, and this will be a primary means of monitoring the implications of the new service on Londoners' travel behaviour. Londoners

already make approximately one million trips between 22:00 and 05:00 on Friday and Saturday nights. Demand on other nights of the week is lower, but still more than half a million trips, as shown in figure 3.21 below.

Figure 3.21 Trips by day and purpose: 22:00-05:00 (London residents only).



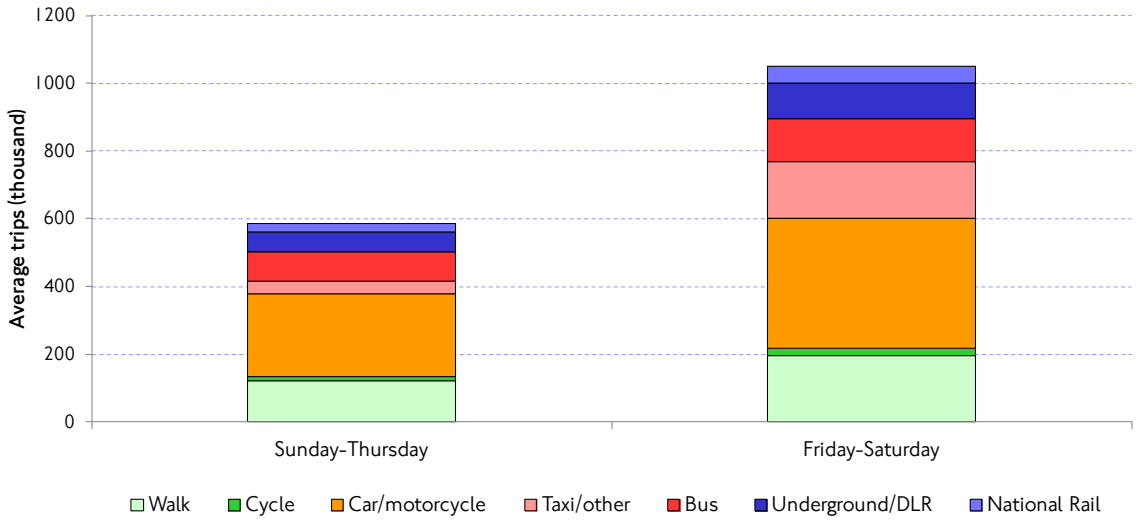
Source: LTDS 2010-13.

While Friday and Saturday nights have a substantial number of leisure trips, it is noticeable that there are more than 100,000 work trips made at night on both weeknights and weekend nights. This would include workers in London's night-time economy as well as early shift-workers. Trips in the 'other' category would include, for example, people dropping off or collecting friends and family from airports and train stations.

This data only considers London residents and trips wholly within Greater London. For leisure trips in particular, the total number of trips made overnight may be supplemented by a substantial number of trips made by non-Londoners, including tourists. There would also be a significant number of trips made by Londoners and non-Londoners alike to/from destinations further afield involving late night or early morning transits via Heathrow airport, Victoria Coach Station and other transport hubs.

The differing nature of late night trips is reflected in mode shares across the week, as shown in figure 3.22.

Figure 3.22 Trips by day and mode: 22:00-05:00 (London residents only).



Source: LTDS 2010-13.

Overall, there are 80 per cent more trips made on Fridays and Saturdays, however the increase is not evenly spread across the modes. Taxi trips are more than three times higher on Friday and Saturday nights, becoming the third most used mode ahead of public transport alternatives. This reflects their popularity as a means of travel home from pubs and clubs.

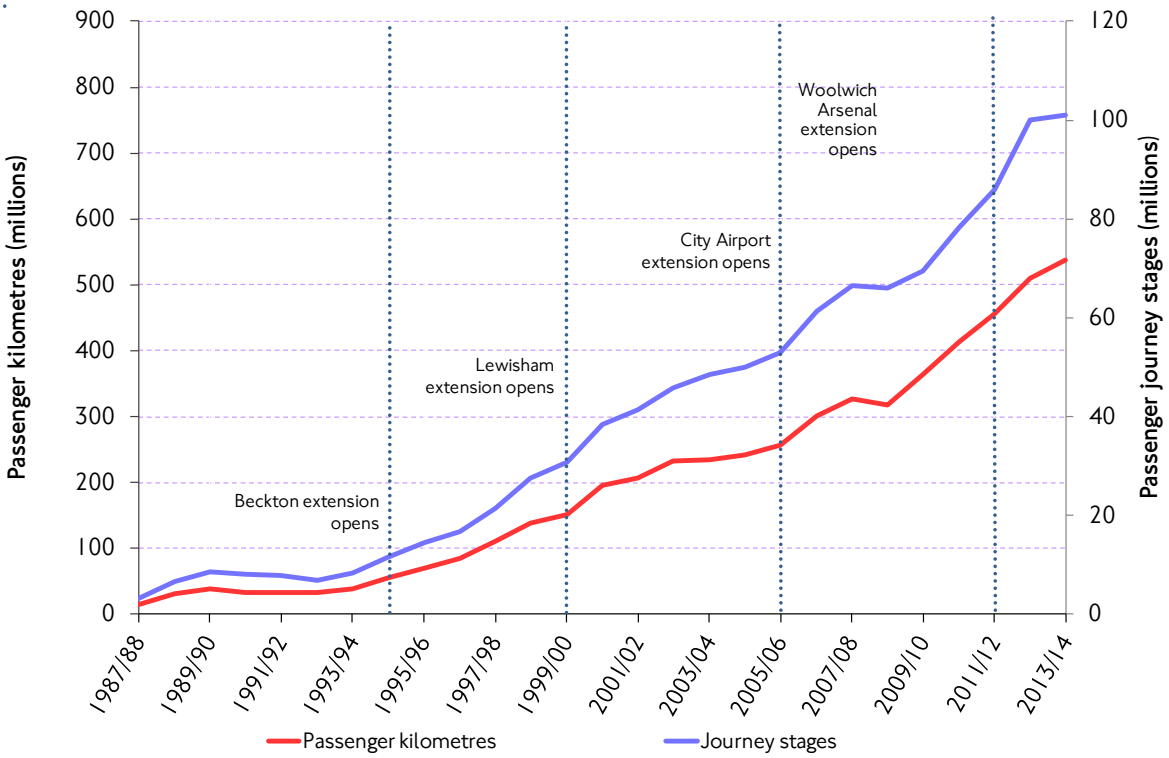
Changes in the characteristics of night-time demand will become apparent as the Night Tube is rolled out. For example, it is likely that there will be some mode shift from bus and taxi for trips in central London (as forecast above). As an extensive overnight metro rail service has never been provided in London before, it remains to be seen to what extent new trips will be generated following the roll-out of Night Tube. These changes will be monitored using LTDS, station entry/exit counts and Oyster data.

3.8 Modal trends: Docklands Light Railway (DLR)

Figure 3.23 shows the trend for travel by DLR since its initial opening in 1987. Patronage has grown steadily over this period as the network has progressively expanded. Principal milestones in the development of the network are shown in the figure to aid interpretation.

In 2013/14, 537 million passenger kilometres were travelled on the DLR, equivalent to 101 million journey stages. The number of passenger kilometres has increased by 5.3 per cent since 2012/13 and the number of journey stages has increased by one per cent. This is a lower rate of increase than the recent trend but could be expected following the additional patronage boost during the London 2012 Games on this network.

Figure 3.23 Passenger kilometres and journey stages by DLR.



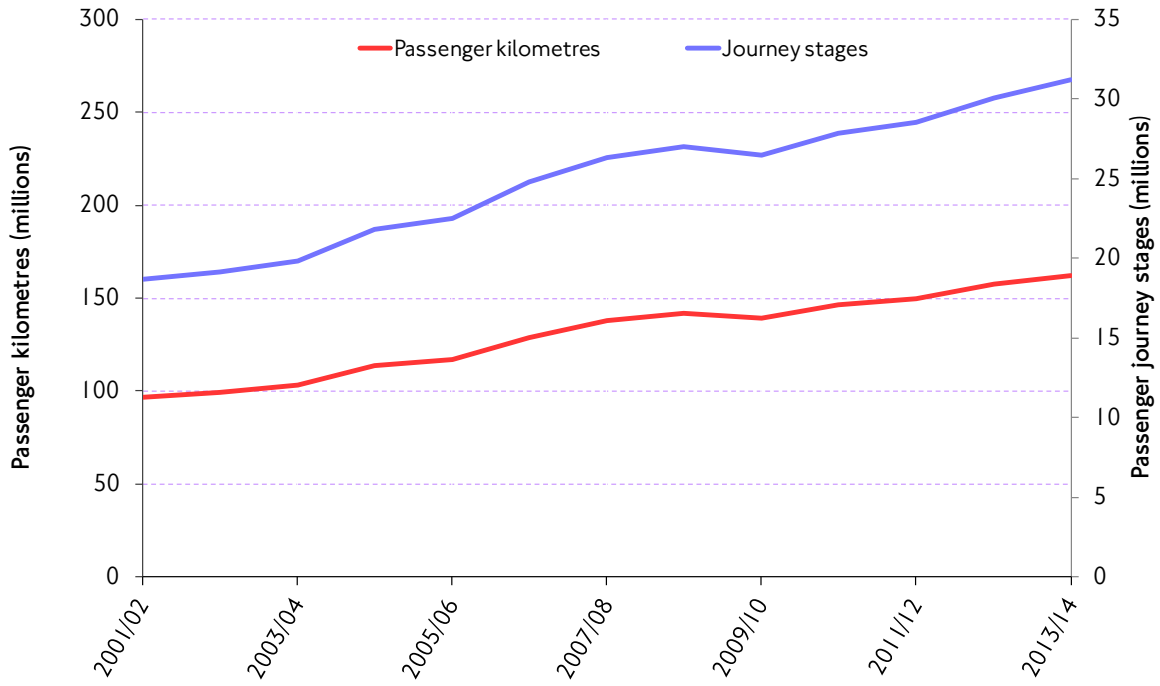
Source: TfL Service Performance data.

3.9 Modal trends: London Tramlink

London Tramlink initially opened in 2000 and the network has been relatively stable in extent since, albeit with a service restructuring in 2006. Figure 3.24 shows steady patronage growth averaging 4.4 per cent for passenger kilometres and journey stages over the period since opening. Aggregate growth since 2001/02 has been 67 per cent for journey stages and passenger kilometres. Tram kilometres operated have increased by 20 per cent over the period since 2001/02.

In the most recent year there were 2.9 per cent more passenger kilometres and 3.8 per cent more journey stages than in 2012/13.

Figure 3.24 Passenger kilometres and journey stages by London Tramlink.



Source: TfL Service Performance data.

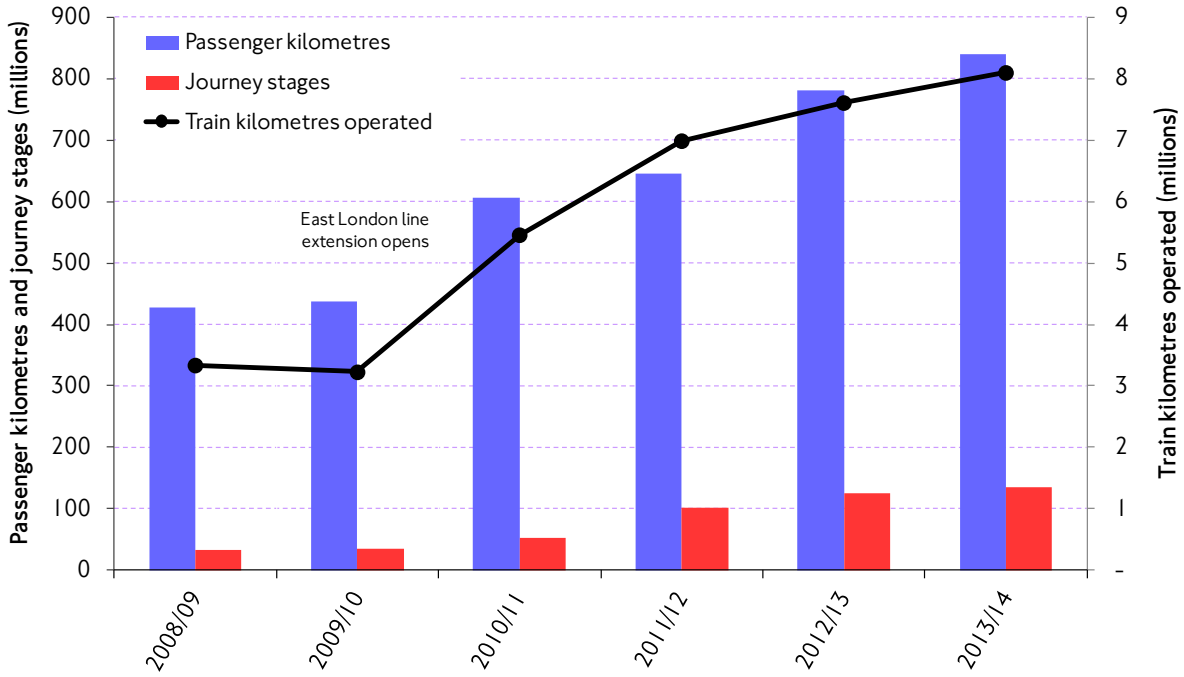
3.10 Modal trends: London Overground

Since the first full year of operation of the London Overground in 2008/09, passenger kilometres have increased by 97 per cent, with a 309 per cent increase in passenger journey stages and a 143 per cent increase in train kilometres operated. This reflects a shortening of journey stage lengths following the extensions of the network to a number of key interchanges.

This strong growth reflects the incremental development of the network. In April 2010, the East London line became part of the network when the phase one extension was completed. In 2011/12 a major infrastructure upgrade project led to the introduction of the May 2011 timetable which provides four peak trains an hour from Stratford to Richmond together with four peak trains an hour from Stratford to Willesden, and a 'turn up and go' service of eight trains an hour in the central section of the North London Line. In December 2012, the South London line extension of the network from Clapham Junction to Highbury & Islington via Surrey Quays opened, completing the orbital route.

In 2013/14, passenger kilometres increased by eight per cent on the previous year, to 840 million and passenger journey stages increased by nine per cent to 136 million (figure 3.25).

Figure 3.25 Passenger kilometres and journey stages by London Overground.

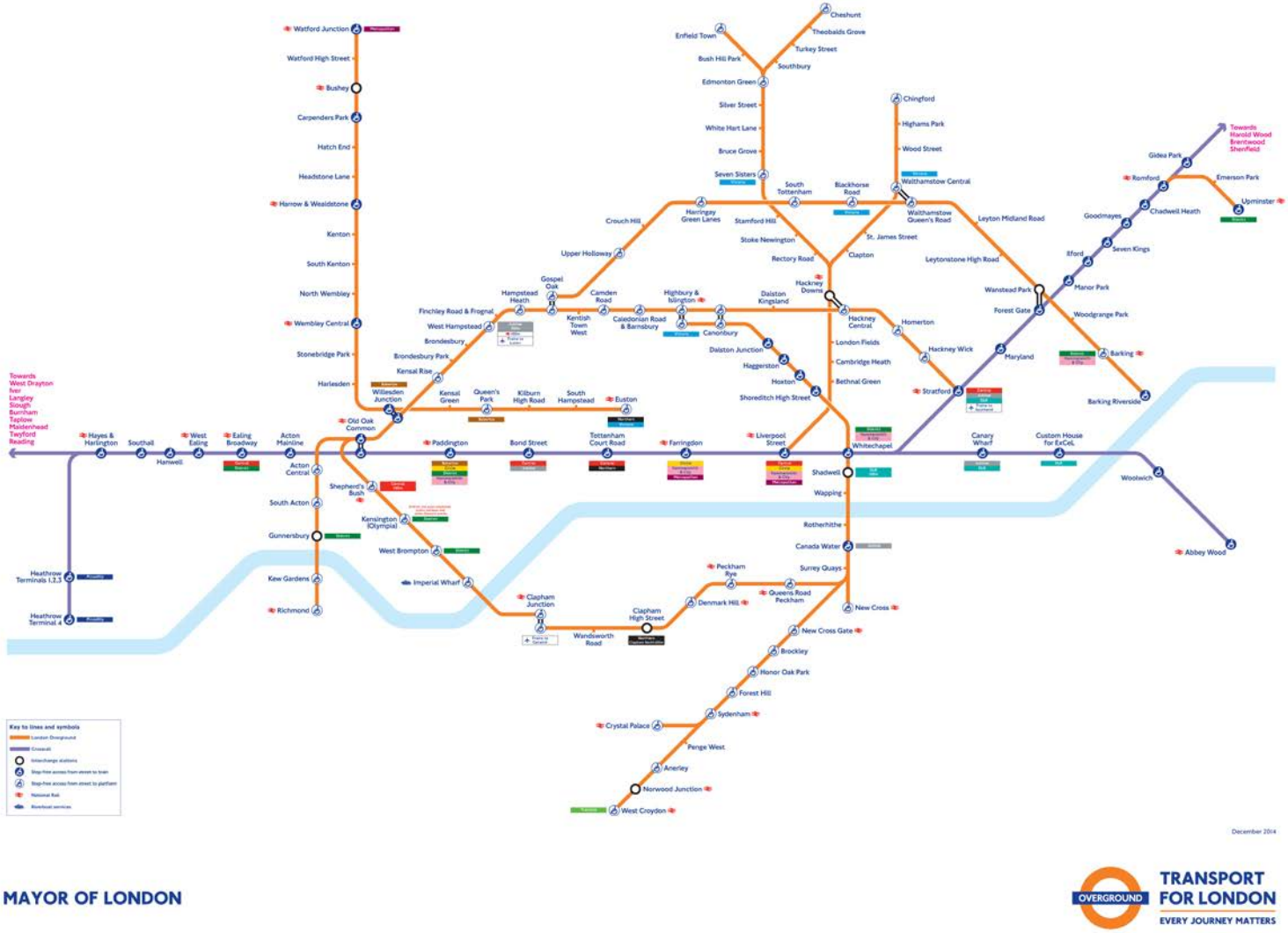


Source: TfL Service Performance data.

TfL to assume responsibility for former West Anglia services in London from 31 May 2015.

From 31 May 2015, TfL (London Overground) will assume responsibility for rail services currently run by Abellio Greater Anglia from Liverpool Street to Enfield Town, Cheshunt (via Seven Sisters) and Chingford, as well as the Romford – Upminster route. The Shenfield to Liverpool Street route will be transitionally be branded TfL Rail until Crossrail trains start to appear on this route in May 2017. All stations managed by London Overground are to be staffed from start to end of services, and new ticket vending machines are to be installed that will accept contactless credit and debit cards (see figure 3.26).

Figure 3.26 Lines to be operated by London Overground from June 2015.



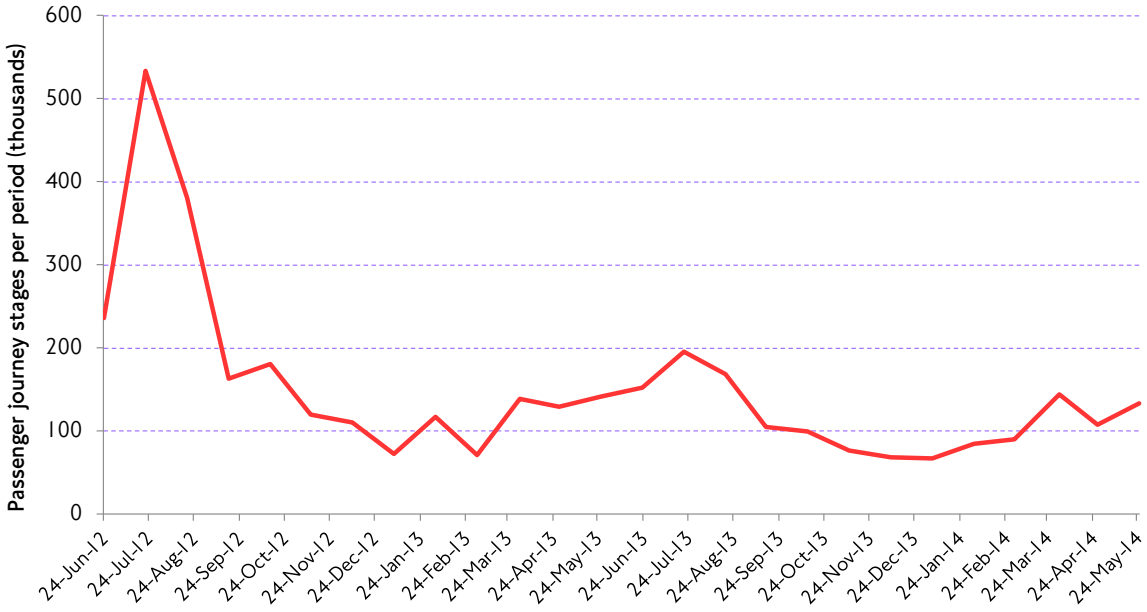
Source: London Rail.

3.11 Modal trends: Emirates Air Line

The Emirates Air Line initially opened in June 2012, just prior to the 2012 Games. During the Games themselves, the geographic proximity of the Air Line to Games-related tourism and the 'novelty factor' combined to see patronage exceed 750,000 people in the first two (four-week) periods of operation.

Figure 3.27 shows that, following the exceptional conditions of summer 2012, the Emirates Air Line has settled into a more regular pattern of use, typically between 80,000 and 200,000 passengers per period, with more passengers seen during school holidays. In 2013/14, 1.51 million journeys were undertaken on the Emirates Air Line, less than the 1.77 million journeys that were undertaken in 2012/13, reflecting the one-off Games in the summer of 2012.

Figure 3.27 Number of journey stages by Emirates Air Line.



Source: TfL Service Performance data.

3.12 Modal trends: National Rail in London

National Rail travel has grown strongly at the national level over the past decade, with only a brief slowdown during the recent recession. This pattern is reflected for travel on services defined by the Office of Rail Regulation (ORR) as 'London and South East' (L&SE). Passenger kilometres and passenger journeys increased for the fourth year in a row with increases of 4.4 per cent in passenger kilometres and 7.2 per cent in journeys – the number of journeys in 2013/14 being 60.6 per cent higher than 10 years previously. It should be noted that this strong growth came despite unfavourable weather issues in 2013/14 and reflects an on going increase in National Rail service provision.

Table 3.1 Passenger kilometres and passenger journey stages by National Rail – operators classified by ORR as London and South East operators.

Year	Passenger kilometres (billions)	Year-to-year percentage change	Passenger journeys (millions)	Year-to-year percentage change
1998/99	17.1	..	616	..
1999/00	18.4	7.6	639	3.6
2000/01	19.2	4.3	664	4.0
2001/02	19.3	0.5	663	-0.1
2002/03	19.8	2.6	679	2.4
2003/04	20.1	1.7	690	1.6
2004/05	20.5	1.9	704	2.1
2005/06	20.7	1.1	720	2.2
2006/07	22.2	7.1	769	6.9
2007/08	23.5	6.1	828	7.7
2008/09	24.2	2.9	854	3.1
2009/10	23.8	-1.8	842	-1.4
2010/11	25.0	5.2	918	9.0
2011/12	26.5	5.7	994	8.3
2012/13	27.4	3.4	1,033	3.9
2013/14	28.6	4.4	1,107	7.2

Source: Office of Rail Regulation.

3.13 Modal trends: Road traffic in London

Scope

This section looks at road traffic volumetric trends in London, using (in the first instance) data on vehicle kilometres in London from the Department for Transport (DfT). The latest available data is for the 2013 calendar year, and shows an apparent slowing in the established rate of decline in traffic volumes that has been seen since 2000, although more recent data from other sources suggests a possible return to growth in 2014. The overall picture presented by the different available indicators of road traffic is explored further in section 3.14 below.

Trend since 2000

DfT data shows that vehicle kilometres in London in the latest year (2013) were 11.1 per cent lower than in 2000, and at their lowest level since 1993. This fall has been particularly prominent in central London (this indicator applies to an area larger than the central London Congestion Charging zone), where vehicle kilometres in 2013 were 23.9 per cent below the 2000 level. In inner London, the equivalent fall was 17.7 per cent, while vehicle kilometres in outer London fell by 7.7 per cent. Traffic in outer London only started to fall steadily in the second half of the decade, from 2007 onwards, after a slight increase in 2006, and in 2012 it started to increase again.

Developments in 2013

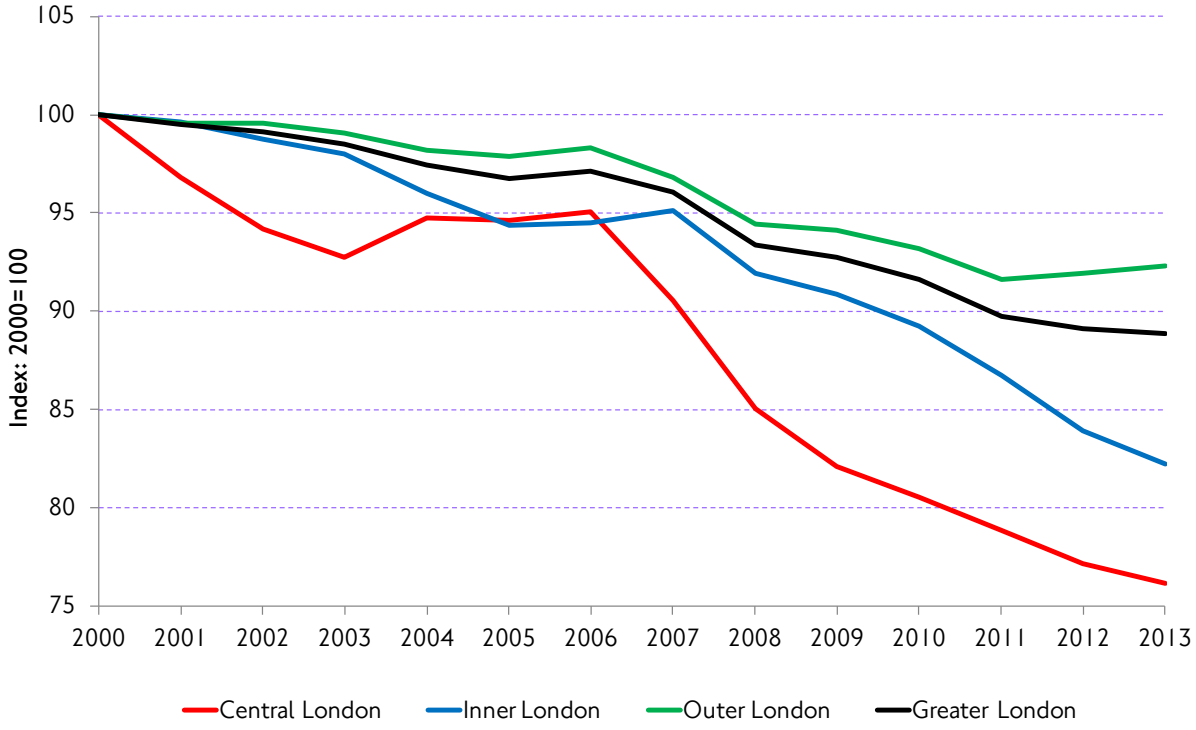
Vehicle kilometres in 2013 were down by 0.3 per cent overall, with the biggest fall in inner London, which was 2.0 per cent down on the previous year. Traffic in central London fell by 1.3 per cent, while traffic in outer London, which accounts for about

70 per cent of traffic in London, increased by 0.4 per cent, continuing the weak growth seen in 2012 (figure 3.28).

Developments in 2014

The traffic data considered in this section run only to the end of the 2013 calendar year. While it is too early to draw firm conclusions, it is interesting to note at this stage that observed traffic data for 2014 are showing increases in traffic relative to 2013. If sustained, this could signify a break with the now long-established pattern of slowly declining levels of road traffic in London (see also section 3.14 of this report).

Figure 3.28 Trends in road traffic (vehicle kilometres), all motor vehicles in central, inner and outer London. Index: Year 2000=100.



Source: Department for Transport.
In interpreting the trend for central London shown by figure 3.10, it is important to recognise that this reflects a different area and set of conditions to that previously reported by TfL through the Congestion Charging Impacts Monitoring reports.

At the national level, road traffic volumes increased by 0.4 per cent in 2013 following a slight decrease in 2012. Vehicle-kilometres driven nationally remain well below pre-recession levels, with traffic declining in four of the previous six years (tables 3.2 and 3.3).

Table 3.2 London road traffic (billion vehicle kilometres) by central, inner and outer London. All motor vehicles, with Great Britain comparison.

Year	Central London	Inner London	Outer London	Greater London	Great Britain
1993	1.3	8.7	20.7	30.7	412.3
1994	1.3	8.8	21.0	31.1	421.5
1995	1.3	8.9	21.0	31.2	429.7
1996	1.3	8.9	21.3	31.5	441.1
1997	1.3	8.9	21.5	31.7	450.3
1998	1.3	8.9	21.7	31.9	458.5
1999	1.3	9.1	22.3	32.7	467.0
2000	1.3	9.0	22.1	32.4	466.2
2001	1.2	9.0	22.0	32.3	472.6
2002	1.2	8.9	22.0	32.1	483.7
2003	1.2	8.8	21.9	31.9	486.7
2004	1.2	8.7	21.7	31.6	493.9
2005	1.2	8.5	21.7	31.4	493.9
2006	1.2	8.5	21.8	31.5	501.1
2007	1.2	8.6	21.4	31.2	505.4
2008	1.1	8.3	20.9	30.3	500.6
2009	1.0	8.2	20.8	30.1	495.8
2010	1.0	8.0	20.6	29.7	487.9
2011	1.0	7.8	20.3	29.1	488.9
2012	1.0	7.6	20.3	28.9	487.1
2013	1.0	7.4	20.4	28.8	488.8

Source: Department for Transport.

Table 3.3 Index of London road traffic (all motor vehicles, based on vehicle kilometres). Index: Year 2000=100. With Great Britain comparison.

Year	Central London	Inner London	Outer London	Greater London	Great Britain
2000	100.0	100.0	100.0	100.0	100.0
2001	96.7	99.6	99.6	99.5	101.4
2002	94.2	98.8	99.6	99.1	103.8
2003	92.6	98.0	99.1	98.5	104.4
2004	94.7	96.0	98.2	97.4	106.0
2005	94.5	94.4	97.9	96.8	105.9
2006	95.0	94.5	98.3	97.1	107.5
2007	90.6	95.1	96.8	96.1	108.4
2008	85.1	92.0	94.4	93.4	107.4
2009	82.0	90.9	94.1	92.7	106.4
2010	80.5	89.2	93.2	91.6	104.7
2011	78.9	86.7	91.6	89.8	104.9
2012	77.2	83.9	91.9	89.1	104.5
2013	76.1	82.3	92.3	88.9	104.8

Source: Department for Transport.

3.14 Focus: TfL's interpretation of recent trends in motorised traffic levels in London

Scope

This section reviews the available trend data to help understand whether the recent slowing of the rate of decline in volumes of road traffic in London is indicative of a 'series break', signifying a fundamental change in volumes of demand for travel by road in London.

Long term trend and sources of data

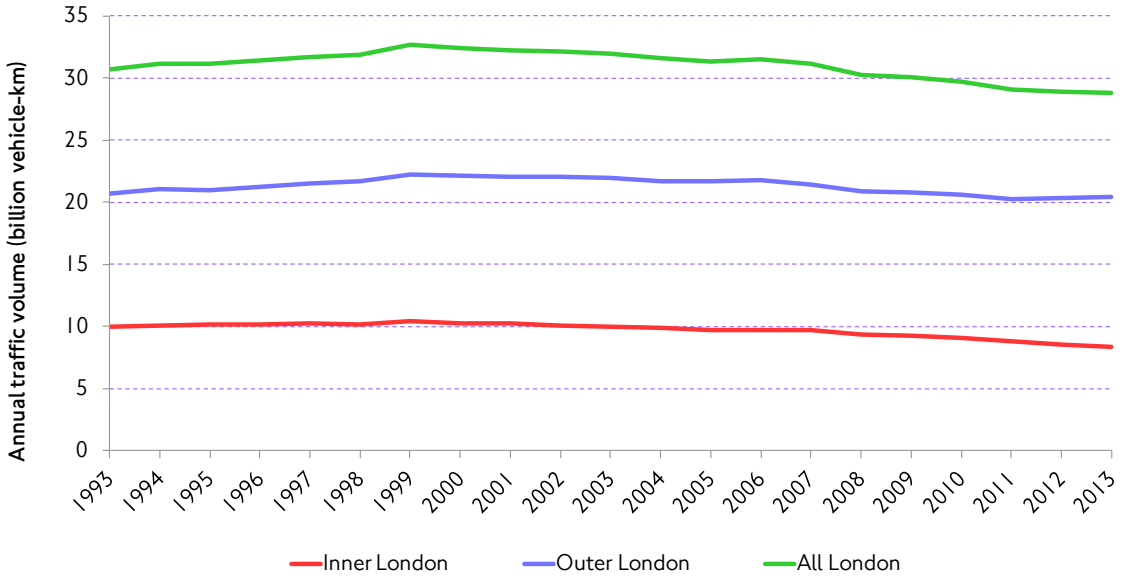
London has seen a long-term decline in volumes of traffic on the road network since the peak in traffic volumes that was reached (at 32.7 billion vehicle kilometres per year) in 1999. There are two main sources of statistics relating to area-wide traffic volumes in London. The DfT produces statistics relating to annual traffic volumes, see figure 3.29. The second source is based on TfL's own automatic traffic counts (figure 3.31).

While the two sources differ from year-to-year, they generally give a similar picture of traffic volumes at the aggregate London-wide level. Between 2007 and 2012, both showed a seven per cent fall in traffic volumes, although for 2013 the DfT statistic suggested an annual decline in traffic while TfL's counts showed a small increase.

Each source showed the same decline in traffic volume in outer London between 2007 and 2013 of five per cent. For inner London, the two were well matched until 2010, but subsequently DfT statistics have shown large year-on-year declines in traffic volume, while TfL's counts have shown smaller declines and even a slight rise in inner London traffic volumes from 2012 to 2013.

Based on what the two sources agree on, it appears that central London traffic volumes are continuing to decline, while outer London volumes increased in 2012 and 2013 after a long-term decline. Given that the two sources differ on the trend in traffic volumes in inner London, it is not clear at present what the true direction of change has been in the most recent years.

Figure 3.29 Annual traffic volume: inner London, outer London and London total.



Source: Department for Transport.

Understanding the decline in traffic volumes in London

The long-term decline in levels of traffic since 1999 was not forecast in advance, and in the 1990s it was expected that growth in London's population would mean continued growth in traffic volumes. As the trend for decreasing traffic volumes has developed, there has been debate about what has caused it.

One hypothesis among transport professionals and commentators, termed 'peak car', is that car travel per capita, having grown for decades, has reached a peak. Observations over the past 15 years in London appear consistent with this hypothesis.

The peak car hypothesis itself does not, however, explain the root causes of the previously unexpected decline in traffic volumes. TfL's recent report 'Drivers of Demand for Travel in London' [4] explored a range of factors that have influenced travel demand, and in particular the decrease in car travel. The Drivers of Demand review found that a range of factors relating to transport supply (highway capacity has decreased), underlying demand (outer London incomes did not rise for many years), and structural changes (driving licence holding is now 10 to 15 percentage points lower among young Londoners than it was in 1991) all contributed to a shift from car travel toward public transport, walking and cycling.

Based on DfT statistics, at the London-wide level the volume of traffic has decreased every year since 1999 with the exception of 2006, and has seen an average annual decrease of 0.9 per cent over the period 1999 to 2013. Inner London too saw decreases every year other than 2006 during this period, and a larger average annual decrease of 1.5 per cent – although TfL's own traffic counts show a less pronounced decline in recent years. Outer London was following a similar, but less steep, pattern of falling traffic volumes, until in 2012 the volume of traffic grew by 0.3 per cent, and then in 2013 traffic grew by another 0.4 per cent. Again, TfL's own

counts show a slightly different picture, having suggested a steeper fall in the years leading up to 2011, followed by a steeper rise in 2012 and 2013.

Have traffic volumes in outer London departed from trend since 2011?

As seen above, statistics from both TfL and the DfT have shown annual increases in traffic volumes in outer London in 2012 and 2013. Statistical analysis of these recent increases has been carried out in order to identify whether these increases represent a significant departure from the long term trend. This statistical analysis has been carried out using the DfT statistics for outer London (which have shown a less steep increase in traffic volumes in 2012 and 2013, and so give a conservative estimate of the increases) since these are available over a longer time series extending back to 1999.

Traffic levels in inner London continued to decline in 2012 and 2013, in both cases at a rate at least as fast as the average seen between 1999 and 2011. In outer London, however, there was a small increase in the volume of traffic of between 0.3 per cent and 0.4 per cent in both 2012 and 2013. While the percentage increases appear small, they represent increases of 70 or 80 million vehicle kilometres each year. This raises a question: are the increases in traffic volume in the past two years 'blips' on what will otherwise be a continued downward trend, or do they represent a departure from the trend of the past 10 to 15 years?

Chow test

The decline in traffic volumes in outer London was seen above to have followed a trend consistent with a roughly constant annual decrease between 1999 and 2011. A model based on this constant can be used to test whether the observations of traffic volume in 2012 and 2013 are consistent with a continuation of this trend through application of a 'Chow test', a statistical technique used to identify a structural break in the relationship between the explanatory variables (in this case time), and the dependent variable (traffic volume).

The average annual decline was around 158 million vehicle kilometres between 1999 and 2011. Extending the model to cover 1999 to 2013, the average annual decline is reduced to 155 million vehicle kilometres. However, looking separately at the period 2011 to 2013, the same model shows an annual increase of 75 million kilometres. So the question is: is the trend better represented by a single model showing a constant decline over the period 1999 to 2013, or by two distinct parts, representing a constant decline between 1999 and 2011 before a subsequent increase averaging 75 million vehicle kilometres per year?

The Chow test generates an answer to this. Comparing the case of the single 1999-2013 model with the case of distinct 1999-2011 and 2011-2013 models produces a p-value of 0.064. This result means that it is unlikely that the trend in traffic volume in the past two years is the same as it was between 1999 and 2011, although the evidence is not conclusive. In terms of significance levels, we would reject the hypothesis that traffic volumes remain on the long term trend at the 10 per cent significance level – instead preferring the hypothesis that traffic volumes are now on a different trend – but would not reject it at the 5 per cent significance level.

Another way of thinking about this result is that if in truth traffic volumes in outer London were still on the same trend as was the case from 1999 to 2011, we would have had only a 6.4 per cent probability of seeing traffic volumes at least as far from

this trend than we did in 2012 and 2013. So, while it is possible that the volumes observed in the past two years were subject to random fluctuations but otherwise were still on the same overall downward trend, this appears relatively unlikely.

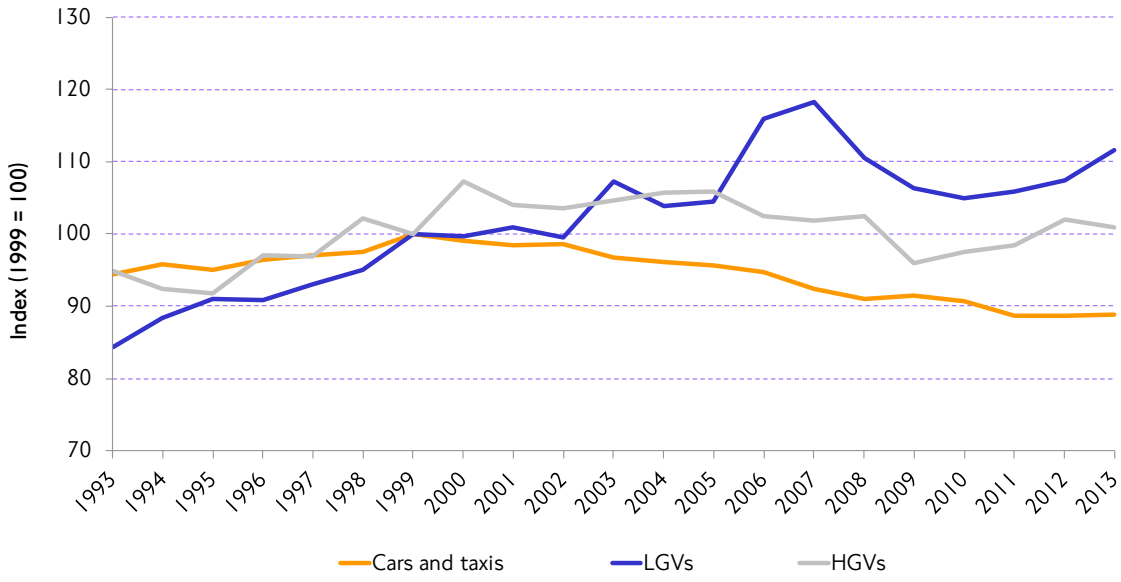
What might have caused road traffic to depart from trend?

The possibility that traffic volumes in outer London have departed from the long term trend since 2011 raises the question of what might have caused this change in trend.

There are many factors known to have an economic relationship with traffic, such as fuel prices, public transport costs, highway capacity, household incomes and economic performance. Changes in any of these could have contributed to a departure from the declining trend in traffic volumes.

Trends in traffic by vehicle type

Figure 3.30 Indexed traffic volume in outer London by vehicle type.



Source: Department for Transport.

Differing trends are evident in volumes of traffic of different types of vehicles. While volumes of car traffic declined from 1999 onward, the quantity of LGV (light goods vehicle) traffic in outer London increased by 18 per cent between 1999 and 2007. Following the onset of the recession, LGV traffic volumes declined each year until 2010, before returning to growth from then onwards. It is also clear that increasing LGV volumes are the main constituent of the increases in aggregate traffic volumes that were observed in 2012 and 2013, and with wider trends such as the growth of internet shopping, with growth of 159 million LGV kilometres between 2010 and 2013. Heavy goods vehicle (HGV) volumes have been relatively stable over the period since 1999, and were around one per cent above the 1999 level by 2013.

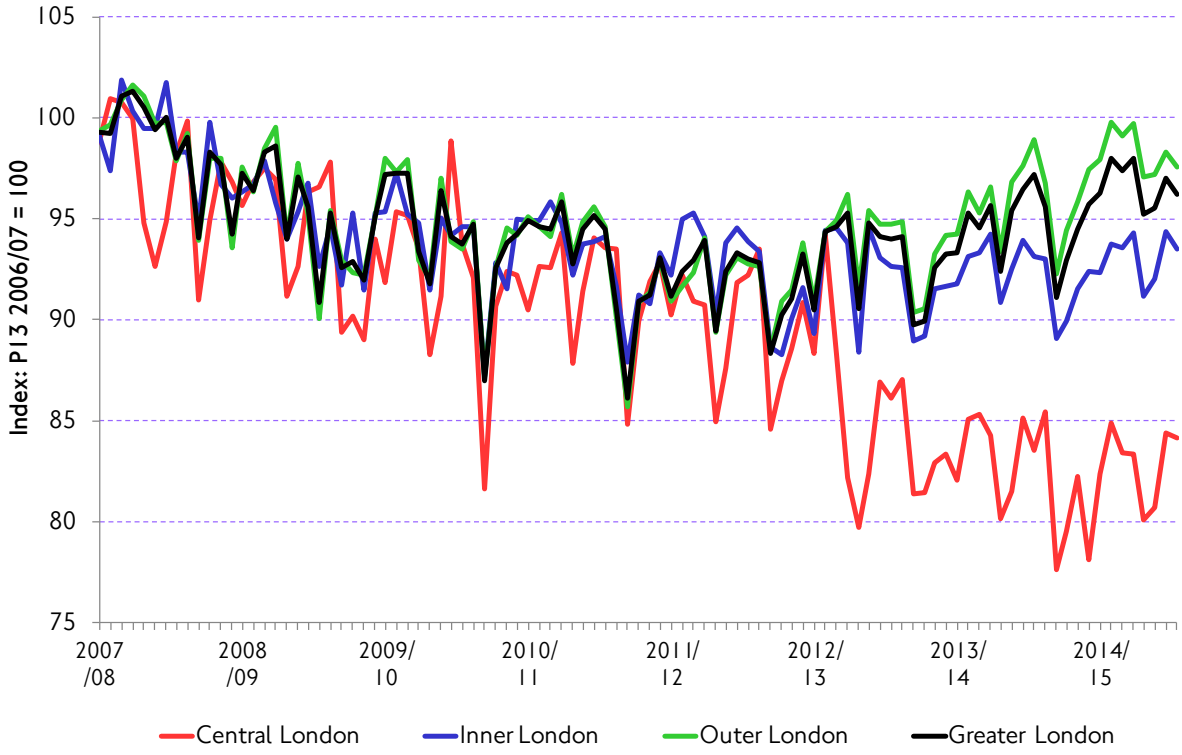
Recent TfL data on traffic trends

Emerging data from TfL's traffic counts suggest that in recent months traffic may have been rising, or at least have ceased to decline, in each of central, inner and

outer London. These counts show that outer London traffic flows have increased in 2014/15 to date, continuing their increasing trend since 2011/12. While volumes observed in some recent periods have been close to the level seen in 2007, no period has yet seen volumes above that level.

Inner London traffic volumes do not appear to have declined since 2011/12, but while data from recent months may suggest an increase, the volumes observed since then have not yet returned to the level seen in 2011/12. TfL's counts also suggest that traffic volumes in central London may not have continued to decrease at the rate seen in previous years in the most recent months for which data is available. Whether this is a long term change remains to be seen until further data becomes available.

Figure 3.31 Recent traffic trend in London as indicated by TfL's automatic traffic count data.



Source: TfL Surface Transport Outcomes Delivery

3.15 Modal trends: Cycling

Scope

This section looks at recent trends in levels of cycling in London, including average daily cycle stages and trips, cycle flows on the TLRN major road network, and the number of cyclists crossing a set of three strategic traffic counting cordons.

Overall levels of cycling in London

Cycling has grown strongly in London in recent years. The London-wide figures for 2013 appear however to represent a temporary pause in the recent established pattern of strong growth of cycling in London. The latest data for 2014 suggest a

return to strong growth in cycling on the TLRN, and other indicators for 2013 (see below) suggest stronger growth on specific parts of the networks.

In 2013, there were 585,000 cycle journey stages in London on an average day, which is a 0.5 per cent increase on 2012. This follows a 1.8 per cent increase in the previous year, with an overall 58.3 per cent increase in cycle stages since 2003 (table 3.4).

Table 3.4 Daily average cycle stages and trips in London.

	Cycle stages		Cycle trips
	Millions	Year on year change %	Millions
2003	0.37	14	0.32
2004	0.38	3	0.33
2005	0.41	9	0.39
2006	0.47	12	0.42
2007	0.47	-	0.42
2008	0.49	5	0.44
2009	0.51	5	0.47
2010	0.54	6	0.49
2011	0.57	5	0.49
2012	0.58	2	0.50
2013	0.58	1	0.50

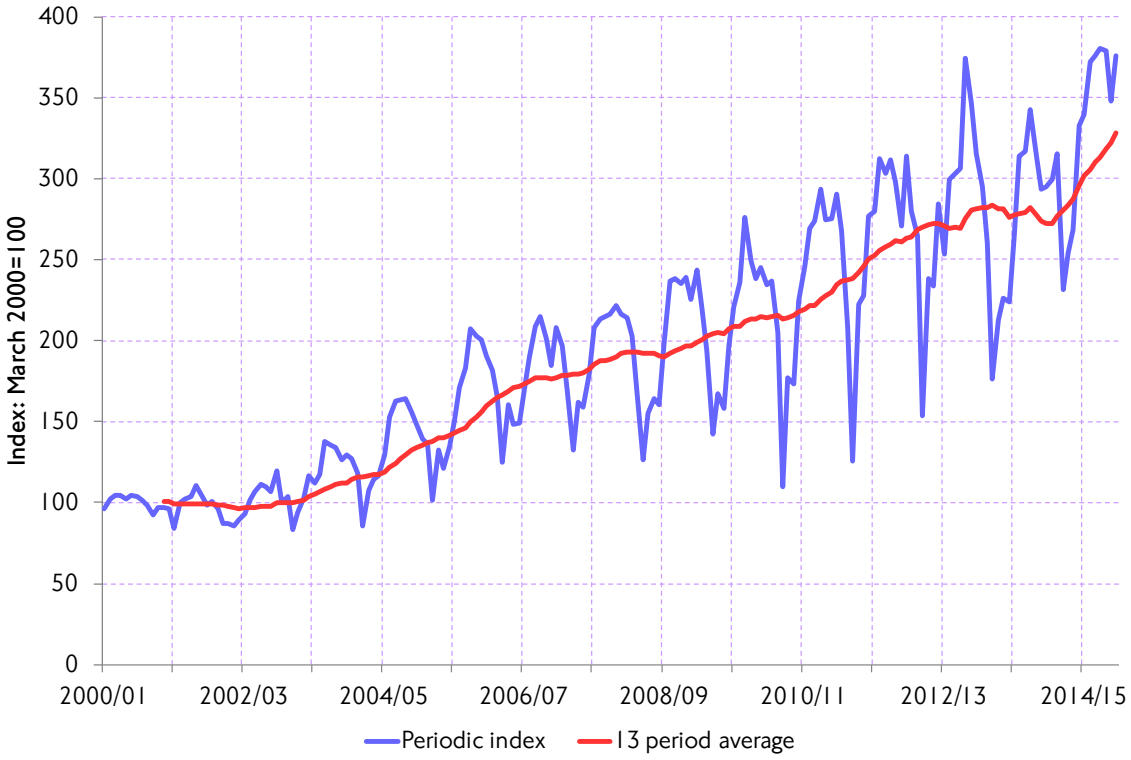
Source: TfL Planning, Strategic Analysis.

Cycle flows on major roads in London

TfL monitors levels of cycling on the TLRN major road network through data collected by automatic cycle counters. Figure 3.32 shows the data as an index with base year of 2000/01, calculated as the average daily cycle flows within each four-week reporting period.

Between 2000/01 and 2013/14, the index increased by 196 per cent overall. Following a nine per cent increase between 2010/11 and 2011/12, the index increased by a further 1.4 per cent in 2012/13 and in the 2013/14 financial year the index grew by 7 per cent, mainly due to strong growth during the first few months of 2014. The chart illustrates these seasonal variations in cycling, with peaks and troughs in the series corresponding with summer and the Christmas and New Year holidays respectively.

Figure 3.32 Trends in cycle flows on the TLRN – annualised and periodic indices.



Source: TfL Surface Transport, Outcomes Delivery.

Cycling on the TLRN in 2014

Initial data for 2014/15 suggests strong growth in cycling on the TLRN in the first half of the financial year. Compared against the equivalent time periods, cycle flows on the TLRN are 20.0 per cent higher than 2013/14. Cycle flows have been higher than in any other year in four of the first seven periods of 2014/15.

TfL is developing new measures of cycling to monitor the impacts of the Mayor's Vision for Cycling in London. TfL's broad approach is summarised in section 3.16 of this report. One aspect of this work will be the development of new area-based measures of cycle volumes, starting with central London.

Cycling flows across strategic counting cordons and screenlines

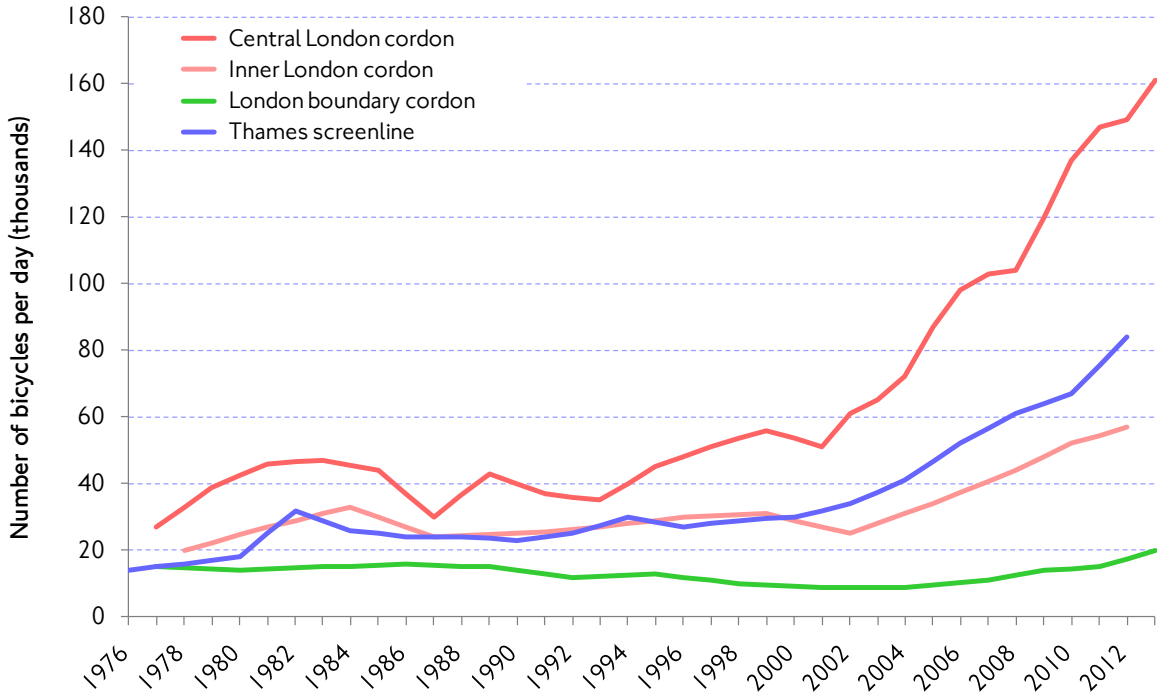
Figure 3.33 shows the number of cycles crossing the three strategic counting cordons in London (central, inner and London boundary) and the Thames screenline between 1976 and 2013. These data are the total number of cycles crossing the cordon in a full weekday (24-hours). Surveys are taken at the same time of year, to ensure that there is no seasonal bias.

The long-term trends are clear, with cycling levels at all cordons remaining broadly constant until the year 2000, after which they started to increase. Rates of growth are highest at the central cordon and on the Thames screenline, with cycle flows at the Thames screenline growing by 25 per cent between 2010 and 2012. Flows across the central cordon surrounding central London (not the same as the

Congestion Charging zone) grew by 8.1 per cent in 2013, following slower growth of 1.4 per cent in 2012, with flows more than 200 per cent higher than in 2001.

Growth has also occurred at the inner and boundary cordons, although the growth started later and at a much lower rate than in central London. Cycle flows at the inner cordon increased by 10 per cent between 2010 and 2012 (the last available year of data). Flows at the boundary cordon also increased in 2013, and were 33 per cent higher than in 2011. However, cycle flows across the central cordon are more than twice as high as the inner and boundary cordon flows combined.

Figure 3.33 Long-term trends in cycling across strategic cordons and screenlines in London, 24-hour weekdays, both directions.



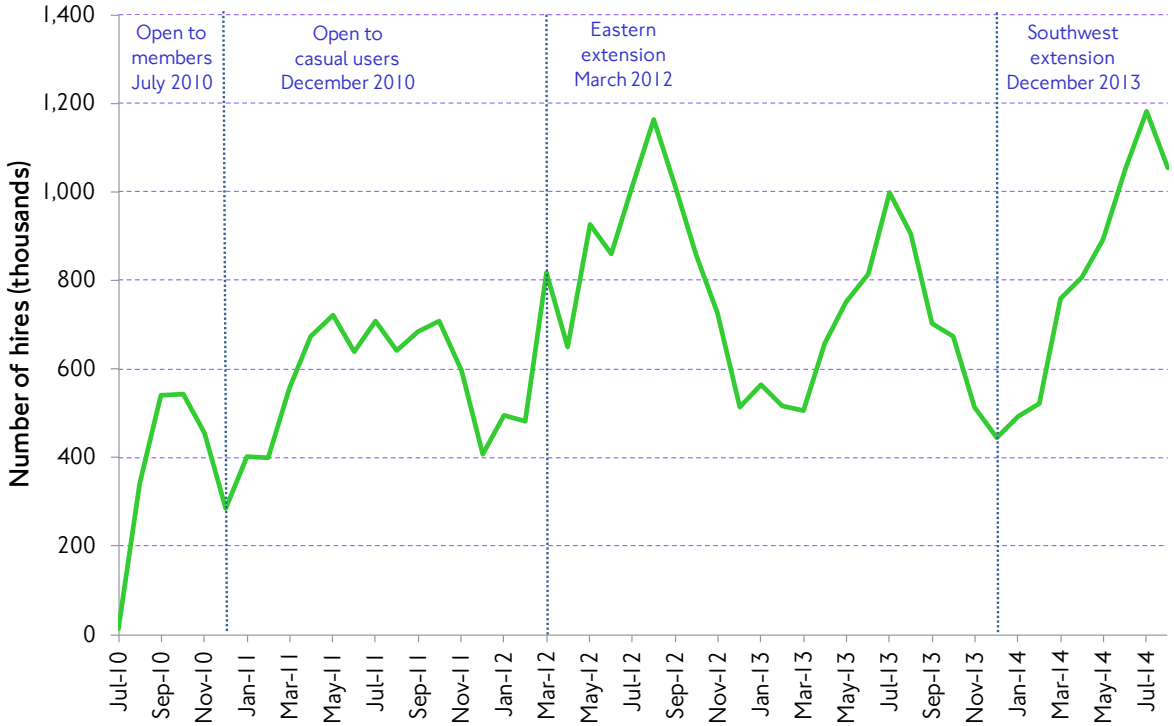
Source: TfL Surface Transport, Outcomes Delivery.

Barclays Cycle Hire in central and inner-east London

The Barclays Cycle Hire scheme began in July 2010. Since then there have been progressive enhancements, including the opening up of the scheme to casual members in December 2010, an expansion to the east in 2012 and an expansion to the south west in late 2013.

In the financial year to March 2014, there were a total of 8.2 million cycle hires, down from 9.3 million to March 2013. This should be viewed in the context of an exceptional year in 2012/13 including the Games in summer 2012 and the extension of the scheme to east London. The south west extension was launched in December when cycling levels are typically at their lowest. For this reason, the impact of the south west extension only becomes apparent in summer 2014, with July 2014 having the highest number of hires since the scheme began (Figure 3.34).

Figure 3.34 Trend in monthly cycle hires by type of hire. Barclays Cycle Hire scheme.



Source: TfL Surface Transport, Outcomes Delivery.

3.16 Focus: Monitoring the impacts of the Mayor's Vision for Cycling in London

In March 2013 the Mayor of London launched his Vision for Cycling in London, a plan of action designed to achieve the ambitious objective established in the Mayor's Transport Strategy (MTS) of increasing cycling levels by 400 per cent. The Vision seeks transformational change to conditions for cycling in London, with a 10-year, £913m programme of investment in new and improved infrastructure alongside a range of related initiatives to improve the quality, safety and attractiveness of the cycling experience in London. This chapter outlines TfL's emerging proposals for a comprehensive outcomes/impacts monitoring strategy for the Mayor's Vision for Cycling.

The Vision sets out clear objectives for this investment in terms of expected outcomes. Part of TfL's work to implement the Mayor's Vision involves putting in place a programme of objective monitoring, including surveys, studies and other research, to verify that the key goals are being achieved. Feeding back early insights on progress to enable future investment to be based on the latest evidence, and better understanding the processes at work such as the degree of 'market penetration' being achieved, are important aspects of the work. It is also important to understand the wider implications of these changes, for example the extent to which they affect patronage on - and conditions for - other modes of transport, since the Mayor's 'cycling revolution' must take place against the backdrop of wider transport changes in London.

The Mayor's Vision for Cycling in London

The Mayor's Vision for Cycling targets four related key outcomes:

A Tube network for the bike

The London cycle network will offer two clear kinds of branded route. High-capacity **Cycle Superhighways** will offer direct routes, mostly on main roads. **Quietways** will be formed of routes on quieter back streets, taking in off-street sections through green spaces and along waterways; these are primarily targeted at those wanting a more relaxed journey.

In central London, Quietways will connect with Superhighways to form a dense '**Grid**' network of cycling routes. These will be supported by new on-street wayfinding to make them easy to navigate, and will transform the experience of cycling in the busiest parts of London. The East-West and North-South Cycle Superhighways will form part of the Grid.

Three outer London boroughs will undergo radical transformation through the **'Mini-Hollands'** programme to make them as cycle-friendly as their Dutch counterparts. With a range of infrastructure interventions and related initiatives in each borough, this programme concentrates high levels of spending on relatively small areas to generate a step-change in cycling levels in these locations.

Collectively, these initiatives are intended to create a coherent, joined-up and branded network, with a level of recognition and geographical simplicity to emulate that of the Tube network.

Safer streets for the bike

Cycling safety remains a powerful disincentive to many potential cyclists as well as a worry for experienced cyclists. The Vision seeks a 'smart, targeted approach' designed in particular to tackle the primary causes of collisions involving cyclists (eg junction design). The 'Tube network for the bike' infrastructure programmes will improve safety for cyclists along the routes and in those areas. The Better Junctions programme is also improving the safety of cycling at key junctions by redesigning these junctions and introducing physical interventions in order to address actual and perceived dangers for cyclists. Overall, more people making journeys by bike should create a safer environment for cycling.

More people travelling by bike

Previous analysis by TfL demonstrated the large untapped potential for cycling in London [5]. It was estimated that approximately 4.3 million 'potentially cyclable' trips in London are made by mechanised modes on an average day. These are mostly short trips which could be very reasonably cycled: over half are under 3km in length and would take around 12 minutes to cycle. Nearly two thirds of all potentially cyclable trips are made by car, especially in outer London; the remainder are largely made by bus. In total, there are nearly 3.5 million trips made every day in London which would take less than 20 minutes for most people to cycle.

Key to realising this potential is ensuring that cycling is, and is seen as, a mainstream and safe mode of transport that attracts people of all ages and backgrounds. The 'Tube network for the bike' infrastructure programmes will support safer and more comfortable cycling, making cycling a more feasible and attractive travel option. Other specific measures in the Vision are designed to target and support particular journey purposes, demographics or cycling in certain areas. These include the creation of cycle hubs and 'superhubs' at strategic locations such as rail stations,

provision of cycle parking, initiatives involving children and cycling to schools, development of the Cycle Hire scheme, and a range of promotional events designed to grow the profile of cycling.

Better places for everyone

Central to the Mayor's Vision for Cycling is that more cycling should benefit everyone – through making places more attractive, 'liveable' and safe. The cycling infrastructure being delivered as part of the Vision can improve the urban realm in many ways, as well as enhance local economic vitality. The Vision includes measures to improve the behaviour of cyclists and the perception of them amongst the wider public. The potential to shift journeys currently made by public transport to bike can contribute to relieving the pressure on public transport, particularly in central London. In terms of public health, there will be improvements to personal health through increased physical activity, as well as net improvements to air quality and reduced greenhouse gas emissions.

TfL's approach to measuring and understanding the outcomes of the Mayor's Vision for Cycling

Monitoring the outcomes of the Mayor's Vision for Cycling will require a multi-disciplinary programme of surveys and research. These would be targeted at understanding progress towards the key outcomes identified above, but also set firmly in the wider context of the Mayor's Transport Strategy, subsequent initiatives such as the Roads Task Force Vision, and the wider set of indicators, trends and concerns described elsewhere in these Travel in London reports. This section briefly reviews the main considerations that affect the scale and scope of the monitoring work and explains the main methodological decisions that need to be considered.

Top-level objectives for monitoring work

At the top level, TfL has identified four main objectives for the monitoring work:

- To provide a small number of simple, readily-communicable measures to track performance against the goals of the MTS and the Mayor's Vision for Cycling, alongside a wider body of evidence for analysis/interpretation of impacts and trends.
- To provide a consistent and robust approach to measuring outcomes across projects of different types, so that schemes and findings can be compared, and relative contributions assessed.
- To collect evidence about the efficacy of various interventions, from specific junction layouts or light segregating objects such as traffic wands to programmes like the Quietways. This is to enable future policy making to be evidence-led such that investment can be targeted to greatest effect. This also includes improving the evidence base for the development of predictive modelling tools for cycling.
- To ensure that TfL can understand the wider implications of developing cycling in London, in the context of other MTS goals, related transport schemes and policies, and wider trends and developments affecting transport in London.

Identifying the indicators to be measured

Looking across the outcomes targeted by the Mayor's Vision for Cycling, and taking stakeholder and other technical priorities into account, it is possible to identify 12

Table 3.5 Strategic outcomes for the Mayor's Vision for Cycling monitoring programme.

Monitoring objective	Examples of indicators
Track progress towards strategic (MTS) cycling targets	Change in cycle journey stages 2001-2026 (400 per cent target) Cycle mode share (all journey stages) Contributions to growth and reasons for this
Understand the potential 'market' for cycling and penetration achieved	Baseline evidence for forecasting demand Barriers specific to socio-demographic groups 'Market penetration' for potentially-cyclable trips
Quantify cycle volumes on the principal networks/other London geographies	Kilometres cycled on each cycle infrastructure type Cycle volumes/mode shares at specific count locations Cycle trends on all roads (eg 'controls')
Understand the characteristics of cycle trips (length, purpose, etc.)	Origins/destinations Journey length, times, purpose etc. Relative use of/influence of infrastructure
Understand the characteristics of cyclists and how this is changing	Socio-demographic characteristics Level of experience as cyclist Process of mode transfer
Understand the motivations and constraints applicable to cycling and how they change	Reasons for choosing to cycle in relation to alternatives Perceptions/experience of cycle safety Cycling propensity among different groups
Track experience and satisfaction of cyclists	Cyclists' evaluation of the new infrastructure Recognition/impact of improvements under the Mayor's Vision for Cycling Evaluation of overall conditions for cycling in London
Understand attitudes of wider population to cycling	Evaluation of streetscape/urban realm improvements Attitudes of non-cyclists to cycling Perceptions of cyclist behavior
Cyclist safety – trends, understanding, mitigation	Collision/KSI statistics Incremental impact of new infrastructure/initiatives Perceptions of safety
Understand impact on other transport modes	Impact on other aspects of road network operation Modal transfer from public transport modes Economic vitality of town centres
Identify and apportion the incremental impact of specific schemes	Effectiveness of specific configurations and elements Networks vs. area-based schemes (eg Mini-Hollands) New cyclists vs. more trips by established cyclists
Better understand and quantify the wider impacts of cycling	Health impacts and benefits Impact of cycling initiatives on local economies Impact of cycling initiatives on urban realm

'strategic objectives' for the monitoring work (see table 3.5). Three examples of the specific aspects to be measured or understood under each heading are given for illustration. These examples can be developed into a comprehensive list of indicators that can be cross-referenced against a range of potential research methodologies, to optimise the use of existing monitoring and identify new surveys and research.

Basic methodologies available

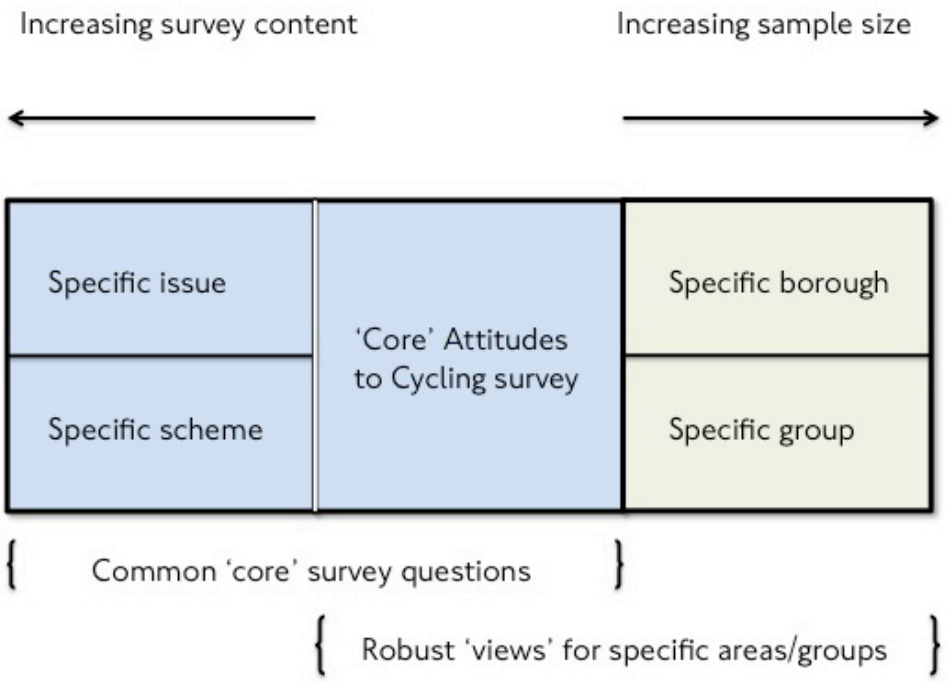
In general terms there are four main types of survey/research that can be deployed as part of the Mayor's Vision for Cycling monitoring work. These are:

- **Cycle volume count surveys**, undertaken either specifically for cyclists or as part of an 'all road modes' classified traffic count. Counts are optimal for gauging volumes across points, networks or areas, but reveal nothing about characteristics of cyclists or cycle trips.
- **On-street intercept and follow-up surveys** which intercept cyclists who are using a piece of infrastructure and follows them up with a questionnaire, typically online. These are optimal for establishing usage patterns, trip characteristics, socio-demographics and motivations of users, as well as responses to specific infrastructure or specific features of infrastructure.
- **General or specific attitudinal surveys,** for example TfL's established *Attitudes towards Cycling* (AtC) survey which covers both cyclists and non-cyclists. Surveys of this type are optimal for understanding market penetration and views/experiences of non-cyclists.
- Finally, a wide range of **case studies** can be deployed, involving primary data collection, secondary analysis or detailed qualitative investigations. These are optimally targeted at answering specific research questions – particularly around the 'non-infrastructural' elements of the Vision such as looking at the travel behaviour of school children or examining collision rates and types in relation to specific elements of infrastructure.

Modular surveys

'Modular surveys' is an important concept underpinning the Vision monitoring. It refers to either; the use of a common survey or questionnaire framework that can be selectively extended to cover additional aspects or indicators of interest, or the use of a common survey content with a modular sample that can be optimised to give the required statistical precision for specific geographic areas, infrastructure elements or socio-demographic groups (ie sample stratification). In some cases, it will be appropriate and optimal to extend both the survey content and the sample coverage.

Figure 3.35 The modular approach to cycling surveys as exemplified by TfL's Attitudes towards Cycling survey.



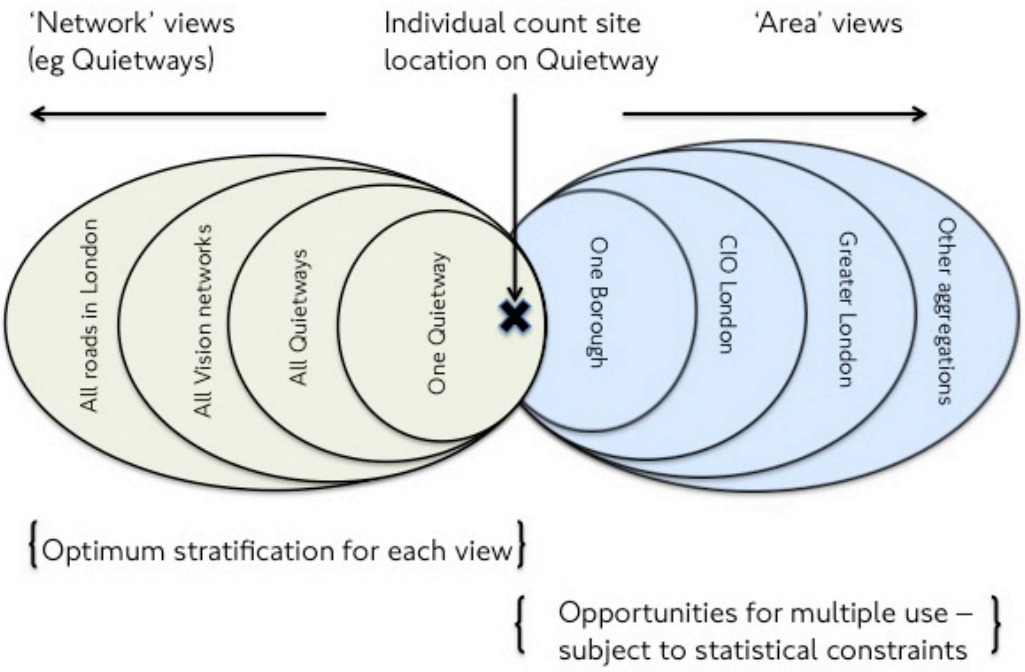
Source: TfL Planning, Strategic Analysis.

The way this would work is best understood by referring to two examples. TfL's existing *Attitudes towards Cycling* survey is a long-standing tracker survey of the attitudes of London residents to aspects of cycling in London. It provides valuable feedback on how Londoners (both cyclists and non-cyclists) perceive aspects such as safety and the quality of cycling facilities, and provides several measures around the propensity of individuals to cycle.

In its 'basic' form it is undertaken twice per year among a representative sample of around 1,000 Londoners, giving good statistical precision for comparisons at the London-wide/broad socio-demographic group level. However, the Mayor's Vision for Cycling introduces several new interventions - such as the Quietways and Mini-Hollands programmes - for which specific feedback will be required but are not covered by the existing survey. These can be covered by developing specific questionnaire sections (modules) administered alongside the core content of the 'basic' survey - giving specific feedback and valuable cross-cutting relationships.

In a similar way, understanding exactly why some 'hard to reach' groups are not taking up cycling to the same extent as others can be addressed through sample boosts, targeted at giving necessary sample size for these groups to allow statistically precise feedback. Figure 3.35 illustrates these ideas.

Figure 3.36 Illustration of multiple uses for a single cycle volume count or intercept survey interview site.



Source: TfL Planning, Strategic Analysis.

Similar logic can be applied to cycle volume counts and intercept surveys of cyclists on the new infrastructure networks (figure 3.36). Here, a single count or interview site can form part of several independent sample strata, producing a good site-specific estimate of cycle volumes for local studies as well as contributing to infrastructure-specific, network, or area-based measures (eg central, inner or outer London) of cycling volumes, journey characteristics or the cyclist experience.

Next steps

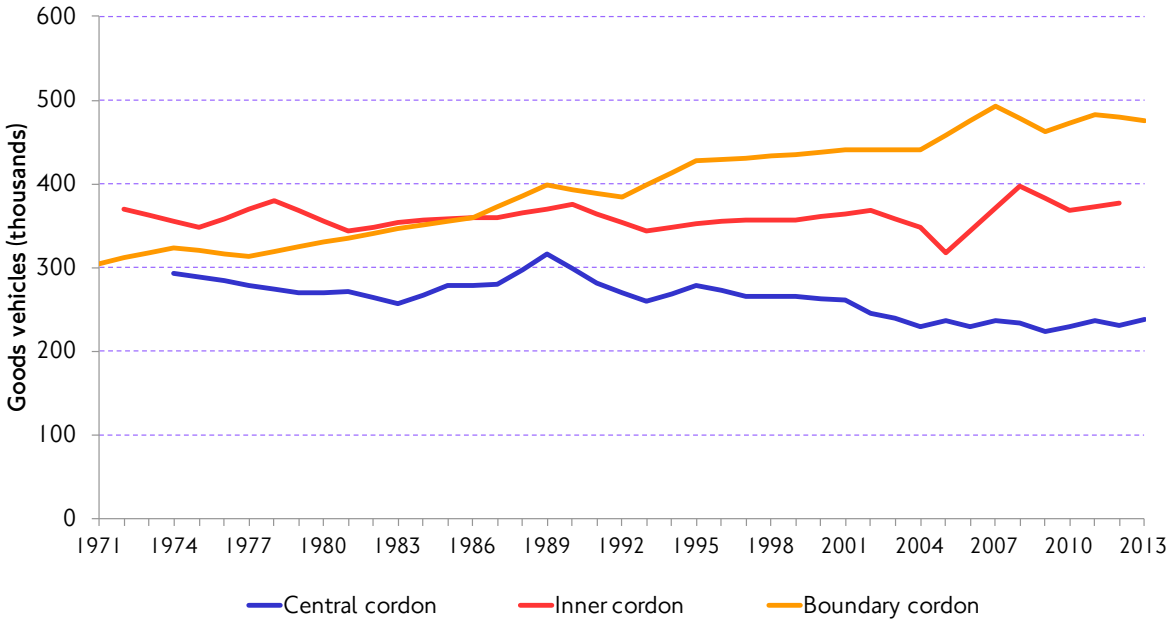
TfL will continue to develop these ideas with stakeholders and expects to progressively put in place elements of the monitoring over the coming year. Findings will be published at intervals, either through future Travel in London reports or via other channels.

3.17 Modal trends: Road-based freight and servicing

Trends in freight and servicing vehicles

Road is by far the dominant mode for goods transport in London in terms of the weight of goods lifted. Goods vehicles are monitored as part of TfL's Cordon & Screenline counts. Figure 3.37 shows the trends in the volume of freight vehicles crossing the central, inner and boundary cordons, corresponding to central London, inner London and the GLA boundary respectively.

Figure 3.37 Daily total goods vehicles crossings at the three cordons: 24 hour flows, 1971-2013.



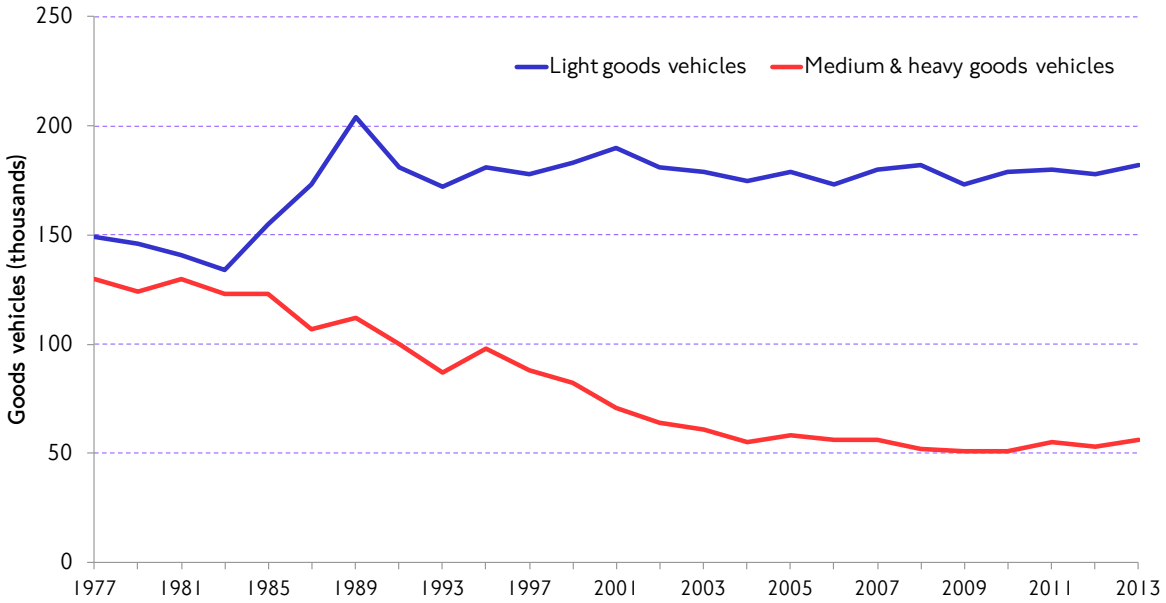
Source: TfL Surface Transport, Outcomes Delivery.

Goods vehicle traffic crossing the central cordon declined steadily from the late 1980's to 2009, when it reached its lowest level in the series during the peak of the recession. Since then there have been minor fluctuations around the pre-recession mean. It now stands approximately 20 per cent below volumes in the 1970s. Goods vehicle traffic crossing the inner cordon is now only 2 per cent greater than the volumes observed in the 1970s and has remained relatively stable throughout the series, although with some fluctuations during the previous decade. Goods vehicle traffic crossing the boundary cordon has increased steadily since the 1970s and is now 56 per cent higher than in 1971 (all of these in terms of the numbers of vehicles observed).

Looking more closely at the central cordon (figure 3.38), it can be seen that the decline in goods vehicle traffic has largely come from a decline in medium and heavy goods vehicles. Over the past 20 years, light goods vehicle volumes have

remained stable, while medium and heavy goods vehicle volumes have almost halved in number (mostly in the period 1993 to 2003).

Figure 3.38 Daily total goods vehicles crossings at the central cordon: 24 hour flows, 1977-2013.



Source: TfL Surface Transport, Outcomes Delivery.

Looking at 2012, the latest year for which complete data is available:

- All goods vehicles ('light' goods vehicles up to 3.5 tonnes - LGV and 'heavy' goods vehicles over 3.5 tonnes - HGV) travelled a total of 4.8 billion vehicle kilometres on London's roads. Approximately 80 per cent of these were performed by LGVs (ie up to 3.5 tonnes gross weight), and 20 per cent by HGVs (15 per cent by rigid goods vehicles and 5 per cent by articulated goods vehicles).
- LGVs are estimated to have performed approximately 60 per cent of their total distance travelled in London in 2012 on major roads and 40 per cent on minor roads, compared to approximately 80 per cent and 10 per cent for HGVs.
- LGVs were responsible for 13 per cent of the vehicle kilometres travelled by all motorised road vehicles in London in 2012, whereas HGVs were responsible for 4 per cent.

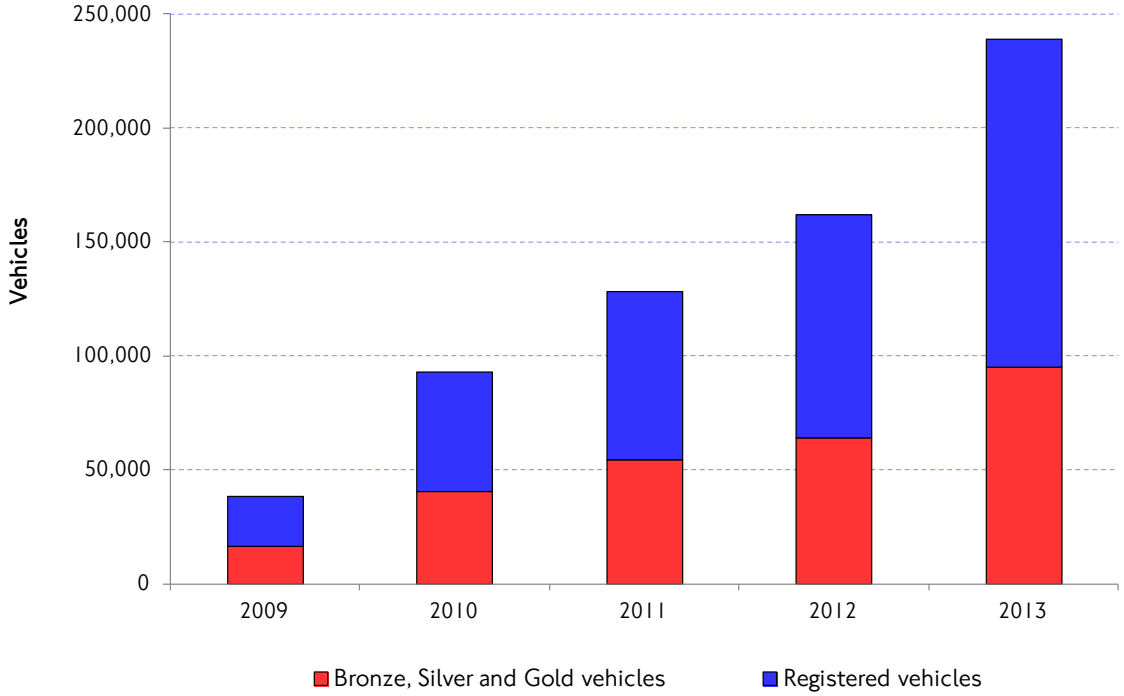
London Fleet Operator Recognition Scheme (FORS)

The Fleet Operator Recognition Scheme (FORS) is a voluntary accreditation scheme for fleet operators [6]. Its purpose is to raise the level of quality within fleet operations, and to demonstrate which operators are achieving the standards. FORS provides operators with practical advice and guidance to help reduce fuel consumption, CO_2 emissions, vehicle collisions, and penalty charges through improving driver behaviour, vehicle and fleet management, and safety and efficiency in transport operations.

FORS uptake is reported against the Mayor's Transport Strategy freight target of 50 per cent of commercially registered delivery and servicing vehicles operating regularly in London to be FORS accredited by 2016. In November 2014, 210,000

vehicles were accredited at bronze, silver or gold levels, which equates to 41 per cent of the 516,641 unique commercially registered vans and trucks that were seen in London 5 or more times in the year (2012) (see figure 3.39).

Figure 3.39 Number of FORS accredited vehicles, 2009 to 2013.



Source: TfL Freight Unit, 2014.
Note: Data is for the end of March each year except 2014.

On joining FORS an organisation and its depot fleet receive registered status. There are three levels of FORS certification (bronze, silver, and gold) that can be achieved by companies and their fleets based on their attaining the required standards.

TfL requires that all businesses working for or on behalf of it take measures to improve the Work Related Road Risk (WRRR) standards of its goods vehicles to help reduce the risk of collisions with cyclists and other vulnerable road users. These WRRR standards require that operators working for TfL have at least Silver status in the Fleet Operator Recognition Scheme (FORS), vehicles are fitted with close proximity warning systems, Class VI mirrors and rear warning signs, drivers are trained in approved safe urban driving practices, and drivers' licences are checked regularly with the DVLA.

As part of the Construction Logistics and Cycle Safety (CLoCS) [7] initiative, a large number of construction companies such as Mace, Wilson James and Skanska are introducing similar requirements for all their sites nationally. This has led to a significant increase in the number of FORS accredited vehicles.

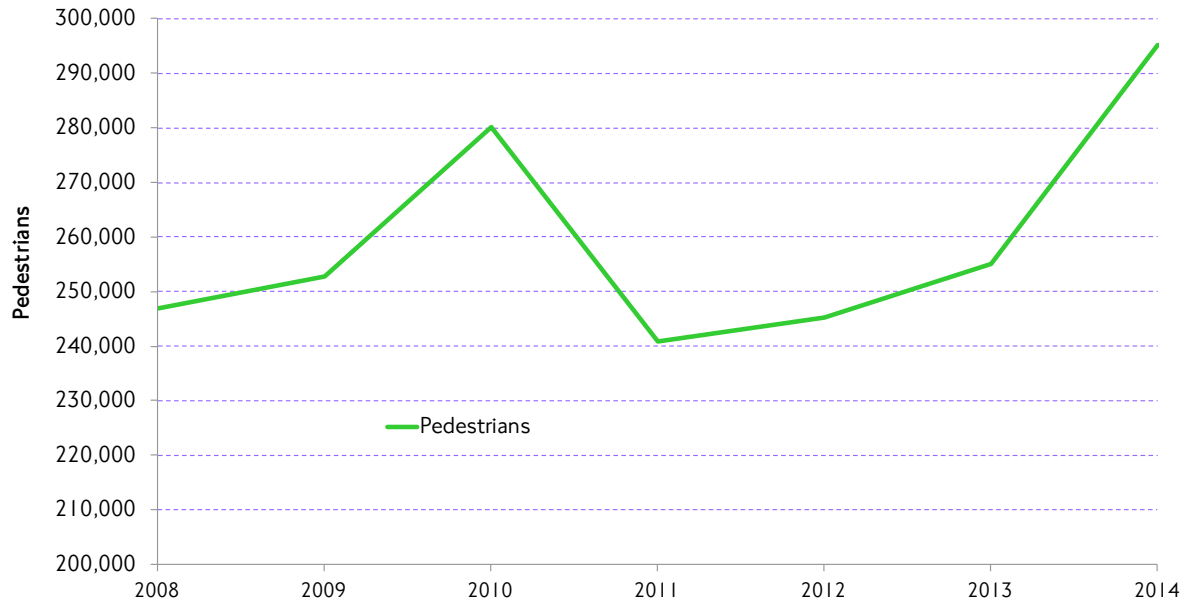
In April 2014, LGVs accounted for approximately 50 per cent terms of the vehicles in FORS, HGVs for approximately 35 per cent, cars for 13 per cent and coaches and minibuses for approximately 3 per cent.

3.18 Modal trends: Walking

Walking accounts for 21 per cent of all journey stages in London. An overview of data on walking and relevant trends was given in Travel in London report 6.

TfL monitors pedestrians crossing each of the 30 bridges and foot-tunnels crossing the Thames, as well as foot passengers on the Woolwich Ferry. Figure 3.40 shows the total pedestrian volumes in the period 7am to 7pm for a typical spring day on these crossings (counts are undertaken at a consistent time of year to avoid seasonal bias).

Figure 3.40 Weekday pedestrian volumes on Thames crossings (7am – 7pm).



Source: TfL Surface Transport, Outcomes Delivery.

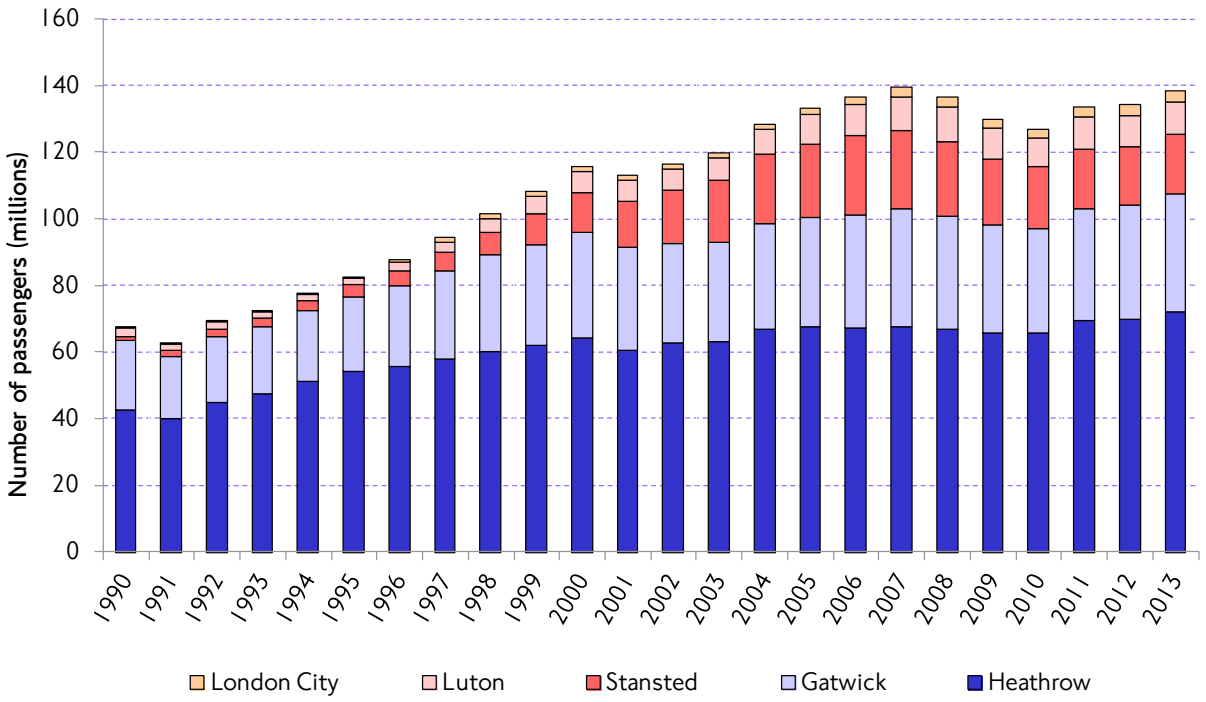
Pedestrian volumes on monitored bridges and tunnels have been increasing since 2011, with the highest level ever recorded in 2014. This trend however needs to be interpreted in terms of factors such as the weather and increases in the resident population and number of visitors (see chapter 2 of this report). The impact of the London Games in 2012 is not evident in these (spring) counts, since the Games were later in the year, but this aspect was covered extensively in Travel in London report 5. Note also the origin point of the figure.

3.19 Other modes – travel demand trends

Travel by air

London has five international airports, of which two are among the 10 busiest airports in Europe. Heathrow saw its highest ever number of passengers in 2013, with 72.3 million passengers, up from 70.0 million in 2012. Heathrow accounted for 52 per cent of London's air passengers, with Gatwick accounting for 25 per cent. Overall there was an increase of 3.3 per cent in the total number of passengers using London's airports between 2012 and 2013, taking numbers back towards the pre-recessionary peak of 2007 – looking at the recent trend, the impact of the recession, and recent slow recovery, are clearly evident (figure 3.41).

Figure 3.41 Terminal passengers by London area airport.



Source: Civil Aviation Authority.
Note: Terminal passengers are those passengers either joining or leaving an aircraft, including interlining and transfer passengers.

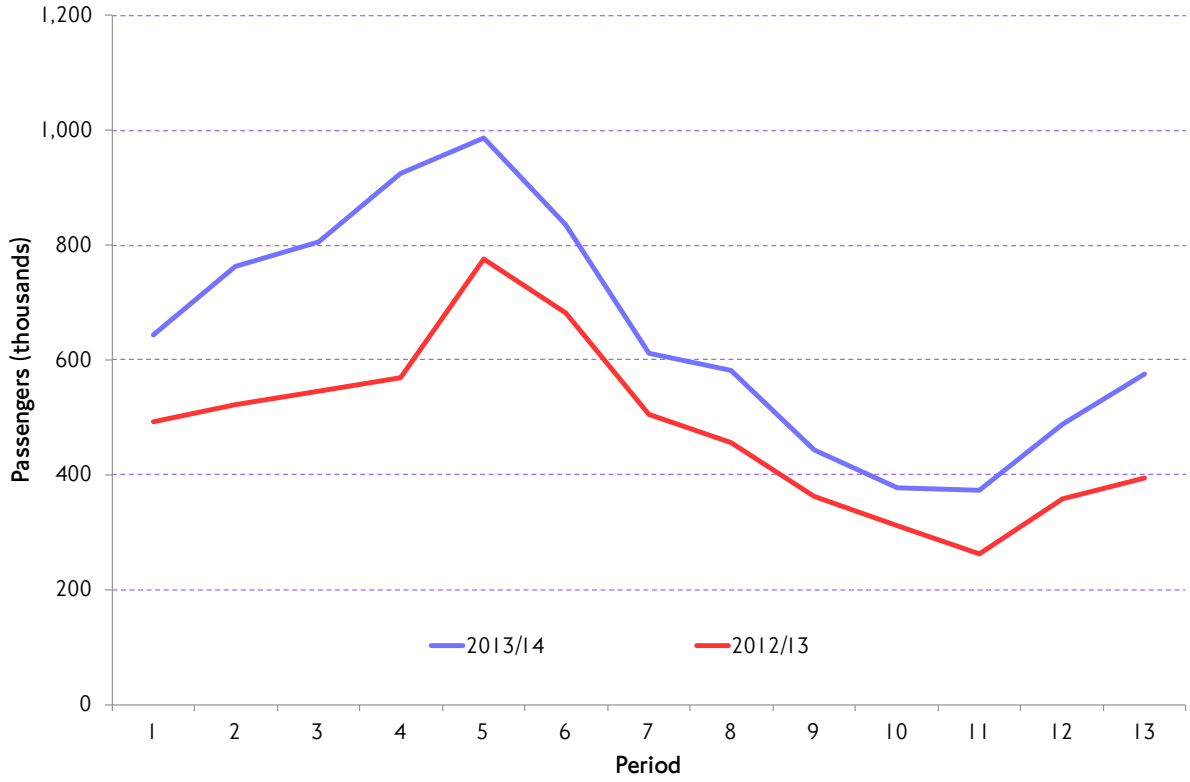
River Services

Patronage on TfL's River Services has seen strong growth in recent years, with more than 8.4 million passengers carried in 2013/14.

At the start of 2013/14, a new method of counting passengers was introduced that is intended to give more accurate information based on a full count of boarders and persons alighting at each pier, rather than previous data based partly on boarders and partly on ticket sales. This means that patronage numbers for 2013/14 are not directly comparable with those from previous years.

Figure 3.42 shows data for the whole of 2012/13, based on the previous system of counting, and data from the start of 2013/14 based on the new system. It is not possible to give a precise comparison at present in terms of change over the past year. However, it is estimated (from trials using both methods of counting in parallel) that, like-for-like, there was an approximate 15 per cent increase in passengers in 2013/14 over the previous year, in part reflecting the favourable weather experienced in summer 2013 and the increased number of visitors to London.

Figure 3.42 Passengers using TfL's River Services. Estimates for 2012/13 against 2013/14 (based on new counting method).



Source: TfL River Services.

Licensed London taxis and private hire vehicles

At the end of 2013/14 there were 25,538 drivers in London licensed to ply for hire – an increase of 0.3 per cent on 2012/13. There were 22,810 licensed taxis – an increase of 2.9 per cent on 2012/13.

The year 2013/4 saw a 5.9 per cent increase in the number of licensed private hire vehicles, alongside a 2.0 per cent decrease in licensed private hire drivers.

The latest year saw a return to a long-term upward trend among licensed vehicles of both types, following small reductions in the previous year as a possible result of vehicle age limits coming into effect.

3.20 Focus: Car clubs

Car clubs in London

Car clubs give people access to a vehicle on a pay-as-you-go basis. This can be appropriate for those who don't want to own a car but still have occasional need for one, or for business use, in place of car pool vehicles. Car clubs are supported in London Plan policies 6.2 and 6.11 and 6.13 as a means to promote sustainable travel, smooth traffic flow, tackle congestion and implement sustainable levels of car parking in developments. Car clubs arrived in London in 2003. Since then, membership and car numbers have increased steadily and 2013/14 saw an acceleration of the introduction of hybrid and electric vehicles.

There are a number of variations on how car club schemes operate. In the UK, the main model to date has been the round-trip or 'back to base' scheme, where the

member rents a vehicle from a designated bay (usually on-street and controlled by the host Borough) and returns it to the same location at the end of the rental period. A more recent innovation is the emergence of one-way or 'point-to-point' schemes, whereby cars are available for one-way rentals and can be dropped off at a location other than the pick-up point.

TfL produced a car clubs strategy document in 2008 [8]. TfL, GLA, club operators, Carplus and London Councils are currently collaborating on an updated strategy due for release in March 2015.

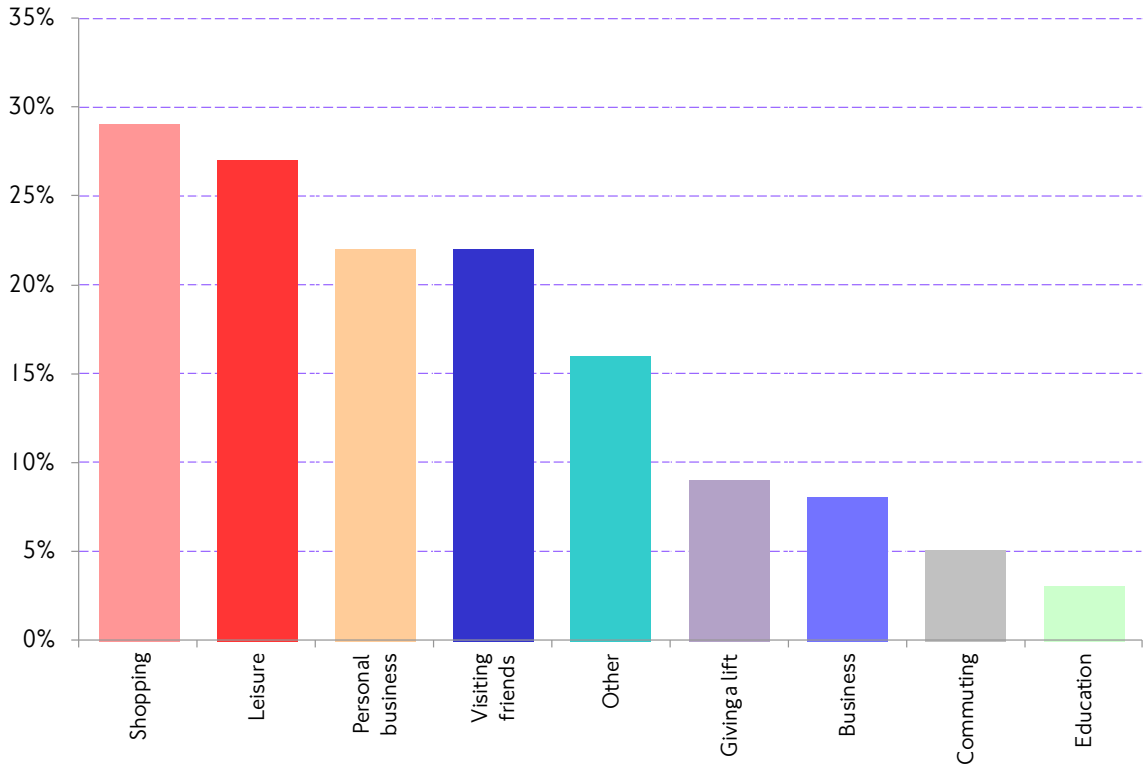
The evidence base from the Carplus annual survey

Carplus is a not-for-profit, environmental transport NGO (non-government organisation) that promotes accessible and low-carbon alternatives to traditional car use in the UK. They run an accreditation scheme for car club operators and provide information, advice and consultancy. Since 2007, Carplus has commissioned an annual survey of members of accredited car clubs with funding support from TfL. Key findings from the 2013/14 London survey are:

- The current number of car club members in London stands at 137,000. This is approximately two per cent of London's adult population or about 3.4 per cent of driving licence holders.
- Fifty per cent of Londoners have access to a car club car within a five minute walk of where they live.
- The car club fleet in London is 99.9 per cent Euro 5 or Euro 6 air quality standard compliant, with the remaining 0.1 per cent meeting the Euro 4 standard.
- The average CO_2 emissions of the car club fleets in London are 33 per cent lower than the national average car fleet and have shown a 17 per cent improvement from the car club fleet average reported in 2011.
- Some 80 per cent of car club members don't own a car and 72 per cent did not travel in a household car in the past year.
- Car club members are more likely to use sustainable travel options including public transport, walking and cycling with one in three being regular cyclists and 53 per cent regularly travelling by Underground.

The following figures illustrate several aspects of the car club 'market' in London. Figure 3.43 shows the journey purposes for which people use car club vehicles, in terms of the journey purpose of the 'last trip made'. There is, as might be expected, an emphasis on 'non-regular' journeys, the nature of which are particularly appropriate for the car club business model. Respondents could pick more than one purpose for their journey and just over one in four trips included shopping, closely followed by leisure. While it suggests that only a small proportion of car club trips are for business purposes, this is probably an under-representation as this part of the survey covers private users; corporate users are surveyed separately and most business use is captured there.

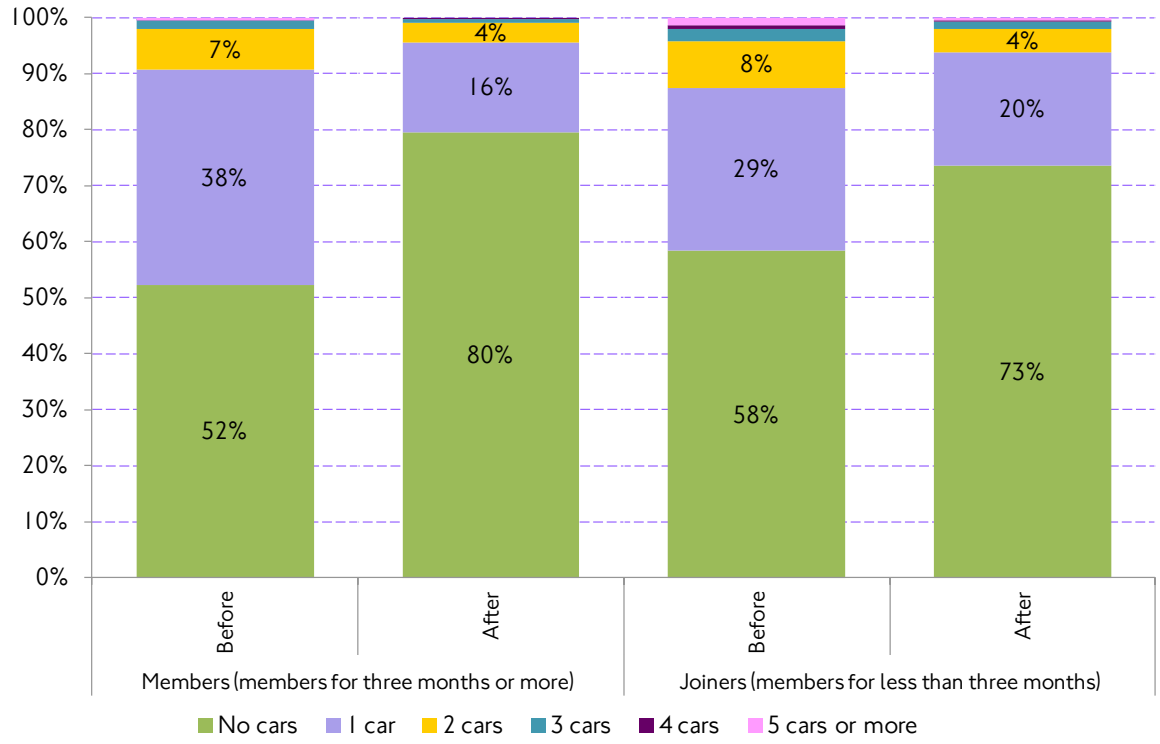
Figure 3.43 Car clubs in London – journey purpose breakdown for 'most recent trip' using a car club vehicle.



Source: Carplus annual survey 2013/14.
Base: 2,413 respondents.

In the Carplus survey report, respondents who had joined the car club in the three months prior to completing the survey are referred to as 'joiners'. Respondents who had joined before this time are referred to as 'members'. This distinction enables ongoing changes in travel behaviour to be tracked as new joiners become more familiar with their car club membership. For example figure 3.44 shows that while both members and joiners reduce their car ownership after joining the car club, members consistently have lower car ownership than joiners. This suggests that not only does car ownership reduce on joining the car club initially; it then continues to fall as car club use becomes more established as part of users' behaviour.

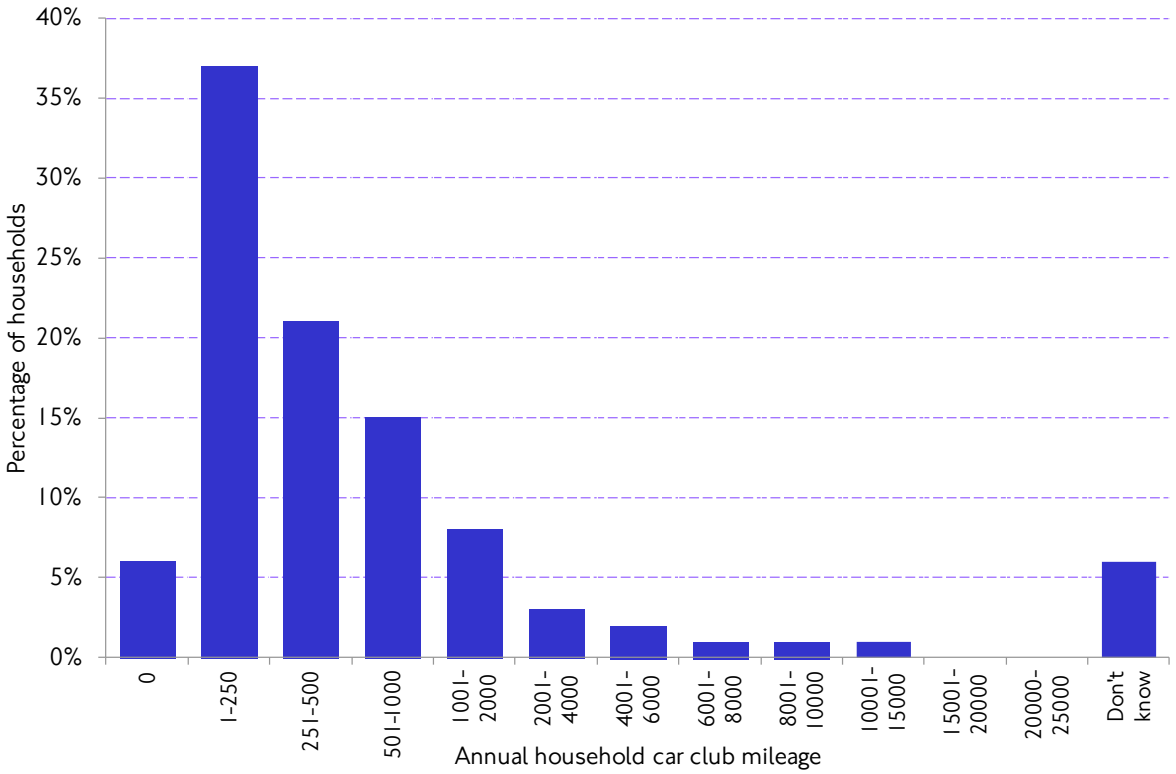
Figure 3.44 Car clubs in London – car ownership before and after joining a car club.



Source: Carplus annual survey 2013/14.
Base: 2,413 respondents.

Figure 3.45 shows the annual household mileage of London car club members in car club vehicles. In the 12 months prior to completing the survey 64 per cent of all members' households travelled less than 500 miles in car club vehicles.

Figure 3.45 Car clubs in London – members' annual household mileage in car club vehicles.



Source: Carplus annual survey 2013/14.
Base: 2,413 respondents.

About 20 per cent of car club members also have household cars that are used in addition to car club vehicles. The average annual household car mileage among this group using both car club cars and household cars was 2,165 miles. This compares to National Travel Survey data of an average 5,029 miles driven per year among households with a least one full car licence holder. Therefore, average annual household mileage among London respondents who had been car club members for three months or longer was 57 per cent lower than the average of all licence-holding households in London. It should be noted that this does not indicate a 57 per cent reduction in miles travelled resulting from being a member of a car club, as current car club member households were already likely to be driving less than the London average before joining the car club.

TfL research into the potential of car clubs in London

The Roads Task Force was set up by the Mayor of London in July 2012 to tackle the challenges facing London's streets and roads. As part of work to take this forward, in April 2014 TfL commissioned a survey of 1,544 London resident licence holders to:

- Understand licence holders' attitudes towards various types of car clubs;
- Gain insight into perceived barriers to membership;
- Explore attitudes to parking and the relationship between parking costs/availability and the attraction of car clubs;
- Explore various policy combinations capable of stimulating membership uptake.

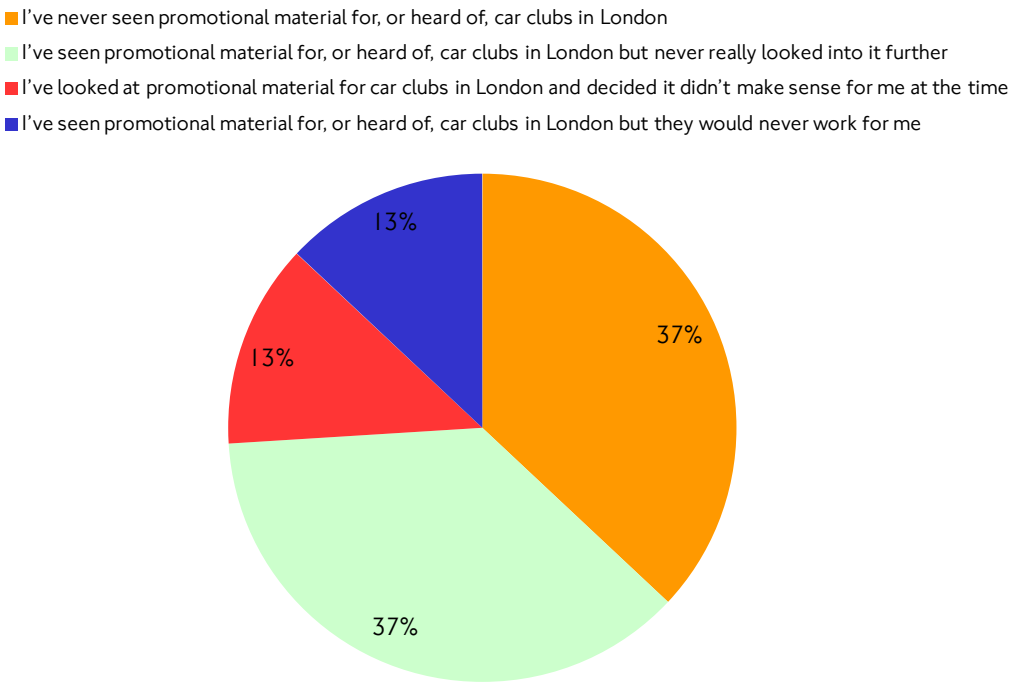
Increased car club membership will result in a change in car availability for personal travel. This could realise substantial benefits in terms of decreased (household) car ownership and reduced congestion.

Some key findings from the TfL survey

1. Perceptions and experience of car clubs among non-members

Non-members of car clubs made up 97 per cent of the survey respondents. Amongst these non-members there appears to be a gap in knowledge of what car clubs are and how they actually work. Figure 3.46 shows that 37 per cent of non-car club members in the TfL survey had never seen promotional material or heard of car clubs. A further 37 per cent of respondents were aware of car clubs, but had not gone on to do any further research into them. The remaining 26 per cent of respondents had done some research into car clubs but had not become members, deciding that it would either never work for them (13 per cent) or that it did not make sense at the time (13 per cent). Lack of awareness of car clubs and failure to follow up and investigate joining a car club once aware are perhaps major factors limiting the level of membership recorded in London (currently 2 per cent of the entire London population), suggesting that improving awareness of car clubs has significant potential to increase membership rates.

Figure 3.46 Awareness of car club concept amongst respondent who are currently non-car clubs members.



Source: TfL Parking and car clubs potential users and use survey. April 2014.
Base 1,372 respondents.

2. Potential take-up

Regarding potential take-up of car club membership in London, three main market segments have been identified where take-up may be particularly high:

- Non-car households in Inner London, where there are likely to be considerable parking pressures;
- One car and multi-car households in Inner London, where there are likely to be considerable parking pressures;
- Non-car households in Outer London, where parking pressures are lower but the car club vehicles are likely to be an attractive option for some trips.

The majority of the benefits of reducing car travel through car clubs may be realised through car owning households reducing their ownership, thereby replacing private car trips with that of a combination of car clubs, public transport etc. However this is not as clear-cut with non-car owning households. In some situations car clubs may add car trips by substituting what would otherwise have been made by public transport, cycling etc. On the other hand, car club membership may help maintain the number of current non-car households by deferring future car purchases, leading to a net reduction in future demand for private car use.

Propensity for people to join and use a car club

Respondents were presented with a range of scenarios including variations of the following:

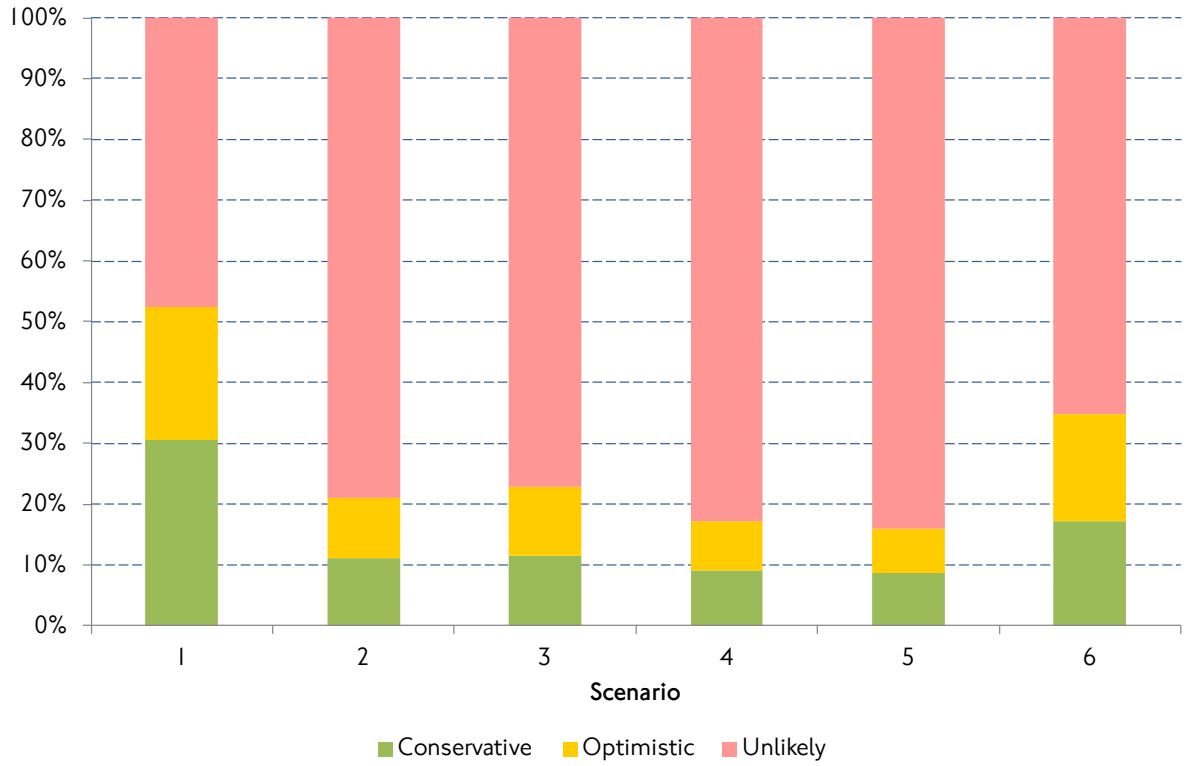
- The car club scheme design including annual membership cost, usage cost, access times; and pick-up/drop-off arrangements, namely collect and return (traditional) or one-way (point-to-point).
- Local parking policy.
- Local public transport fares and availability (including cycle hire provision).

They were asked to indicate their likelihood to become a car club member on a scale of 1 to 10 (where 1 is very unlikely and 10 is very likely). In addition, if the respondent indicated a likelihood of becoming a member (ie they selected 6 or more on the scale), the propensity of changing household car ownership was also indicated.

The likelihood values used to quantify the propensity to become a member were used to determine three potential membership levels:

- 'Conservative', which includes only those who indicated a likelihood of 8 or higher on the likelihood scale.
- 'Optimistic', which includes all those who indicated a likelihood of 6 or more.
- 'Unlikely', which includes all those who indicated a likelihood of 5 or lower.

Figure 3.47 Likelihood of respondents to join car club for a range of scenarios.



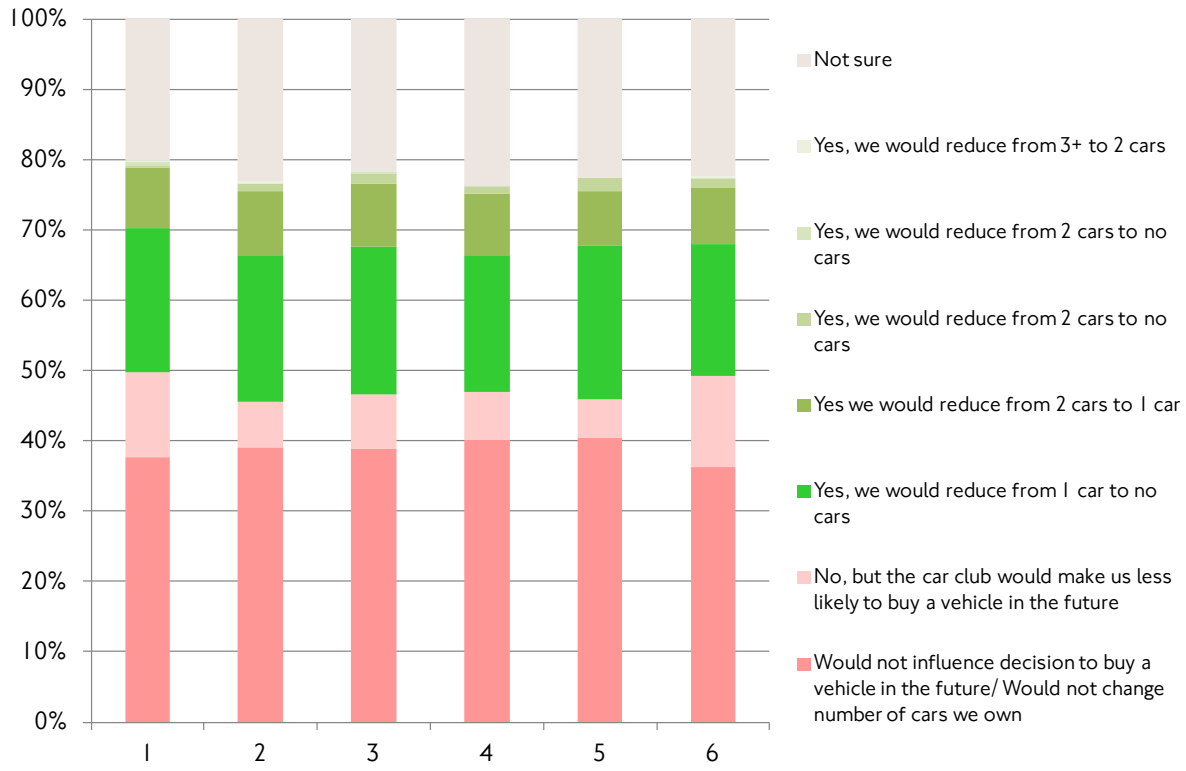
Source: TfL Parking and car clubs potential users and use survey April 2014.
Base 573 respondents.

Scenario 1 was designed to be the most attractive offering, scenario 5 the least and the others covered a range between the two.

Figure 3.47 shows the likelihood to join across the different scenarios. The results indicate that most licence holders would prefer a point-to-point car club scheme (scenarios 1, 2, 4 and 6). Point-to-point schemes allow users to collect and drop off the car within a defined area rather than having to collect and drop off at the same fixed bay. Access times to vehicles and hourly usage rates also a have significant role in determining membership levels.

The results suggest that changes to local parking policy (eg higher parking permit prices) are not likely to play a significant direct role in encouraging individuals to take up car club membership, but that it is more likely to do so indirectly by increasing the likelihood that ownership will be reviewed, and with a reduced level of household car ownership may well become car club membership. Whilst not a focus of this research it is worth noting that local parking policy that is supportive of car clubs could increase the number bays available, which could improve the availability and convenience of the car club and hence encourage membership.

Figure 3.48 Likelihood of respondents to change household car ownership for range of scenarios.



Source: TfL Parking and car clubs potential users and use survey April 2014.
Weighted base 1544 respondents.

Figure 3.48 shows the likelihood of respondent to change their car ownership if they had indicated a likelihood of becoming a car club member. The results indicate that a significant proportion of licence holders (up to a third regardless of the car club offer itself) think that on becoming a member they would either reduce their household car ownership level or defer the purchase of another vehicle if they were to join their preferred scheme.

3.21 Key reference statistics

Table 3.6 brings together indicators of transport patronage across the principal modes of transport, covering the most recent three years, and summarising the key statistics from this chapter. The percentage change over the most recent year is also shown.

Table 3.6 Summary of key indicators of travel demand for principal travel modes in London.

Mode and indicator	Units	2011 or 2011/12	2012 or 2012/13	2013 or 2013/14	Difference (%) 2013 or 2013/14 vs. previous year
Public transport					
Total PT passenger kilometres	Millions per year	18,891	19,706	20,374	3.4
Total PT journey stages	Millions per year	3,708	3,795	3,915	3.2
Bus passenger kilometres	Millions per year	8,121	8,160	8,411	3.1
Bus journey stages	Millions per year	2,320	2,311	2,382	3.1
Underground passenger km	Millions per year	9,519	10,099	10,423	3.2
Underground journey stages	Millions per year	1,171	1,229	1,265	2.9
DLR passenger kilometres	Millions per year	456	510	537	5.3
DLR journey stages	Millions per year	86	100	101	1.1
London Tramlink passenger kilometres	Millions per year	150	158	162	2.9
London Tramlink journey stages	Millions per year	29	30	31	3.8
Overground passenger km	Millions per year	645	780	840	7.7
Overground journey stages	Millions per year	103	125	136	8.9
National Rail pass. km (L&SE)	Millions per year	26,462	27,357	28,599	4.5
National Rail journeys (L&SE)	Millions per year	994	1,033	1,107	7.2
Road traffic					
Motor vehicle kms – GLA	Billions per year	29.1	28.9	28.8	-0.3
Motor vehicle kms – central	Billions per year	1.0	1.0	1.0	-1.3
Motor vehicle kms – inner	Billions per year	7.8	7.6	7.4	-2.0
Motor vehicle kms – outer	Billions per year	20.3	20.3	20.4	0.4
Central London cordon	'000 motor vehicles	1,161	1,144	1,181	3.2
Inner London cordon	'000 motor vehicles	n/a	1,898	n/a	n/a
Outer London cordon	'000 motor vehicles	2,568	n/a	2,539	-1.1
Thames screenline	'000 motor vehicles	n/a	811	n/a	n/a
Cycling					
Cycle flows on TLRN	Cycles counted (index 2000/01=100)	272.6	276.4	295.6	7.0
Cycles – central cordon	Cycles counted thousand	147	149	161	8.1
Cycles – inner cordon	Cycles counted thousand	n/a	57	n/a	n/a
Cycles – outer cordon	Cycles counted thousand	15	n/a	20	33.3
Cycles – Thames screenline	Cycles counted thousand	n/a	84	n/a	n/a
Other modes					
Airport terminal passengers	Millions	133.6	134.4	138.7	3.3
River Thames passengers	Passengers (thousand)	n/a	n/a	8.412	n/a
Licensed taxis	Vehicles (thousand)	23.1	22.2	22.8	2.9
Licensed taxi drivers	Number (thousand)	25.3	25.5	25.5	0.3
Licensed private hire	Vehicles (thousand)	54.0	49.9	52.8	5.9
Licensed private hire	Drivers (thousand)	64.1	67.0	65.7	-2.0

Source: TfL Planning, Strategic Analysis.

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4. Performance of the transport networks

4.1 Introduction and contents

This chapter reviews aspects of the service supply and the operational performance provided by London's transport networks, updating the range of indicators introduced in previous Travel in London reports, and following on from the trends in travel demand on the individual transport modes described in the previous chapter. It provides a summary of the performance of the TfL-operated mass public transport networks, together with National Rail in London, in terms of indicators of service provision and operational reliability. It then looks at the performance of London's road network, covering measures such as traffic speeds, journey times and journey time reliability.

A Focus topic looks at the impact of the Tube upgrade programme on service provision and operational performance. A second Focus topic examines traffic speeds and congestion data for London's road network, looking for evidence of differential trends, both to explore what is possible with the GPS-based speeds/congestion data and to set a baseline for future measurements. This is important given the large-scale adjustments to future road network capacity implied by the Roads Task Force [1] and the Mayor's Vision for Cycling in London [2].

4.2 Key modal trends (service supply)

Public transport in London has, over recent years, benefited from the longest run of sustained high operational performance and service provision ever recorded. All key indicators of service provision have shown a marked trend of improvement over the last decade, and this has been sustained in the latest year.

- A total of 76.2 million train kilometres were operated on the **Underground** in 2013/14, up from 75.6 million in 2012/13. This was broadly in line with rates of growth over much of the last decade, excepting the period immediately before and during the London 2012 Games. Underground train kilometres operated are now 19 per cent greater than those of 2000, and 8 per cent greater than those of the previous peak in 2008/09, with the benefits of the Tube upgrade programme, including the current renewal of the entire sub-surface train fleet, now evident.
- In 2013/14, 490.9 million vehicle kilometres were operated on the **bus network**, up slightly from 490.5 million kilometres from 2012/13, although continuing to reflect the relatively slow rate of increase in service provision on the bus network since 2004/05 following the major increase in the preceding five years.
- On the other TfL rail modes 2013 saw continued incremental development to the networks and the services operated on them. On the **Docklands Light Railway** there were 5.8 million kilometres operated in 2013/14, up from 5.7 million kilometres in 2012/13. On **London Overground** 8.1 million kilometres were operated in 2013/14, up from 7.6 million kilometres in 2012/13. On **Tramlink** there were 3.0 million kilometres operated in 2013/14, up from 2.9 million kilometres in 2012/13.

These developments enabled 35 per cent more bus kilometres and 19 per cent more Underground kilometres to be operated in 2013/14 compared to 2000/01. This compares to an increase in population of 16 per cent and a 21 per cent

increase in overall travel demand over the same period. Broadly, therefore, increased service supply is keeping pace with increasing travel demand and is, in part, facilitating it.

4.3 Key modal trends (operational performance)

Alongside increased public transport provision, there have been sustained improvements to the quality and reliability of public transport services. Service reliability indicators in 2013/14 for the major public transport modes were at, or close to, best-ever levels, following on from and maintaining the exceptional performance to support the London 2012 Games. For the first time in recent years, however, there is some evidence of deterioration in road network performance.

- Levels of service reliability on the **Underground** maintained their recent highs. In 2013/14, 97 per cent of scheduled train kilometres were operated, very marginally down on the 98 per cent of 2012/13 but reflecting an increase of one per cent in train kilometres scheduled. There were further incremental improvements in excess journey time – down to 5.2 minutes in 2013/14 from 5.3 minutes in 2012/13.
- **Bus** reliability, as measured by excess waiting times, again matched the best ever minimum of 1.0 minute first achieved in 2010/11. This means that the average customer has to wait just one minute longer for a bus than they would otherwise do if the service ran perfectly to schedule. Meanwhile, 97.7 per cent of scheduled bus kilometres were operated, marginally up on the value of 97.6 the previous year, and the 11th year in succession that this indicator has stood above 97 per cent.
- Reliability further improved on the **Docklands Light Railway** in 2013/14, with both key indicators of service performance standing above 99 per cent for the first time. Some 99.2 per cent of scheduled services were operated, with 99.3 per cent 'on time'. **London Tramlink** returned a reliability value of 98.9 per cent of scheduled services operated, an improvement of 1.6 percentage points on the previous year and continuing a recent trend of consistently high performance. **London Overground** recorded a Passenger Performance Measure (PPM) of 96.1 per cent, marginally down on the previous year, but still being the second-best performer of London & South East train operating companies.
- On **National Rail** in 2013/14, c2c, operator of services from London Fenchurch Street, scored the highest PPM measure – at 96.7 per cent. However, six of ten operators recorded PPM scores below 90 per cent – to some extent undoubtedly a reflection of the very poor weather in the first months of 2014.
- Levels of delay (congestion) and journey time reliability on London's **road network** have remained remarkably stable over recent years. In 2013/14, however, there were signs of deteriorating conditions, with decreases in average speeds, increases in excess delay and a marginal but possibly-significant decline in journey time reliability. This corresponded with a marked slowing in the rate of decrease for traffic volumes in London – a consistent feature for many years – and emerging evidence of increasing traffic more recently.

Table 4.1 below summarises key service supply and operational performance indicators for the most recent three years, these also compared to the position in 2001.

Table 4.1 Key indicators of public transport service provision and performance since 2000/01. Summary of typical values.

Mode	Measure	2000/01	2011/12	2012/13	2013/14
Service provision					
Buses	Kilometres operated	365 million	490 million	490 million	491 million
London Underground	Kilometres operated	64 million	72 million	76 million	76 million
DLR	Kilometres operated	2.9 million	4.9 million	5.7 million	5.8 million
London Tramlink	Kilometres operated	2.4 million	2.7 million	2.9 million	3.0 million
London Overground	Kilometres operated	n/a	7.0 million	7.6 million	8.1 million
Service performance					
Buses	Excess wait time	2.2 minutes	1.0 minutes	1.0 minutes	1.0 minutes
London Underground	Excess journey time	8.6 min	5.8 min	5.3 min	5.2 min
DLR	Reliability	96%	98%	99%	99%
London Tramlink	Reliability	99%	99%	97%	99%
National Rail	ORR L&SE PPM	78%	92%	91%	90%
London Overground	ORR PPM	n/a	97%	97%	96%

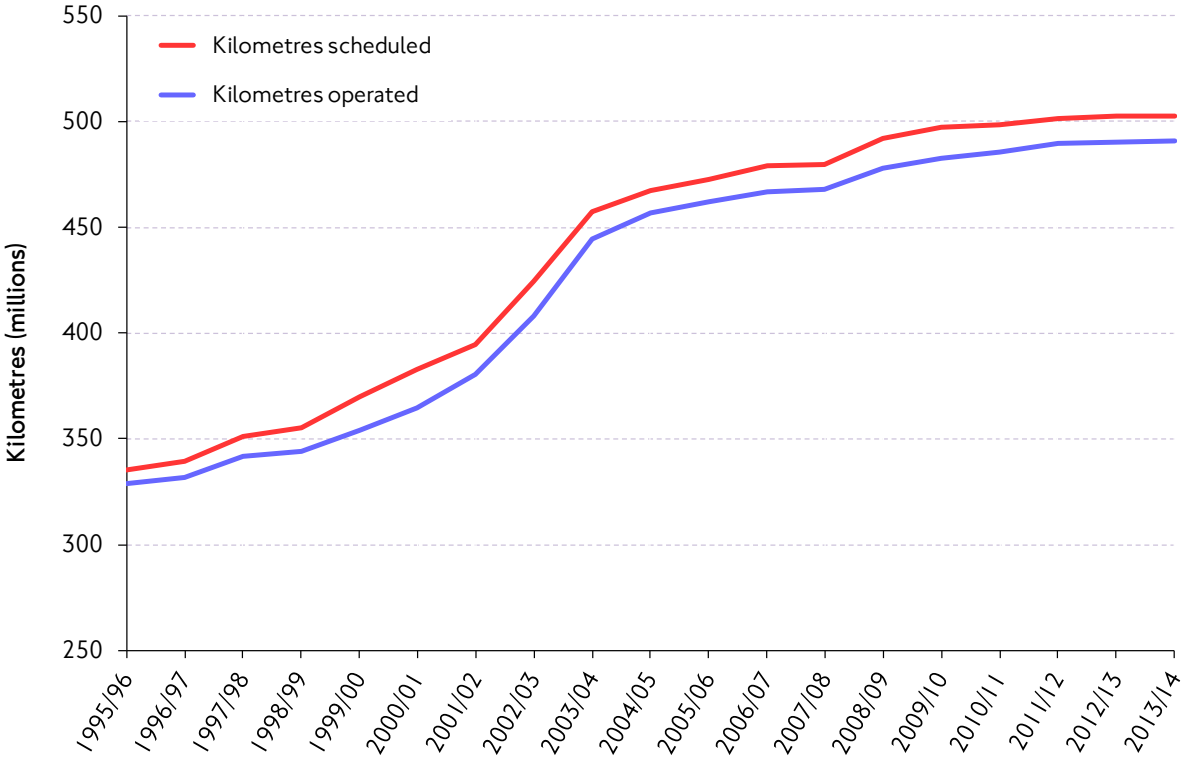
Source: TfL Planning, Strategic Analysis.

4.4 Modal performance indicators: Bus

Bus service supply

The bus is one of London's transport success stories, with service provision, service quality and patronage increasing substantially since the start of the last decade. Buses in London carried almost 2.4 billion people in 2013/14, and operated 490.9 million bus-kilometres (97.7 per cent of the scheduled service), a slight improvement on performance in 2012/13 (see figure 4.1).

Figure 4.1 Bus service provision – scheduled and operated bus kilometres.



Source: London Buses.

Bus service performance

Table 4.2 shows measures of bus service reliability. In 2013/14, the percentage of timetabled services 'on time' for low frequency bus routes decreased slightly following the high in 2012/13, although this is partly due to a substantial expansion in the monitoring of these services.

The average actual waiting time for high frequency services has remained stable at 5.9 minutes. This follows the increase in 2012/13, which can be attributed to an expansion of monitoring to cover the period 05:00 – 24:00 continuously. Scheduled levels of service are lower at times of day not previously monitored such as late evenings and Sunday mornings. Despite these changes, monitored actual wait times are still 13 per cent below those of 2000/01 and excess wait time remained at the historic low of one minute.

Table 4.2 Indicators of bus service reliability.

Year	Kilometres scheduled (millions)	Percentage of scheduled kilometres			High frequency services[1]		Low frequency services[2]
		Operated	Lost due to traffic congestion[4]	Lost due to other causes[5]	Average wait time (minutes)[6]		Percentage of timetabled services on time[3,7]
					Actual	Excess	
2000/01	383	95.3	2.1	2.6	6.8	2.2	67.7
2001/02	395	96.4	2.0	1.6	6.6	2.0	69.4
2002/03	425	96.1	2.6	1.3	6.4	1.8	70.5
2003/04	457	97.2	1.7	1.1	5.8	1.4	74.6
2004/05	467	97.7	1.6	0.8	5.6	1.1	77.1
2005/06	473	97.7	1.7	0.6	5.6	1.1	77.2
2006/07	479	97.5	1.9	0.6	5.5	1.1	78.1
2007/08	480	97.5	2.0	0.5	5.5	1.1	79.1
2008/09	492	97.0	2.3	0.7	5.5	1.1	80.8
2009/10	497	97.1	2.3	0.6	5.5	1.1	80.5
2010/11	499	97.4	2.1	0.5	5.4	1.0	81.4
2011/12	502	97.6	1.9	0.5	5.4	1.0	83.2
2012/13	503	97.6	1.7	0.7	5.9	1.0	83.6
2013/14	502	97.7	1.9	0.4	5.9	1.0	82.5

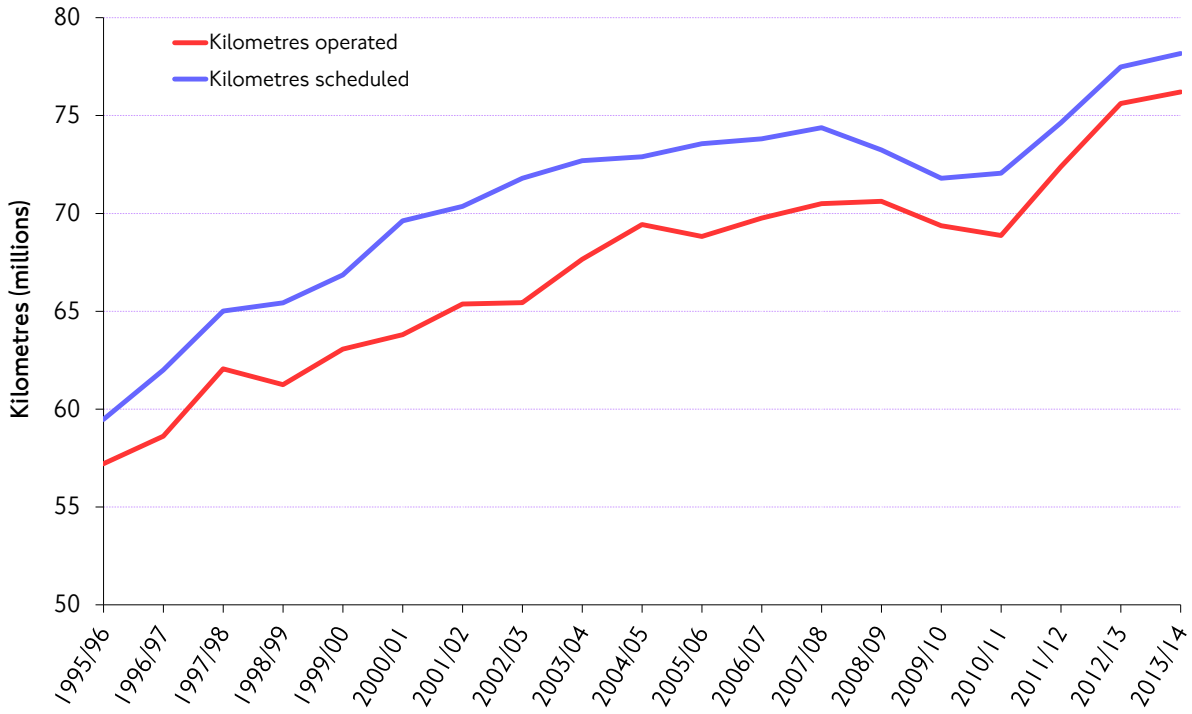
Source: London Buses.
1. High frequency services are those operating with a scheduled frequency of five or more buses an hour.
2. Low frequency services are those operating with a scheduled frequency of fewer than five buses an hour.
3. Buses are defined as 'on time' if departing between two and a half minutes before and five minutes after their scheduled departure times.
4. Also includes other lost kilometres outside the control of the operator.
5. Includes all lost kilometres within the control of the operator.
6. Results for high frequency routes from 2012/13 reflect the move to a greatly expanded QSI system for monitoring of this group of routes.
7. Results for low frequency routes from 2013/14 reflect the move to a greatly expanded QSI system for monitoring this group of routes.

4.5 Modal performance indicators: Underground

London Underground has substantially increased its service offering over the last decade – in the context of a largely static physical network in terms of its extent. This reflects the success of the Tube upgrade programme, providing the ability to increase both capacity and service reliability.

Underground train kilometres scheduled in 2013/14 were 11 per cent higher than in 2000/01, while train kilometres operated were 19 per cent higher, denoting an improvement in operational reliability. The year 2013/14 saw one per cent more train kilometres scheduled and one per cent more train kilometres operated than in 2012/13. The slower rate of change in 2013/14 can be attributed in part to the atypically large increase in supply associated with the completion of upgrades and service improvements prior to the London 2012 Games. This is represented by a steep rate of change between 2010/11 and 2012/13 (see figure 4.2).

Figure 4.2 London Underground: Train kilometres scheduled and train kilometres operated.



Source: London Underground.

Figure 4.2 shows two other significant features. Firstly, the three years 2008/09 to 2010/11 saw small falls in both measures (note the origin point of the graph, the actual fall was quite modest). This largely reflects the impact of the Tube upgrade plan itself, in the form of planned closures of parts of the network at the weekends for upgrade work. The second feature is that the gap between the service scheduled and that actually operated has tended to narrow – reflecting a more reliable service. In 2012/13, 97.6 per cent of scheduled train kilometres were operated, the highest in the series. Performance in 2013/14 was very marginally lower, with 97.5 per cent of scheduled train kilometres operated.

Underground reliability can also be expressed in terms of passenger-focused measures such as average journey time and excess journey time (see table 4.3). The latter is the additional time that passengers have to wait over and above that implied by the schedule as a result of unreliability in the service. Excess journey time has continued to fall in 2013/14 although at a more modest rate than in previous years, from 5.3 in 2012/13 minutes to 5.2 minutes in 2013/14.

Table 4.3 London Underground – service reliability and journey times.

Year	Train kilometres scheduled (millions)	Percentage of scheduled kilometres operated	Average actual journey time (minutes)	Average generalised (weighted) journey time (minutes)	Excess journey time (weighted) (minutes)	Excess as % of generalised journey time
2000/01	69.6	91.6	28.6	45.7	8.6	18.9
2001/02	70.4	92.9	28.3	45.2	8.1	18.0
2002/03	71.8	91.1	29.1	46.7	9.7	20.7
2003/04	72.7	93.1	27.9	44.3	7.4	16.8
2004/05	72.9	95.3	27.7	44.0	7.2	16.4
2005/06	73.6	93.6	27.8	44.3	7.5	16.9
2006/07	73.8	94.5	28.0	44.7	8.1	18.0
2007/08	74.4	94.8	27.8	44.5	7.8	17.4
2008/09	73.2	96.4	27.5	43.9	6.6	15.1
2009/10	71.8	96.6	27.7	44.1	6.4	14.5
2010/11	72.1	95.6	28.0	44.6	6.5	14.6
2011/12	74.6	97.0	27.5	45.1	5.8	12.9
2012/13	77.5	97.6	26.8	43.6	5.3	12.1
2013/14	78.2	97.5	26.8	43.4	5.2	12.0

Source: London Underground.
1. Excess journey time is the difference between actual journey time and that expected if services run to time, and weighted to reflect how customers value time.

4.6 Focus: TfL's Tube upgrade programme

The Tube upgrade programme

The Tube is the oldest metro system in the world. In the past decade the network, some of which dates back to the 1860s, has been renewed as part of a major transformation programme – the 'Tube upgrade programme'. The key components of this programme have been:

- **Introducing new rolling stock.** A new fleet of trains has been introduced on the Victoria line, air-conditioned walk-through trains are now in use on the Metropolitan, Circle and Hammersmith & City lines and are being rolled out on the District line. Plans are underway to design new trains for the Bakerloo, Central, Piccadilly and Waterloo & City lines, to be introduced in the 2020s.
- **Upgraded signal systems** to reduce delays and increase network capacity by allowing for a higher frequency of service. Following the installation of new signalling, the Victoria and Jubilee lines are now among the most advanced metro systems in the world with peak frequencies of 34 trains per hour (tph) and 30-tph respectively. In the past year, work has been continuing to install new signalling on the Northern line which will increase line capacity by 20 per cent. New signalling will also be installed on the Metropolitan, Circle, District and Hammersmith & City lines in the next five years.

- **Modernised stations** by upgrading fire, public address and CCTV systems, lifts and escalators. Major interchanges such as Blackfriars, Stratford, King's Cross St Pancras, Paddington (Hammersmith & City Line) and Wembley Park have been transformed. A redeveloped Vauxhall station will open in 2015, followed by Tottenham Court Road in 2016, Bond Street in 2017 and Victoria in 2018. An ambitious plan to upgrade capacity at Bank station is continuing to progress.
- **Renewal of track and civil structures** such as bridges and drainage systems to reduce safety risks, allow speed and weight restrictions to be removed and reduce the risks of flooding.

London is beginning to reap the benefits of this investment, as demonstrated by the excellent operational performance of the Tube in the face of unprecedented demand during the London 2012 Olympic and Paralympic Games. Passenger numbers are continuing to grow and reliability is continuing to improve alongside this.

Case study: Transforming the Victoria line

On 20th January 2013 a 33-tph peak frequency timetable was introduced on the Victoria line, since increased to 34-tph (peak frequency) in June 2014, marking the culmination of a wide-ranging upgrade of the line including new signalling systems and new rolling stock. The principal components of the Victoria line upgrade have been:

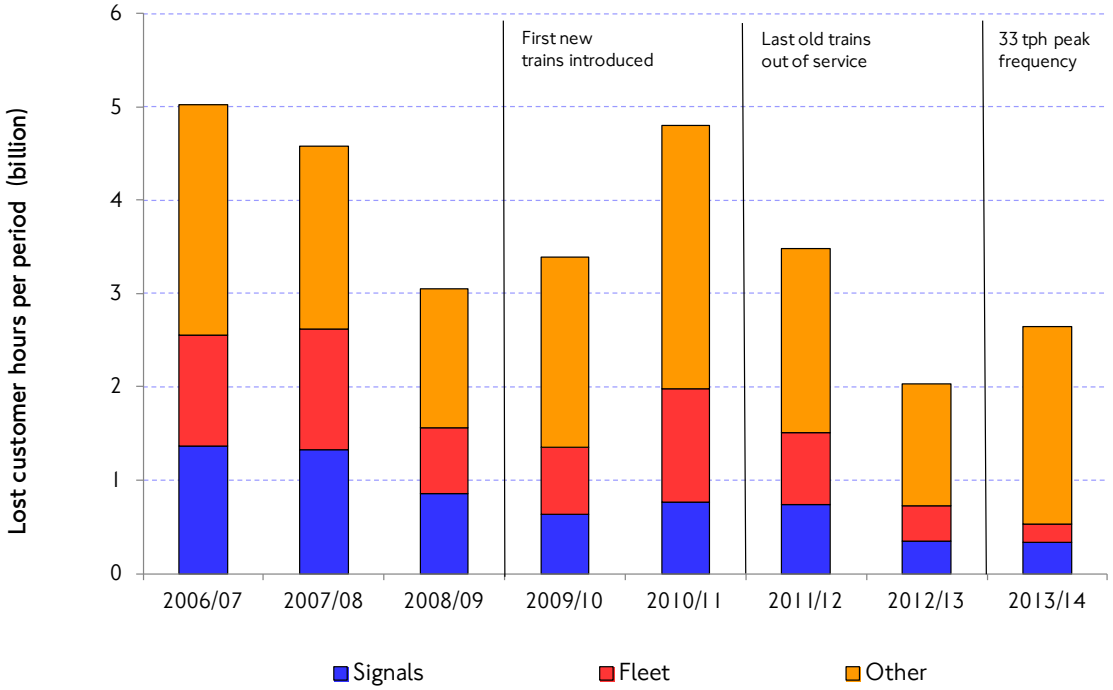
- Introduction of 47 new eight-car trains to replace the existing 43 trains.
- Introduction of a new signalling system.
- Construction and commissioning of a new Service Control Centre.
- Installation of 31 platform humps to increase accessibility (step-free from platform to train).
- Supporting track, power and depot works.

The programme has renewed trains and supporting systems that were nearing 40 years in age at the beginning of the upgrade, and has allowed for more frequent and more reliable services to be run on the line.

More reliable assets

As a result of the upgrade, ageing signalling equipment and rolling stock have been replaced. The relative reliability of these assets pre and post upgrade is highlighted by the large reductions in 'lost customer hours' due to 'signalling and fleet' (causes) as shown in figure 4.3.

Figure 4.3 Lost customer hours on Victoria line, showing progress of upgrade programme.



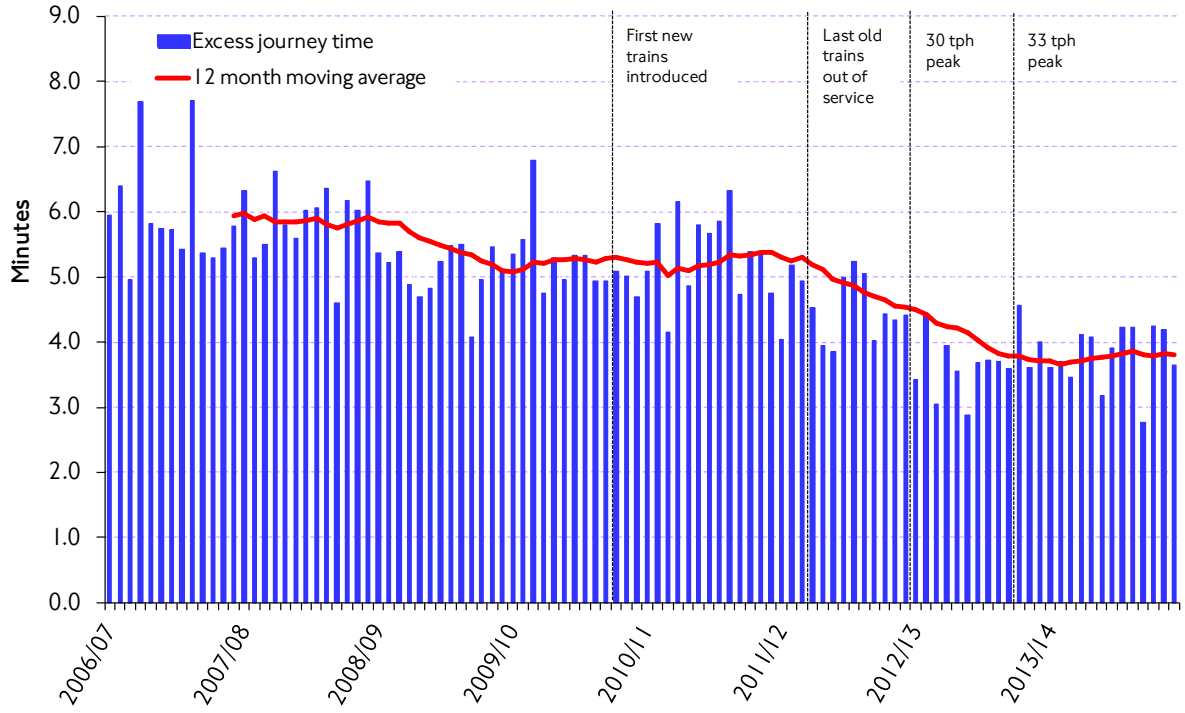
Source: London Underground.

Lost customer hours caused by signal problems have decreased by 75 per cent since 2006/07 while lost customer hours due to fleet causes have reduced by 84 per cent. There was an increase in lost customer hours due to fleet in 2010/11, coinciding with the phased switchover from '67 stock trains to the new '09 stock trains; however this was reversed once the new fleet had bedded in to service. The improved reliability of assets has meant that excess journey time (the difference between scheduled journey time and actual journey time) has fallen by a third following the upgrade, as shown in figure 4.4.

Better journey times

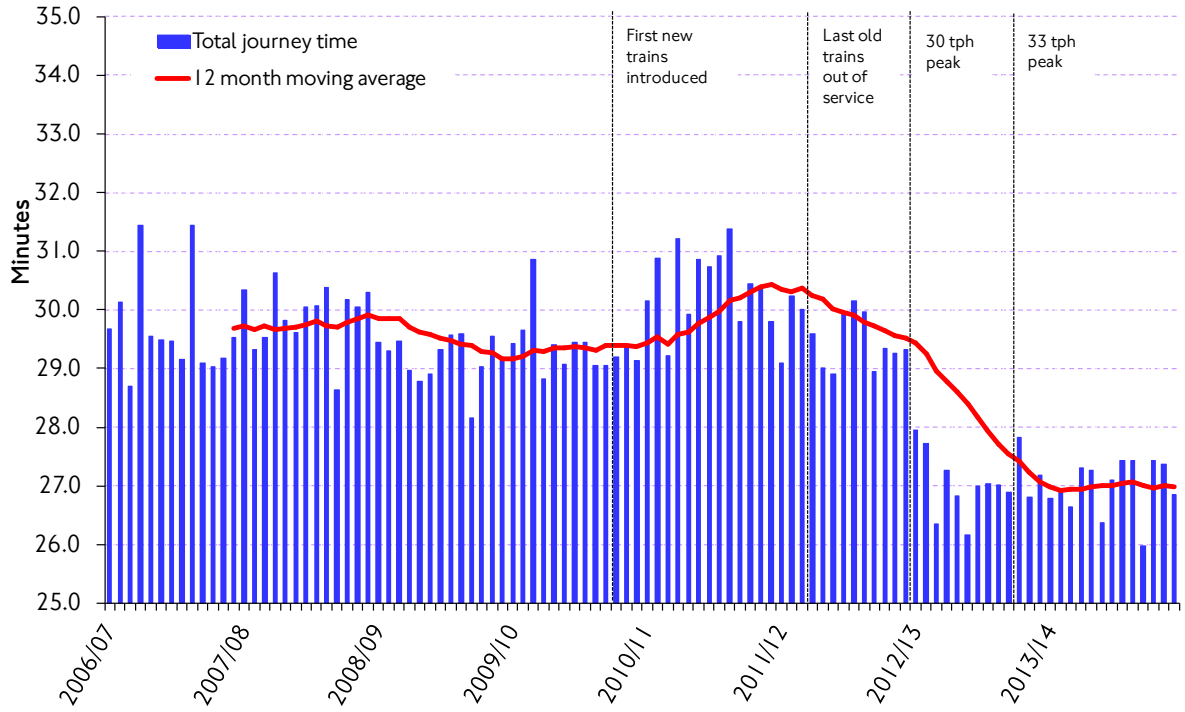
Some 46 per cent of the total time taken for a journey on the Tube is spent on the train, with a further 20 per cent spent waiting on a platform. The upgrade has brought about improved journey times resulting both from operating increased train frequencies (a 33 tph AM peak was introduced in January 2013, rising to 34 tph for two hours of the peak in June 2014), and reduced run times following the introduction of the new 'Distance To Go' Automatic Train Control signalling. Figure 4.5 shows the difference in total journey time per passenger before, during and after the upgrade.

Figure 4.4 Excess journey time on the Victoria line.



Source: London Underground.

Figure 4.5 Total journey time per passenger on the Victoria line.



Source: London Underground.

Total journey time rose slightly during the transition period as new trains were rolled out and signalling works completed. It then began to decline slowly following the withdrawal of the last of the old rolling stock, and then dropped dramatically as peak frequencies are enhanced. It is important to note that the lowering of total journey time has taken place in the context of increasing demand, that otherwise would have led to an increase in total journey time because of increased crowding.

Increased demand

Between 2006 and 2013, overall travel demand in London increased by approximately 12 per cent, however, demand for Underground services increased by 36 per cent. A vital component of the upgrade was to increase capacity in order to cope with this extra demand. Figure 4.6 shows the change in Victoria line demand alongside some of the key milestones of the upgrade.

Figure 4.6 Passenger boardings on the Victoria Line.

Source: London Underground.

Passenger boardings on the Victoria line have increased by 30 per cent since 2006/07. For peak services boardings have increased by 21 per cent whereas for off-peak services the increase was 35 per cent. The bulk of the increase has occurred in the past three years, with demand increasing by 26 per cent since 2010/11. This coincides with the end of economic recession and strong growth in travel in London overall.

The increase in demand over the past three years underlines the significance of reliability and journey time improvements over this time. In particular it should be emphasised that the drop in excess journey time described above has taken place during a period of rapid demand growth that put the line under unprecedented

pressure. The Tube upgrade has improved the service offered in the present and provided a strong basis for continued reliability and resilience in the future.

4.7 Modal performance indicators: Docklands Light Railway

Since 2000/01 the Docklands Light Railway (DLR) has doubled the number of kilometres operated from 2.9 million to 5.8 million, as shown in table 4.4 – reflecting both network expansion and enhanced service levels. The year 2013/14 saw both the percentage of scheduled services operated and the percentage of trains on time reach record levels, at 99.2 per cent and 99.3 per cent respectively.

Table 4.4 DLR service provision and reliability.

Year	Kilometres operated (millions)	Percentage of scheduled services operated	Percentage of trains on time
2000/01	2.9	98.2	96.3
2001/02	2.9	98.3	96.6
2002/03	3.2	98.1	96.3
2003/04	3.4	98.2	96.6
2004/05	3.3	98.5	97.1
2005/06	3.6	98.7	97.3
2006/07	4.3	99.2	97.8
2007/08	4.4	99.1	97.3
2008/09	3.9	98.4	94.6
2009/10	4.6	97.2	94.8
2010/11	4.7	97.5	97.4
2011/12	4.9	97.7	97.5
2012/13	5.7	98.5	98.8
2013/14	5.8	99.2	99.3

Source: Docklands Light Railway.

4.8 Modal performance indicators: London Tramlink

London Tramlink performance in 2013/14 recovered to previous high levels following a slight dip in 2012/13. Scheduled and operated kilometres both increased for the fourth consecutive year. Overall London Tramlink delivers a very high level of reliability with 98.9 per cent of scheduled services being operated in 2013/14 – the 13th successive year that this measure has been above 97 per cent (table 4.5).

Table 4.5 London Tramlink service reliability.

Year	Scheduled kilometres (millions)	Operated kilometres (millions) [1]	Percentage of scheduled services operated
2001/02	2.44	2.41	99.1
2002/03	2.49	2.46	98.9
2003/04	2.50	2.48	99.0
2004/05	2.49	2.42	97.2
2005/06	2.50	2.44	97.4
2006/07	2.57	2.54	98.7
2007/08	2.60	2.57	99.0
2008/09	2.70	2.66	98.5
2009/10	2.62	2.60	99.2
2010/11	2.72	2.70	99.2
2011/12	2.74	2.71	98.9
2012/13	2.98	2.90	97.3
2013/14	3.06	3.03	98.9

Source: London Tramlink.
1. Operated kilometres exclude replacement bus services operated during period of track repair works.

4.9 Modal performance indicators: National Rail and London Overground

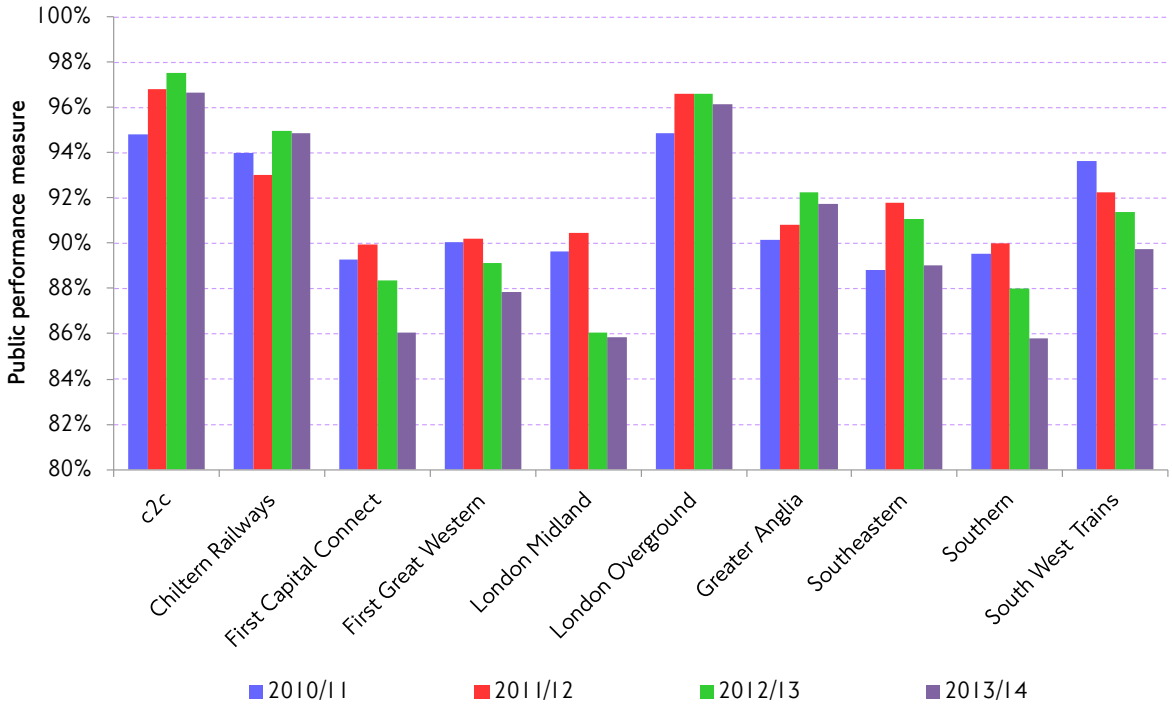
This section looks at the performance of National Rail services in London, including TfL's London Overground network. The reliability of National Rail services is measured through the Public Performance Measure (PPM), which combines figures for punctuality and reliability into a single measure [(3)]. The PPM is therefore the percentage of trains 'on time' compared to the number planned. A train is defined as 'on time' if it arrives no later than five minutes after the planned destination arrival time for services defined by the ORR as 'London and South East' (L&SE) and regional operators, or not later than 10 minutes for long-distance operators.

National Rail service performance

Figure 4.7 shows PPM measures for all services operated by L&SE operators over the last four years. In the latest year, the PPM measure fell, by varying degrees, for each operator, in part reflecting disruptions associated with the severe winter weather during 2013/14.

London Overground was the second best performing London & South East operator for PPM, with a score of 96.1 per cent, down from 96.6 per cent for the two previous years. c2c (operator of services from London Fenchurch Street towards Southend Central) held its position as the best performing L&SE operator on this measure, with a score of 96.7, down from 97.5 in 2012/13.

Figure 4.7 National Rail – public performance measure for London and South East operators (moving annual average as at quarter four each year).



Source: Office of Rail Regulation.

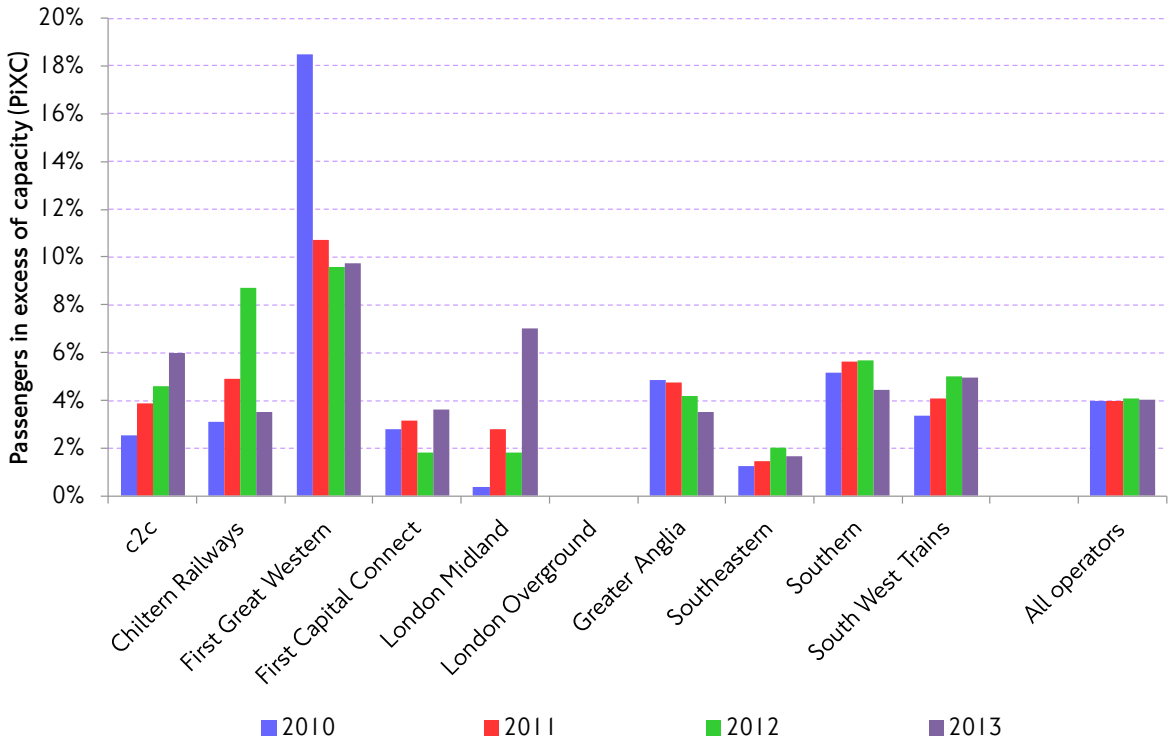
National Rail crowding

Crowding on National Rail is monitored using the DfT's passengers in excess of capacity (PiXC) measure. This compares planned capacity on services arriving in or departing from central London against actual demand, with PiXC being the difference between the two. Figure 4.8 shows PiXC results (for the morning peak period only) for the last four years by train operator. The trend in 2013 was mixed, although the average PiXC value across all operators (combined) has remained broadly stable at around four per cent for the last four years.

In the context of continuing strong growth in demand for rail services, significant reductions in PiXC values for individual operators are usually associated with the acquisition of new rolling stock and/or the provision of new services. Although London Overground is notable for having PiXC values of zero for each of the last four years, this only relates to the Euston-Watford services (other parts of the Overground network are not measured for PiXC, as it is a measure most applicable to 'radial' commuter routes), and this line itself benefited from new rolling stock, offering higher capacities, in 2010. However, the Overground network as a whole is experiencing rapid growth and levels of crowding, while not currently severe, will be a concern in the future, particularly as London Overground assumes responsibility for rail services from Liverpool Street to Enfield Town, Cheshunt (via Seven Sisters) and Chingford, as well as the Romford – Upminster route, from 31st May 2015.

First Great Western services into London Paddington have the highest morning peak PiXC values for the fourth consecutive year, although these have improved since 2010, reflecting the introduction of additional rolling stock.

Figure 4.8 Passengers in excess of capacity (PiXC) for National Rail operators in London during the weekday morning peak.



Source: Office of Rail Regulation.

4.10 Public transport reliability

This section brings together and summarises key reliability statistics for the principal public transport modes in London, including National Rail, as (collectively) one of the strategic outcome indicators for MTS. Values for each mode are shown separately in table 4.6 below. Values for the most recent year are either at, or close to, their long-term historic highs, indicating that high levels of performance on the public transport networks are being sustained.

Table 4.6 Summary of key reliability indicators for the principal public transport modes.

Mode	Units/measure	2011/12	2012/13	2013/14	Trend
Underground	Standardised journey time (minutes)	45.1	43.6	43.4	Improving
Underground	Excess waiting time (minutes)	5.8	5.3	5.2	Improving
London Buses	Excess waiting time for high-frequency routes (minutes)	1.0	1.0	1.0	Stable at excellent level
London Buses	Low frequency routes – percentage of buses on time	83.2	83.6	82.5	Decline this year
DLR	Percentage of trains that ran to time	97.5	98.8	99.3	Recent high
London Tramlink	Percentage of scheduled services operated	98.9	97.3	98.9	Recent high
National Rail	ORR's PPM measure for L&SE operators (all services, average for year)	91.7	91.0	89.6	Decline
London Overground	ORR's PPM measure (all services)	96.6	96.6	96.1	Decline

Source: TfL Planning, Strategic Analysis.

4.11 Public transport capacity

Over the most recent year Underground capacity has increased by 0.7 per cent following line upgrades and increased off-peak service levels. London Tramlink capacity also increased, by 4.3 per cent, while bus capacity increased marginally, by 0.2 per cent. There was a small decrease in DLR capacity, of -2.3 per cent, due to the more frequent use of longer trains during the London 2012 Games; however capacity remains substantially greater than in 2011/12, following the continued roll out of three-car operation to the network.

Table 4.7 Total yearly capacity provided by the principal public transport modes. Million place-kilometres.

Mode	2009/10	2010/11	2011/12	2012/13	2013/14	Percentage change 2012/13 to 2013/14
Underground	63,099	62,446	65,177	66,888	67,328	0.7
Bus	29,311	29,751	29,804	29,558*	29,605	0.2
DLR	2,027	2,338	2,635	3,311	3,234	-2.3
London Tramlink	544	564	566	606	632	4.3

Source: TfL Planning, Strategic Analysis.
Notes: Values for Underground have been revised to reflect published London Underground assumptions for standing capacity. The absolute values given in the table reflect these revised assumptions, and are internally consistent. They do differ, however, from equivalent values published in previous Travel in London reports, although the percentage changes between years are the same.
**Figure re-based mixed operation double deck capacity on certain routes.*

4.12 Performance of the road network for movement by motorised vehicles

This section updates established indicators of road network performance in London, looking at average traffic speeds and delay (congestion) levels, based on Trafficmaster GPS data. It focuses on movement by motorised vehicles. The Roads Task Force report contextualises 'movement' as one of six functions performed by the road network. TfL's proposals for monitoring these functions were described in Travel in London report 6.

Measures of road network performance for motorised vehicle movement

There are three basic measures of road network performance:

- **Average traffic speed** is the simplest measure, but does not indicate how actual network performance compares to what might be 'expected' for the network. This would clearly vary, for example, between major and minor or residential roads.
- **Excess delay** is the conventional measure used to describe traffic congestion, and compares the actual travel rate (expressed as minutes per kilometre) for a given journey against the travel rate for the same journey under uncongested conditions (typically and for practical purposes taken as the early hours of the morning).
- **Journey time reliability** is the MTS outcome indicator for traffic smoothing, which quantifies the variability of actual journeys around a nominal average. The measure is independent of both absolute average speed and delay. This measure is described more fully in Travel in London report 3 [4].

Summary of long-term trends for traffic speeds and delays in London

Previous Travel in London reports have described the trends over two decades towards slower average traffic speeds and increased congestion (delay) in London. They also described the relationship of these trends to levels of traffic demand, which had been falling for much of the last decade, and interventions, such as urban realm improvements, that have reduced the effective capacity of London's road network for general motorised traffic.

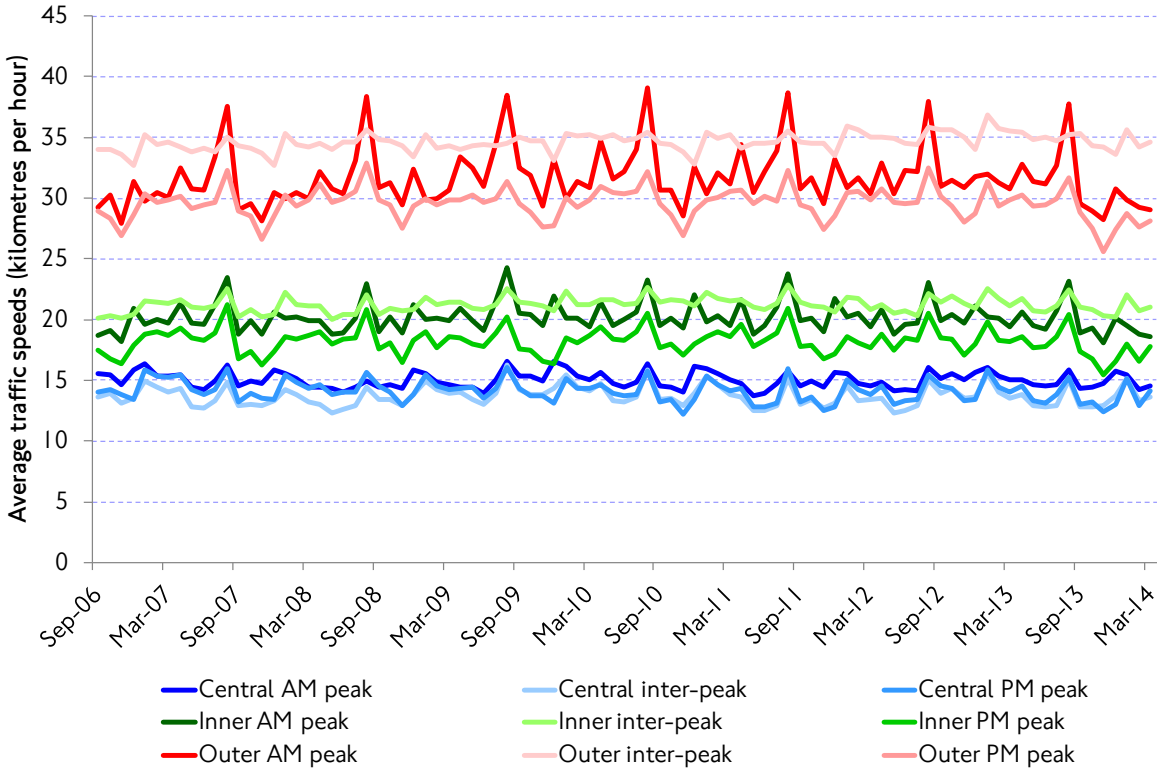
The consistency of this relationship, visible in the data from moving car observer surveys up to 2006/07, has more recently been obscured as newer Trafficmaster GPS data (which replaced the traditional method of recording speeds and delays) has shown a notable lack of 'directional' trend at the aggregate level since first becoming available in late 2006. This is in spite of continued reductions in traffic volumes, and a wide range of interventions by TfL and delivery partners intended to improve the operation of the road network. Possible reasons for this were reviewed in Travel in London report 6 [5].

This trend has changed in the most recent data, with a notable deterioration in average speeds and increase in delay now becoming apparent. This also coincides with a change to the long-established pattern of falling traffic levels in London (see also section 3.13 of this report). The following sections update key indicators of road network performance for the latest year, and take a look at different aspects of road network performance, as revealed by more disaggregate analysis of the Trafficmaster data.

Average traffic speeds

Figure 4.9 shows the trend in average traffic speeds by functional sector of London since late 2006, when these data first became available. Values are summarised in table 4.8. There are clear and expected patterns associated with seasonality and the fluctuations in traffic demand on the network over the course of each year. There are also clear and expected differences in the prevailing average speeds for each of central, inner and outer London. The overall trend was remarkably stable between 2007 and 2013; however between late 2013 and early 2014 there has been notable deterioration in speeds in the peaks for outer London as well as a smaller decline for inner London.

Figure 4.9 Average traffic speeds (kilometres an hour) by functional sector of London. Working weekdays by time period. TfL's 'network of interest'.



Source: TfL Surface Transport, Outcomes Delivery.

Table 4.8 Average traffic speeds (kilometres per hour) by functional sector of London. Working weekdays, by time period. TfL's 'network of interest'.

Area and time period	2007 speed (kph)	2008 speed (kph)	2009 speed (kph)	2010 speed (kph)	2011 speed (kph)	2012 speed (kph)	2013 speed (kph)
Central AM peak	15.2	14.7	15.1	15.2	14.9	15.0	15.1
Central inter-peak	13.6	13.3	14.2	14.0	13.6	13.6	13.6
Central PM peak	14.5	14.3	14.3	14.0	13.8	14.1	13.8
Inner AM peak	20.2	20.0	20.7	20.5	20.4	20.3	20.0
Inner inter-peak	21.1	21.0	21.4	21.6	21.4	21.2	21.2
Inner PM peak	18.4	18.4	18.1	18.5	18.4	18.3	18.0
Outer AM peak	31.0	31.6	32.3	32.2	32.4	32.0	31.4
Outer inter-peak	34.2	34.5	34.4	34.7	34.7	35.0	35.1
Outer PM peak	29.4	30.0	29.5	29.8	29.8	29.8	29.2

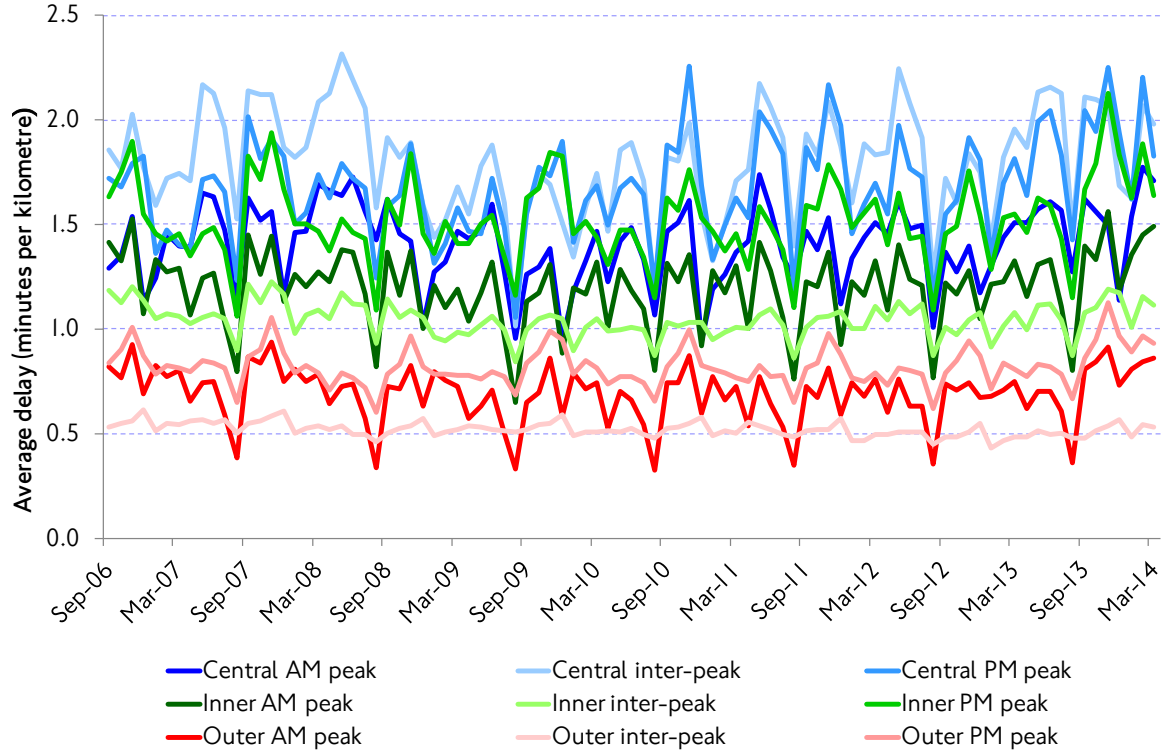
Source: TfL Surface Transport, Outcomes Delivery, based on data from Trafficmaster.
1. Value derived by weighting geographic components by proportion of traffic flow within zone.

Vehicle delay (congestion)

Figure 4.10 shows the trend for congestion (delay), corresponding directly to the speed data in figure 4.9 above. Trafficmaster delay values are calculated against a variable 'uncongested' night-time speed, which is that actually measured on a day-by-day basis, rather than a static nominal 'night-time' speed, as was the case with previous moving car observer data. Furthermore, Trafficmaster 'uncongested' speeds relate to the period from 22:00 to 06:00 – a period which, in many parts of London, sees substantial volumes of traffic. This contrasts with previous practice where uncongested speeds measured by (infrequent) moving car surveys related to the period 02:00 to 05:00.

As well as the expected seasonal and geographical patterns shared with the speed data, figure 4.10 illustrates large differences in the degree of variability of traffic congestion by both area and time period. So, inter-peak congestion in outer London remains remarkably stable from month-to-month at about 0.5 minutes per kilometre, whereas morning peak congestion here may vary by up to 100 per cent from month-to-month. In inner London the degree of variation in peak-period congestion is also roughly twice that of inter-peak congestion. In central London the pattern is reversed – inter-peak congestion being the most variable and this coinciding with the period of highest traffic demand on the network. This pattern is characteristic of networks where traffic demand routinely approaches the carrying capacity of the network. Congestion, as a measure of network instability, increases at a greater rate, and journey times are therefore more variable, the closer that traffic demand is to the carrying capacity of the network.

Figure 4.10 Average vehicle delay (minutes per kilometre) by functional sector of London. Working weekdays, by time period. TfL's 'network of interest'.



Source: TfL Surface Transport, Outcomes Delivery.

Average delay has shown a similar pattern, with the time series remaining relatively stable to late 2013, after which delay began to increase, particularly during the peaks in inner and outer London.

Table 4.9 Average vehicle delay (minutes per kilometre) by functional sector of London. Working weekdays, by time period. TfL's 'network of interest'.

Area and time period	2007 delay (min/km)	2008 delay (min/km)	2009 delay (min/km)	2010 delay (min/km)	2011 delay (min/km)	2012 delay (min/km)	2013 delay (min/km)
Central AM peak	1.4	1.5	1.3	1.3	1.4	1.4	1.5
Central inter-peak	1.9	1.9	1.6	1.7	1.8	1.8	1.9
Central PM peak	1.6	1.6	1.5	1.7	1.7	1.6	1.8
Inner AM peak	1.2	1.2	1.1	1.2	1.2	1.2	1.2
Inner inter-peak	1.1	1.1	1.0	1.0	1.0	1.0	1.1
Inner PM peak	1.5	1.5	1.5	1.5	1.5	1.5	1.6
Outer AM peak	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Outer inter-peak	0.6	0.5	0.5	0.5	0.5	0.5	0.5
Outer PM peak	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Source: TfL Surface Transport, Outcomes Delivery, based on data from Trafficmaster.
1. Value derived by weighting geographic components by proportion of traffic flow within zone.

The recent falls in average speeds and increases in delay coincide with a changing trend for traffic flows in outer London which, following several years of a sustained downward trend, has seen a small rise in 2013. As flows increase, the pressure on the network also increases and its resilience to disruption decreases.

The data above therefore appears to support the hypothesis that the nature of traffic in London is beginning to change following a period of long-term stability.

Validating Trafficmaster data

Travel in London report 6 looked in more detail at the data behind the Trafficmaster indices, to try to understand the validity and causes of the long-term stability that had been observed in these indicators, coming as it did after a prolonged period of deterioration and against the backdrop of falling traffic demand. From September 2013, however, a significant reduction in speeds and an increase in delay have been observed in the high level statistics produced from Trafficmaster data. These changes have been validated to ensure that they represent real world traffic conditions rather than changes to data processing methods or data sources.

Since September 2012, three additional 'cohorts' of vehicles have been added to the standard Trafficmaster data set. This has had the effect of increasing sample sizes, which would be expected to provide more robust statistics. However this has also changed the vehicle mix within the data set, and therefore raises the possibility of sample bias.

Tables 4.10 and 4.11 below compare speed and delay statistics for two months in 2013 and 2014, using data from the original data set and the new data set including the three new cohorts. Different values for both TfL's 'Network of Interest' (NOI) and the Transport for London Road Network (TLRN – London's more major roads) are given. The table shows the difference between values derived from the original source and the new enhanced combination of data sources (in terms of percentage difference).

Table 4.10 Trafficmaster data. Difference between speeds calculated from original sources and from all sources. Percentage difference between sample sets.

	% Difference in speed NOI		% Difference in speed TLRN	
Area and time period	**Sep-13**	**Mar-14**	**Sep-13**	**Mar-14**
Central AM peak	-0.4	-0.3	-0.7	-0.5
Central inter-peak	-1.8	-0.6	-1.6	-0.5
Central PM peak	-2.3	-0.4	-1.8	-0.2
Inner AM peak	-0.2	0.0	-0.4	0.0
Inner inter-peak	-0.4	-0.2	-0.4	-0.2
Inner PM peak	-0.5	-0.1	-0.7	0.0
Outer AM peak	0.0	0.0	-0.1	0.1
Outer inter-peak	-0.1	-0.1	-0.2	-0.1
Outer PM peak	-0.3	-0.2	-0.4	-0.2

Source: TfL Surface Transport, Outcomes Delivery, based on data from Trafficmaster.
1. Value derived by weighting geographic components by proportion of traffic flow within zone.

Average speeds from the original source can be seen to be slightly lower than those from the new combination of sources. Therefore the effect of the new source is to increase the average speed by a very small amount. This contrasts with the visible trend of declining speeds i.e. the main trend is in the opposite direction to what would be expected if there was a sampling bias. This supports the hypothesis that the recent decline in observed average speeds is truly representative of traffic conditions and not being driven by a change to the sample.

Looking at table 4.11 it is also the case that the difference between delay measured using the original data set and delay measured using the new enhanced data set is minimal.

Average speeds derived from Trafficmaster have also been compared against those derived from TfL's London Congestion Analysis Project (LCAP) tool, which uses automatic number plate recognition (ANPR) technology to measure speeds delays and journey time reliability. Trends for average speeds have been found to be similar using both Trafficmaster and LCAP methods. This means that the trends shown above can be reported with a high degree of confidence in their validity.

Table 4.11 Difference between delay calculated from original source and from all sources. Percentage difference between sample sets.

	% Difference in delay NOI		% Difference in delay TLRN	
Area and time period	Sep-13	Mar-14	Sep-13	Mar-14
Central AM peak	0.7	0.0	2.1	-0.4
Central inter-peak	3.9	0.6	4.2	-0.3
Central PM peak	5.1	0.4	4.2	-1.0
Inner AM peak	-0.1	-0.7	0.5	-0.3
Inner inter-peak	0.2	-0.5	0.5	0.1
Inner PM peak	0.6	-0.5	1.1	-0.3
Outer AM peak	-0.4	-0.1	-0.1	-0.2
Outer inter-peak	-0.3	0.1	-0.2	0.6
Outer PM peak	0.2	0.4	0.6	0.6

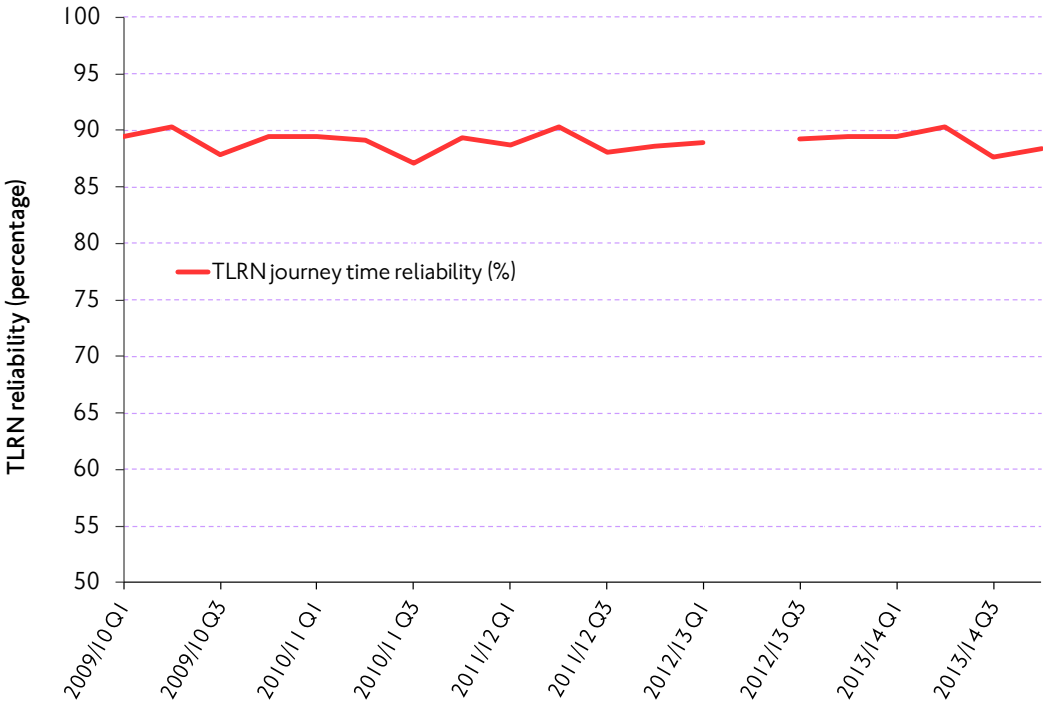
Source: TfL Surface Transport, Outcomes Delivery, based on data from Trafficmaster.
1. Value derived by weighting geographic components by proportion of traffic flow within zone.

Journey time reliability

TfL's assessment of road network performance for MTS is primarily based on the concept of journey time reliability. This considers the relationship of actual measured journeys (using ANPR cameras) to a nominal average journey time that is representative of journeys by road in London. This is measured quarterly on a road corridor basis, covering most of the TLRN major road network in London, and is aggregated to a London-wide index for the purpose of MTS assessment (figure 4.11).

Against a current working target of 89 per cent of road journeys in London to be achieved within five minutes of the nominal 30-minute average journey time, recorded performance since the start of this measure in 2009 has mostly been between 88 and 90 per cent. Seasonal factors are evident in the graph (for example with JTR peaking at 90.3 per cent in the summers of 2009, 2011 and 2013) but there is no evidence of a clear 'directional' trend in this indicator. Note that, due to the widespread alterations made to the operation of the major road network in London during the 2012 Games, a comparable value for this period is not available.

Figure 4.11 AM peak journey time reliability on the TLRN. Percentage of journeys completed within an allowable 'excess' of a normalised average journey time.



Source: TfL Surface Transport, Outcomes Delivery.

There has however been a decline in journey time reliability in the last two quarters of 2013/14 and preliminary data suggests that this trend is continuing into 2014/15. This can be related back to the growing evidence of a change to the historic trend of traffic flows, especially in outer London, as discussed above and in chapter 3 of this report.

Approximately 80 per cent of journey time unreliability can be attributed to traffic volumes and therefore this indicator has been coming under increasing pressure in recent quarters. For every two per cent annual rise in traffic volumes it is expected that JTR will fall by about 0.5 of a percentage point without intervention.

Since 2012 flows in the hour preceding the AM peak (06:00–07:00) have increased by between three and four per cent on average across all TLRN corridors putting direct pressure on AM peak JTR. Travel in London report 6 includes a more detailed discussion of the proportional contribution of explanatory factors to the loss of journey time reliability.

4.13 Focus: Congestion on different parts of London's road network

Scope

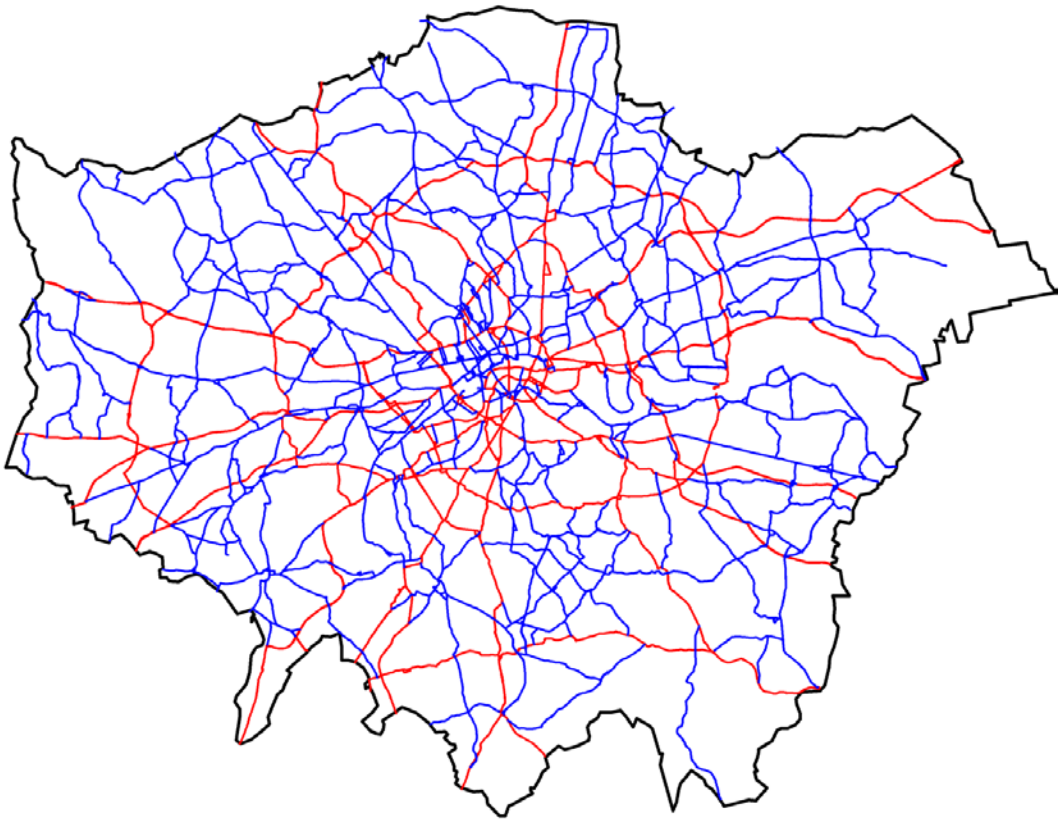
This section considers how Trafficmaster speed and delay data can be used to monitor performance trends on the different parts of London's road network. It is important to establish baselines and refine TfL's measurement capabilities in this regard, given the network capacity and management challenges implied by the Mayor's Roads Task Force and Cycling Vision initiatives.

The NOI, TLRN and BPRN networks

The data in section 4.12 relate to TfL's standard measurement of the performance of the road network in London. More specifically it covers TfL's 'Network of Interest' (NOI). This is defined as all 'M' and 'A' numbered roads, in addition to busy minor roads and busy bus routes. Within the Greater London area, the NOI is 4,613km in length.

The Roads Task Force embeds the concept of applying policies in different ways across different parts of the road network. In particular, it identifies nine broad 'street types', each with different characteristics and challenges. Due to sampling limitations, meaningful analysis of Trafficmaster data is currently restricted to the NOI as a whole, meaning that it disproportionately measures the busiest roads. Nevertheless, it is possible to consider distinct networks within this subset of London's roads, notably the TLRN and the Borough Principal Road Network (BPRN), which combined account for three-quarters of the NOI. The remainder of the NOI consists of motorways (managed by the Highways Agency) and roads managed by local authorities (Figure 4.12).

Figure 4.12 TLRN (red) and BPRN (blue) in Greater London.



Tables 4.12 and 4.13 summarise annual average speed for the TLRN and BPRN in Greater London. Average speeds on the TLRN have consistently been higher than those on the BPRN over the past seven years. The difference between the two networks is greater in both absolute and percentage terms in inner and outer

London. Average speeds in outer London are more than 10 km/h faster on the TLRN than the BPRN across all time periods, and especially in the inter-peak.

Table 4.12 Average speed (kilometres per hour) by functional sector of London. Working weekdays, by time period. TLRN.

Area and time period	2007 (km/h)	2008 (km/h)	2009 (km/h)	2010 (km/h)	2011 (km/h)	2012 (km/h)	2013 (km/h)
Central AM peak	16.4	15.7	16.0	16.0	15.9	15.9	15.9
Central inter-peak	15.8	15.4	16.2	16.0	15.5	15.5	15.3
Central PM peak	15.9	15.7	15.4	14.9	14.7	16.0	14.5
Inner AM peak	22.1	21.9	22.8	22.5	22.5	22.7	22.3
Inner inter-peak	23.4	23.2	23.7	24.1	24.1	23.7	24.0
Inner PM peak	19.9	19.8	19.4	20.0	20.2	21.5	19.5
Outer AM peak	34.6	35.6	36.4	36.3	36.3	35.9	34.8
Outer inter-peak	41.5	42.0	41.7	42.4	41.8	42.5	42.6
Outer PM peak	34.7	35.4	34.6	35.0	34.8	37.3	33.7

Source: TfL Surface Transport, Outcomes Delivery, based on data from Trafficmaster.
1. Value derived by weighting geographic components by proportion of traffic flow within zone.

Table 4.13 Average speed (kilometres per hour) by functional sector of London. Working weekdays, by time period. BPRN.

Area and time period	2007 (km/h)	2008 (km/h)	2009 (km/h)	2010 (km/h)	2011 (km/h)	2012 (km/h)	2013 (km/h)
Central AM peak	13.8	13.4	13.9	14.2	13.8	13.7	14.0
Central inter-peak	11.6	11.2	12.0	12.2	11.8	11.8	11.9
Central PM peak	13.1	12.9	13.0	13.0	12.9	13.0	13.0
Inner AM peak	18.4	18.1	18.7	18.4	18.2	17.9	17.7
Inner inter-peak	18.9	18.8	19.0	19.2	18.9	18.6	18.6
Inner PM peak	16.9	17.1	16.6	16.9	16.6	16.6	16.3
Outer AM peak	24.6	24.9	25.0	24.9	25.3	25.0	24.8
Outer inter-peak	25.4	25.6	25.2	25.5	25.8	25.9	25.9
Outer PM peak	22.3	22.6	22.1	22.1	22.4	22.5	22.2

Source: TfL Surface Transport, Outcomes Delivery, based on data from Trafficmaster.
1. Value derived by weighting geographic components by proportion of traffic flow within zone.

Table 4.14 Percentage difference in average speed (kilometres per hour) by functional sector of London. Working weekdays, by time period. TLRN versus BPRN.

Area and time period	Difference between average speed on TLRN versus BPRN
Central AM	12%
Central inter-peak	22%
Central PM	10%
Inner AM	21%
Inner inter-peak	22%
Inner PM	16%
Outer AM	29%
Outer inter-peak	39%
Outer PM	34%

Source: TfL Surface Transport, Outcomes Delivery, based on data from Trafficmaster.
1. Value derived by weighting geographic components by proportion of traffic flow within zone.

Table 4.14 above highlights how the difference between average speeds on the TLRN and BPRN generally increases as one moves from central London towards outer London. During the peaks in central London, average speeds on the TLRN are only 10 per cent faster than those on the BPRN. In contrast, average speeds on the TLRN in outer London are approximately one third faster than those on the BPRN for all time periods. This suggests that the two networks are considerably more different in character in outer London.

Tables 4.15 and 4.16 summarise annual average delay for the TLRN and BPRN in Greater London. It is clear that speeds are uniformly lower on the BPRN compared to the TLRN, which is to be expected given the characteristics of these two parts of the network. The picture for central London is less clear, with the TLRN consistently offering faster speeds only in the inter-peak. Again this might be expected, given the dense character of central London and general functional similarity of the major roads here.

Table 4.15 Average vehicle delay (minutes per kilometre) by functional sector of London. Working weekdays, by time period. TLRN.

Area and time period	2007 delay (min/km)	2008 delay (min/km)	2009 delay (min/km)	2010 delay (min/km)	2011 delay (min/km)	2012 delay (min/km)	2013 delay (min/km)
Central AM peak	1.4	1.5	1.4	1.5	1.5	1.4	1.5
Central inter-peak	1.6	1.6	1.4	1.5	1.5	1.6	1.7
Central PM peak	1.6	1.6	1.6	1.8	1.8	1.6	1.9
Inner AM peak	1.1	1.1	1.0	1.1	1.1	1.0	1.1
Inner inter-peak	1.0	1.0	0.9	0.9	0.9	0.9	0.9
Inner PM peak	1.4	1.4	1.5	1.4	1.3	1.4	1.5
Outer AM peak	0.7	0.6	0.6	0.6	0.6	0.7	0.7
Outer inter-peak	0.4	0.4	0.4	0.4	0.4	0.3	0.4
Outer PM peak	0.7	0.6	0.7	0.7	0.7	0.7	0.7

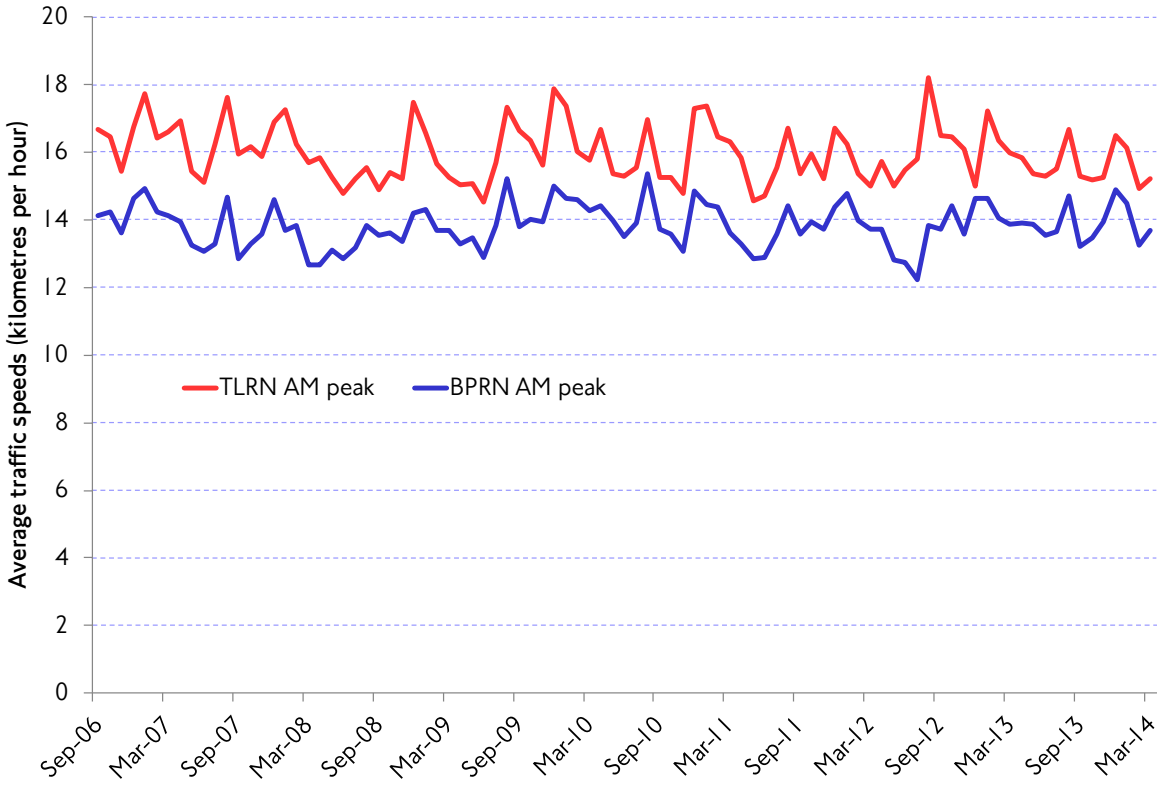
Source: TfL Surface Transport, Outcomes Delivery, based on data from Trafficmaster.
1. Value derived by weighting geographic components by proportion of traffic flow within zone.

Table 4.16 Average vehicle delay (minutes per kilometre) by functional sector of London. Working weekdays, by time period. BPRN.

Area and time period	2007 delay (min/km)	2008 delay (min/km)	2009 delay (min/km)	2010 delay (min/km)	2011 delay (min/km)	2012 delay (min/km)	2013 delay (min/km)
Central AM peak	1.5	1.6	1.3	1.3	1.5	1.5	1.6
Central inter-peak	2.4	2.5	2.0	2.0	2.2	2.2	2.4
Central PM peak	1.8	1.8	1.6	1.7	1.8	1.8	1.9
Inner AM peak	1.4	1.4	1.2	1.3	1.4	1.4	1.5
Inner inter-peak	1.3	1.3	1.2	1.2	1.2	1.3	1.3
Inner PM peak	1.7	1.6	1.6	1.6	1.7	1.7	1.7
Outer AM peak	1.0	0.9	0.9	0.9	0.9	0.9	0.9
Outer inter-peak	0.9	0.8	0.8	0.8	0.8	0.8	0.8
Outer PM peak	1.2	1.1	1.2	1.2	1.2	1.1	1.2

Source: TfL Surface Transport, Outcomes Delivery, based on data from Trafficmaster.
1. Value derived by weighting geographic components by proportion of traffic flow within zone.

Figure 4.13 Average vehicle speed (kilometres per hour) in central area. Working weekdays, AM peak. TLRN and BPRN.

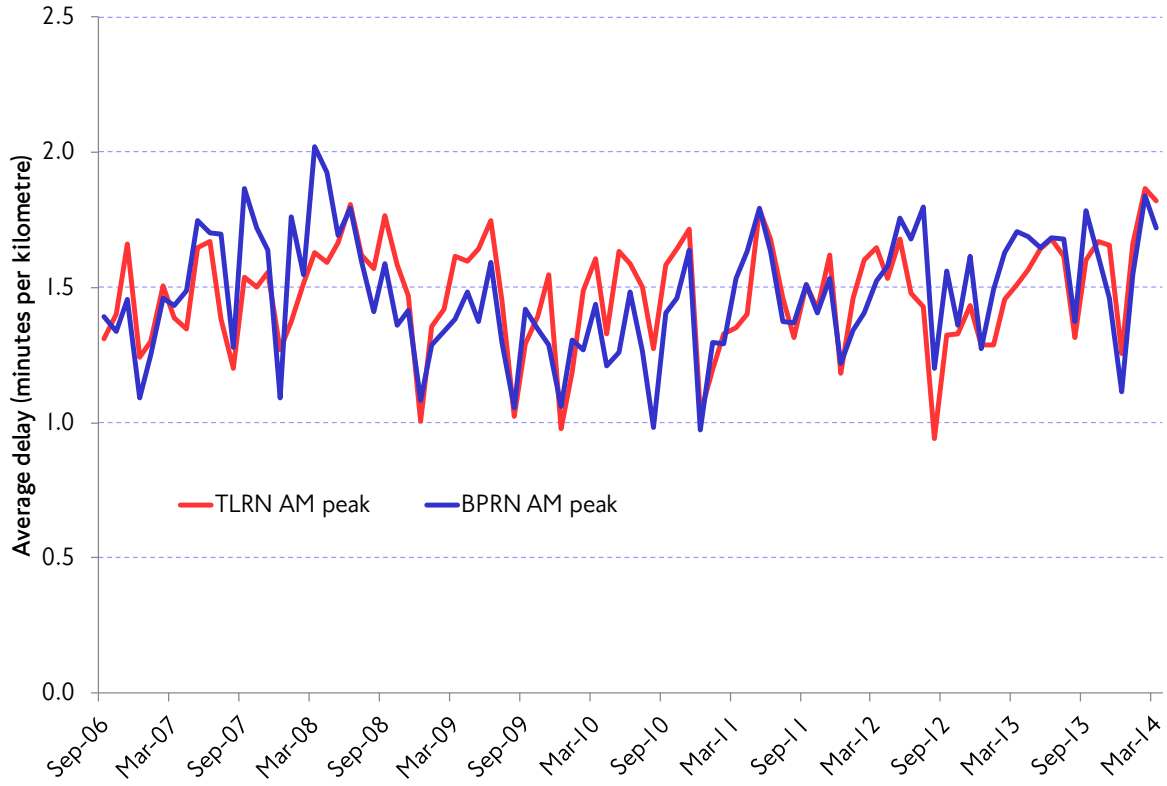


Source: TfL Surface Transport, Outcomes Delivery, based on data from Trafficmaster.

Average speeds in the AM peak on the TLRN in central London have consistently been higher than those on the BPRN across the full time series (figure 4.13). In general speeds on both networks follow similar trends with the exception of diverging trends in spring and summer 2012. This corresponded with a series of major events on the central London road network (for example, Diamond Jubilee celebrations and the London 2012 Games) as well as on-street maintenance works in advance of the Games. During this period the TLRN (in particular the links which comprised part of the Olympic Route Network) was heavily managed to ensure its performance was maintained at the highest level. Large sections of the BPRN were not actively managed and therefore performance was lower when faced with these exceptional conditions.

The longer-term differences between the TLRN and BPRN can be seen more clearly in the trends for average vehicle delay (figure 4.14).

Figure 4.14 Average vehicle delay (minutes per kilometre) in central area. Working weekdays, AM peak. TLRN and BPRN.



Source: TfL Surface Transport, Outcomes Delivery, based on data from Trafficmaster.

Comparing the trends for the TLRN and BPRN in the AM peak in central London, it can be seen that beyond the usual seasonal variability, there was a deeper recessionary impact on delay on the BPRN, with a substantial reduction in delay in 2008 being maintained until 2011. At the same time, the trend for the TLRN has been more stable, and during the period of the recession, delay on the TLRN exceeded that on the BPRN, before falling below again in 2012.

The historic trend suggests that the TLRN may be less responsive to external factors than networks lower down in the hierarchy. This is not unexpected, as the TLRN is the more actively managed network, and is managed by one single authority. Looking more closely at the most recent data however, it can be seen that both the TLRN and BPRN have deteriorated in a similar way since late 2013, with average delay broadly the same on both networks. It remains unclear to what extent the management of the TLRN in busy times diverts traffic and therefore contributes to congestion on the other networks. The greater variability in congestion on the BPRN could on the one hand be a consequence of the lower capacity of its links, but may also be exacerbated by diverted traffic from a heavily managed TLRN at busy times.

4.14 Key reference statistics

The service enhancements and best ever performance scores for public transport reported above contribute to **supporting population and economic growth**, and TfL's future planning is strongly focused on ensuring that transport continues to play its part in supporting the future development of London. The table below

summarises the key statistics, and illustrates how investment in increasing capacity and strong operational performance are supporting the continued growth of London.

Table 4.17 Indicators of public transport service provision and performance by mode.

Service and indicator	Units	2011 or 2011/12	2012 or 2012/13	2013 or 2013/14	Trend
Underground					
Level of service scheduled	Million train km	74.6	77.5	78.2	Strong improvement
Level of service operated	% of schedule	97.0	97.6	97.5	Steady improvement
Service reliability	Standardised journey time	45.1	43.6	43.4	Recent improvement
Service reliability	Excess journey time	5.8	5.3	5.2	Strong improvement
Bus					
Level of service scheduled	Million bus km	501.6	502.6	502.4	
Level of service operated	Per cent	97.6	97.6	97.7	Consistently excellent
Service reliability	Excess waiting time	1.0	1.0	1.0	Consistently excellent
DLR					
Level of service operated	Million train km	4.9	5.7	5.8	Strong improvement
Level of service operated	% of schedule	97.7	98.5	99.2	Consistently excellent
Service reliability	% of trains on time	97.5	98.8	99.3	Consistently excellent
London Tramlink					
Level of service scheduled	Million train km	2.74	2.98	3.06	Strong improvement
Level of service operated	% of schedule	98.9	97.3	98.9	Consistently excellent
National Rail					
Service reliability – all L&SE operators (peak)	ORR PPM (% peak only)	88.1	86.9	85.0	Recent decline
Service reliability – all L&SE operators	ORR PPM (% all services)	91.7	91.0	89.6	Recent decline
Service reliability – London Overground	ORR PPM (% all services)	96.6	96.6	96.1	Consistently excellent

Source: TfL Planning, Strategic Analysis.

References

(1) Roads Task Force Vision for London's Streets and Roads. https://www.tfl.gov.uk/cdn/static/cms/documents/rtf-report-chapter-1.pdf

(2) The Mayor's Vision for Cycling in London. http://www.london.gov.uk/sites/default/files/Cycling%20Vision%20GLA%20template%20FINAL.pdf

(3) Public Performance Measure for National Rail. See http://data.gov.uk/dataset/public_performance_measure_ppm

(4) Travel in London report 3, see section 4.5. http://www.tfl.gov.uk/cdn/static/cms/documents/travel-in-london-report-3.pdf

(5) Travel in London report 6, see section 6.4. http://www.tfl.gov.uk/cdn/static/cms/documents/travel-in-london-report-6.pdf

Monitoring and assessing progress with the implementation of the Mayor's Transport Strategy

5. Safety and security on the transport networks

5.1 Introduction

Chapters 2 to 4 of this report looked at recent trends for travel demand and operational performance across the TfL modes and compared these, where appropriate, with MTS expectations. These earlier chapters therefore quantify the changing context and background to the MTS, in terms of aggregate travel demand and transport supply.

The next four chapters look at progress across the wider range of MTS goals, covering: safety and personal security, improving transport opportunities for all Londoners, transport and quality of life and aspects of TfL's wider organisational performance. The emphasis is on giving a broad evidence-based assessment of trends, but focusing on topics of particular contemporary interest each year. This chapter focuses on safety and security on the transport networks in London.

5.2 Key trends

- The last decade saw strong improvements to the principal indicators of road safety in London. The year 2013 saw a 23 per cent reduction in KSIs on the previous year, the lowest number since records began, and a drop in fatalities on London's roads to the second lowest level since records began. Improving safety for vulnerable road users, who now account for 79 per cent of persons killed or seriously injured (KSIs) in 2013, is key to delivering London's casualty reduction target.
- On the Underground in 2013/14 there was one passenger fatality and 127 other injuries – a 19 per cent decrease in the injury rate compared to the previous year. The recent trend is of relative stability in this measure despite rapidly increasing demand on the public transport networks. On the bus network, casualty numbers showed a decrease, of 4 per cent on those of 2012.
- Rates of reported crime across the public transport networks continued to fall, extending the encouraging trend since the middle of the last decade. In terms of reported crime, levels are now about half of what they were in 2005/06.

5.3 Road safety

Recent years have seen substantial reductions in the number of casualties from road traffic collisions in London. This section updates recent progress against casualty reduction benchmarks.

Strategic frameworks for road safety

In June 2013, the Mayor and TfL published Safe Streets for London [1]. This plan seeks to develop the road safety elements of the MTS and covers the period up to and including 2020. In 2014, TfL has begun to deliver on the many strands of the Safe Streets for London action plan. Motorcycle, Pedestrian and Cycle Safety Action Plans have been published to set out the detailed plans to increase the safety of the most vulnerable road users in the Capital.

TfL has published six commitments which make clear how TfL, the boroughs and other partners will be working to meet London's road safety target and drive down road casualties. The six commitments are:

- To lead the way in achieving a 40 per cent reduction in the number of people killed or seriously injured on the Capital's roads by 2020 – with a longer term ambition of freeing London's roads from death and serious injury.
- To prioritise safety of the most vulnerable groups – pedestrians, cyclists and motorcyclists – which make up 79 per cent of serious and fatal collisions.
- To provide substantial funding for road safety, invested in the most effective and innovative schemes.
- To increase efforts with the police, boroughs and enforcement agencies in tackling illegal, dangerous and careless road user behaviour that puts people at risk.
- To campaign for changes in national and EU law to make roads, vehicles and drivers safer.
- To work in partnership with boroughs and London's road safety stakeholders to spread best practice and share data and information.

TfL is upgrading its speed camera network and replacing obsolete wet film cameras with new digital cameras. TfL is also undertaking two 20mph speed limit trials on the TLRN in the City of London which are being monitored closely to inform future further 20mph locations on the TLRN.

Operation Safeway has proved an effective way of clamping down on dangerous behaviours, and educating all road users about their safety.

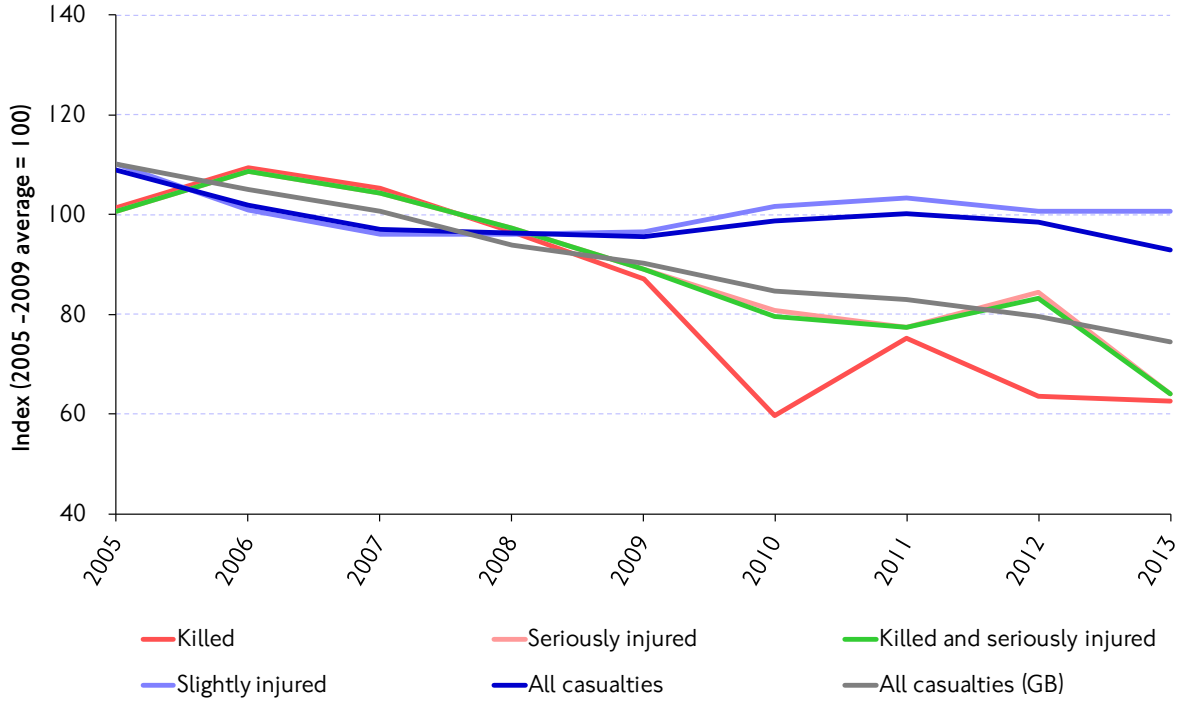
Locations for the Better Junctions programme were announced in 2014, and consultation has begun on new designs with the aim of rebuilding many of London's worst junctions as part of a £300m investment programme. Alongside these tried and tested methods, TfL is working with partners and stakeholders to innovate, with new solutions for London. Trials are underway of technologies that help bus drivers detect pedestrians and cyclists near their vehicles. New digital speed cameras can also operate as red light cameras when the traffic lights change.

A full summary of TfL's road safety programme and activity in 2013 can be found in 'Collisions and casualties on London's roads: Annual report 2013' [(2)].

Casualty trends in London

Figure 5.1, indexed to the Government's 2005-2009 baseline for measuring progress, shows the long-term trend of casualty reduction in London since 2005. Table 5.1 summarises casualty statistics in 2013 compared to 2012 and the 2005-09 baseline.

Figure 5.1 Long term trend for road traffic casualties in London, by severity of injury. Index values relative to 2005-2009 average baseline.



Source: TfL Strategy and Outcome Planning, Surface Transport, Outcomes Delivery.

Casualties in 2013

In 2013 a total of 27,199 personal injury casualties were reported in London. Of these, 132 were fatally injured, 2,192 were seriously injured and 24,875 were slightly injured. Compared to 2012:

- Fatalities fell by 1.5 per cent in 2013, from 134 to 132, the second lowest since records began. The number of fatalities fell among pedestrians and motorcyclists, and remained the same among cyclists.
- There was a 24 per cent decrease in all serious casualties from 2,884 to 2,192, the lowest level since records began.
- Slight casualties decreased by 3.4 per cent (24,875 compared to 25,762).
- Overall casualties (all injury severities) in 2013 decreased by 5.5 per cent compared with 2012 (27,199 compared to 28,780) – the lowest level of casualties on record.

Annual changes in collisions and casualties during 2013 should be considered in the context of long term casualty trends in London, as fluctuations year on year are not always indicative of longer term trends. It should also be noted that large percentage changes in small numbers may not be statistically significant.

Although TfL is taking the lead to make roads safer, it cannot achieve these casualty reductions alone. Ninety five per cent of London's streets are the responsibility of boroughs and there are many other partners involved in reducing casualties. Many of the required changes to improve road safety, such as engineering schemes for 20 mph zones, education and enforcement of speed limits have been implemented in recent decades. Additional progress in driving down KSI casualties will be very challenging. The increasing population of London and increased cycling also pose an ongoing challenge.

Table 5.1 shows casualties on London's roads both for 2012 and 2013, compared against the 2005-2009 baseline. Changes in collisions and casualties during 2013 should be considered in the context of long-term casualty trends in London, as year-on-year fluctuations are not always indicative of long-term trends.

In 2013 against the 2005-2009 baseline:

- Fatalities were 37 per cent below the 2005-2009 average.
- All KSI casualties were 36 per cent below the 2005-2009 average.
- Child KSIs were 43 per cent below the 2005-2009 average.
- Slight casualties were three per cent below the 2005-2009 average.
- Pedestrian KSIs were 31 per cent below the 2005-2009 average.
- Powered two-wheeler user KSIs were 36 per cent below the 2005-2009 average.

Pedal cyclist KSIs were 16 per cent above the 2005-2009 average, however this should be seen in the context of a considerable increase in cycling in recent years and a 27 per cent decrease in KSIs compared with 2012.

Table 5.1 Road collision casualties in Greater London in 2013 compared with 2005-2009 average and 2012.

Casualty severity	User group	Casualty numbers			Percentage change in 2013 over	
		2005-2009 average	2012	2013	2012	2005-2009 average
Fatal	Pedestrians	96.0	69	65	*-6%*	*-32%*
	Pedal cyclists	16.6	14	14	*0%*	*-16%*
	Powered two-wheeler	43.4	27	22	*-19%*	*-49%*
	Car occupants	49.4	19	25	*32%*	*-49%*
	Bus or coach occupants	2.4	2	1	*-50%*	*-58%*
	Other vehicle occupants	3.2	3	5	*67%*	*56%*
	Total	**211.0**	**134**	**132**	***-1%***	***-37%***
Fatal and serious	Pedestrians	1,216.4	1,123	838	*-25%*	*-31%*
	Pedal cyclists	420.6	671	489	*-27%*	*16%*
	Powered two-wheeler	791.2	629	510	*-19%*	*-36%*
	Car occupants	949.0	448	335	*-25%*	*-65%*
	Bus or coach occupants	139.6	94	90	*-4%*	*-36%*
	Other vehicle occupants	109.8	53	62	*17%*	*-44%*
	Total	**3,626.6**	**3,018**	**2,324**	***-23%***	***-36%***
	Children (under 16yrs)	**330.2**	**270**	**187**	***-31%***	***-43%***
Slight	Pedestrians	4,214.0	4,143	4,343	*5%*	*3%*
	Pedal cyclists	2,718.2	3,942	4,134	*5%*	*52%*
	Powered two-wheeler	3,806.4	4,022	3,992	*-1%*	*5%*
	Car occupants	12,426.8	11,217	9,850	*-12%*	*-21%*
	Bus or coach occupants	1,429.8	1,232	1,381	*12%*	*-3%*
	Other vehicle occupants	1,004.8	1,206	1,175	*-3%*	*17%*
	Total	**25,600.0**	**25,762**	**24,875**	***-3%***	***-3%***
All severities	Pedestrians	5,430.4	5,266	5,181	*-2%*	*-5%*
	Pedal cyclists	3,138.8	4,613	4,623	*0%*	*47%*
	Powered two-wheeler	4,597.6	4,651	4,502	*-3%*	*-2%*
	Car occupants	13,375.8	11,665	10,185	*-13%*	*-24%*
	Bus or coach occupants	1,569.4	1,326	1,471	*11%*	*-6%*
	Other vehicle occupants	1,114.6	1,259	1,237	*-2%*	*11%*
	Total	**29,226.6**	**28,780**	**27,199**	***-5%***	***-7%***

Source: TfL Strategy and Outcome Planning, Surface Transport, Outcomes Delivery.

Steps being taken to reduce conflict between cyclists and HGVs

TfL commissioned a review into construction logistic operations and cyclist safety (CLoCS) to examine if there were any technical or operational reasons as to why construction vehicles are so disproportionately involved in fatal collisions with vulnerable road users.

The CLoCS programme has brought together vehicle manufacturers, construction clients, fleet operators, regulatory and enforcement bodies, and road safety charities to become an industry-led programme which aims to fundamentally change the way the construction industry manages work-related road safety, especially in relation to vulnerable road users: cyclists, pedestrians and motorcyclists [3].

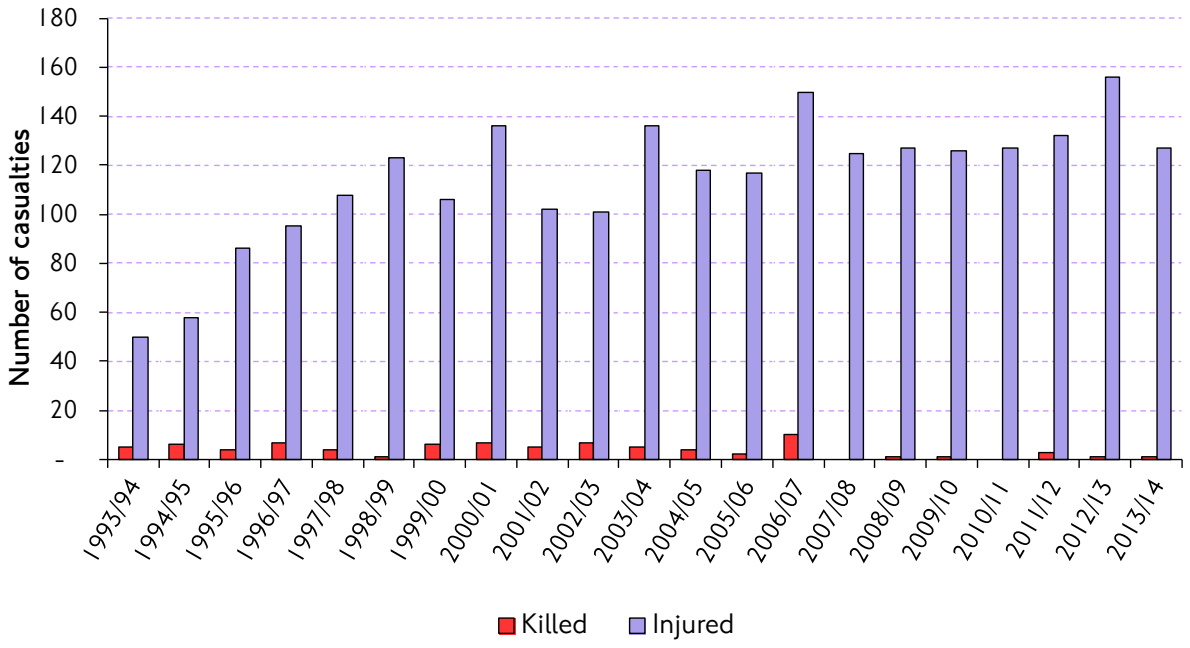
5.4 Passenger safety on the public transport networks

Overall, particularly when viewed in the context of rising service levels and patronage, London's public transport networks continue to offer a safe travelling environment, with notable improvements to passenger safety over more recent years.

London Underground

On the Underground, 2013/14 saw 127 passenger injuries and one fatality. These numbers compare similarly to passenger injuries and fatalities for the years 2007/08 to 2011/12, and represent a substantial decrease from the 156 injuries in 2012/13 (figure 5.2). The fatality occurred at Hounslow East station, where an intoxicated 21-year-old male passenger fell under an eastbound train following a Christmas party.

Figure 5.2 Number of people killed or injured while travelling on London Underground.



Source: Transport for London. Excludes suicides and victims of assault and terrorist activity.

Buses and coaches

In 2013, 89 bus users sustained major injuries in London, with one fatality. The fatality was a 90-year-old male, who fell after the bus was forced to brake suddenly when a car moved lanes into its path. These casualty numbers exclude pedestrian and other vehicle users who might have been injured in collisions involving buses or coaches – these are included in the statistics described in table 5.1. Figure 5.3 shows a consistent trend of improvement in bus or coach passenger injuries over the last decade. The number of people killed or sustaining major injuries while using the buses in 2013 stood at roughly half of the typical values at the start of the decade. This also coincides with an approximate 65 per cent increase in bus or coach patronage, and therefore also represents a substantial reduction in risk per passenger.

Figure 5.3 Number of people killed or sustaining major injuries while travelling on buses or coaches in London.

Source: Transport for London. Excludes suicides and victims of assault and terrorist activity.

5.5 Crime and antisocial behaviour on the public transport networks

Summary

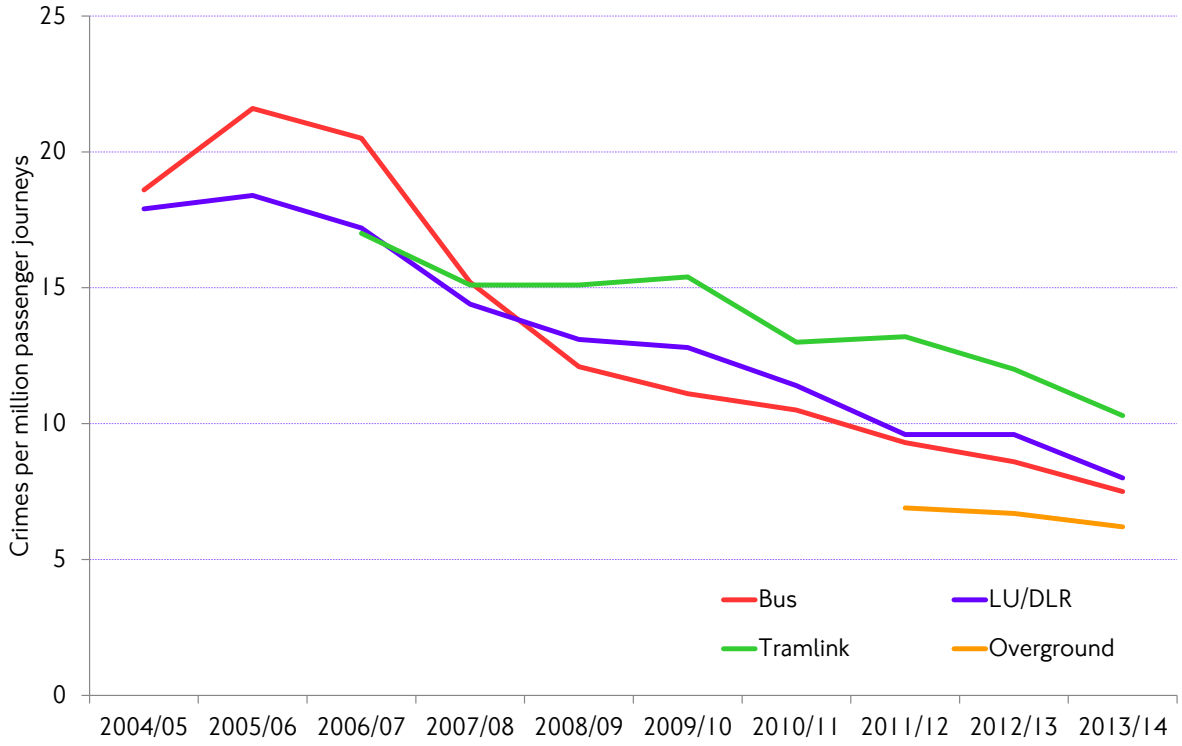
Levels of crime on TfL's transport system have continued to fall in 2013/14 – down by 11.3 per cent on 2012/13. The rate of crime on TfL's public transport system has fallen to 7.6 crimes per million passenger journeys, down from 8.9 in 2012/13. The risk of becoming a victim of crime while travelling on TfL's transport system is now at its lowest recorded level.

Trend for recorded crime on London's public transport networks

Progress during 2013/14 was broadly consistent with recent trends (figure 5.4). There were reductions on the number of reported crimes per million journeys across the entire public transport network compared to 2012/13.

There were 7.5 reported crimes per million customer journeys on the bus network, down from 8.6 in the previous year (a reduction of 12.8 per cent). There were also reductions of reported crime on Tramlink and London Overground over the previous year, these falling by 14.2 per cent and 7.5 per cent respectively. On the Underground and DLR networks, there was a 16.7 per cent reduction in the number of reported crimes per million customer journeys.

Figure 5.4 Crime on TfL's public transport networks. Rate per million passenger journeys.



Source: TfL Enforcement and On-street Operations.

References

(1) Safe streets for London. See https://www.tfl.gov.uk/corporate/safety-and-security/road-safety/safe-streets-for-london

(2) See: http://www.tfl.gov.uk/cdn/static/cms/documents/collisions-and-casualties-on-london-roads-annual-report-2013.pdf

(3) TfL's Safer Lorries scheme. See https://consultations.tfl.gov.uk/buses/safer-lorries

6. Transport connectivity, physical accessibility, customer satisfaction and emissions from ground-based transport

6.1 Introduction

This section considers themes around the contribution of transport to the quality of life of Londoners. It covers, in total, eleven **MTS Strategic Outcome Indicators**, considering firstly the themes of transport connectivity and physical accessibility to the transport system. It then looks at a range of perception-based indicators which gauge customer satisfaction with aspects of the travel environment. Finally, it updates estimates of emissions to atmosphere for ground-based transport.

6.2 Access to jobs and services (transport connectivity)

Background

The key role of London's transport system is to provide access to jobs, services and other opportunities so that London can function efficiently and its economy can continue to grow. The efficacy of London's transport networks was amply demonstrated during the 2012 Games, when unprecedented numbers of visitors were accommodated while the rest of London was kept functioning and 'open for business'. However, on a day-to-day level, it is known that the availability of transport can still act as a constraint on, for example, the ability of people to reach suitable employment opportunities. Furthermore, as London's population continues to grow, new and improved transport links to cater for this growth and to offer greater connectivity assume crucial importance.

Connectivity to jobs

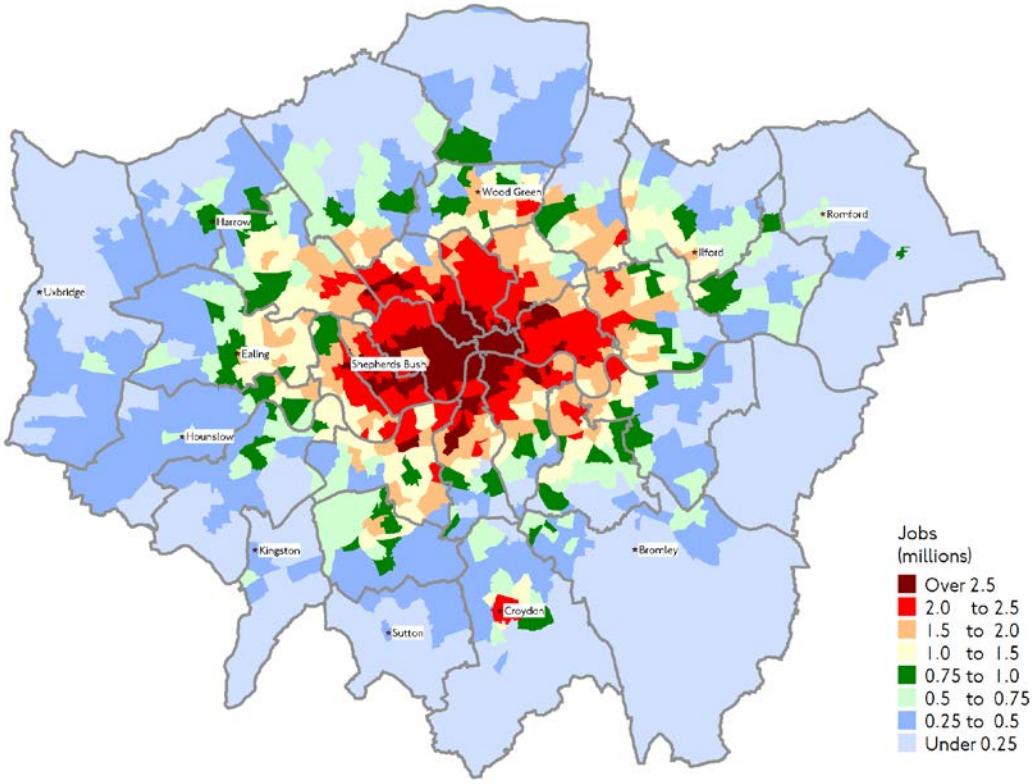
Travel in London report 6 looked at how TfL measures strategic connectivity, and at relative change across London between 2007 and 2016 and, reflecting Crossrail 1, with expected conditions in 2031.

One measure that can be used to quantify the development of the transport networks is the number of jobs (whether filled or currently vacant) that are potentially available within a given travel time from a particular residential location. The basis for assessing this is a travel time contour of 45 minutes by the principal public transport modes, expressed as an aggregate measure across Greater London.

Figure 6.1 shows these results for 2012 (the latest available year for which disaggregate estimates are available). The map should be interpreted in terms of, from any one point, the number of jobs that are potentially reachable in 45 minutes. Given the nature of TfL's transport models used to derive this measure and the evolutionary pace of change in the transport networks, it is not always possible or appropriate to update this indicator each year. Furthermore, the changing number of jobs from year-to-year will also have an impact. As might be expected, the map reflects the concentric pattern of employment density and also the primarily radial orientation of the public transport networks. Typically, for people living in outer London, between 0.25 and 0.5 million jobs are potentially available from their home location within 45 minutes travel time. However, this rises to typically around 2.5 million jobs potentially available to a resident of central London.

Table 6.1 shows the available time-series for this indicator, and shows steady progress in terms of increased access to employment in London, with a 6.2 per cent increase between 2006 and 2013.

Figure 6.1 Number of jobs available by mass public transport within 45 minutes travel time, 2012.



Source: TfL Planning, Strategic Analysis.

Table 6.1 Number of jobs available by mass public transport within 45 minutes travel time, 2013. London-wide average of small-area scores.

Year	Number of jobs available within 45 minutes travel time
2006	937,900
2009	959,400
2011	980,200
2012	989,450
2013	995,950

Source: TfL Planning, Strategic Analysis.

Connectivity to the public transport network

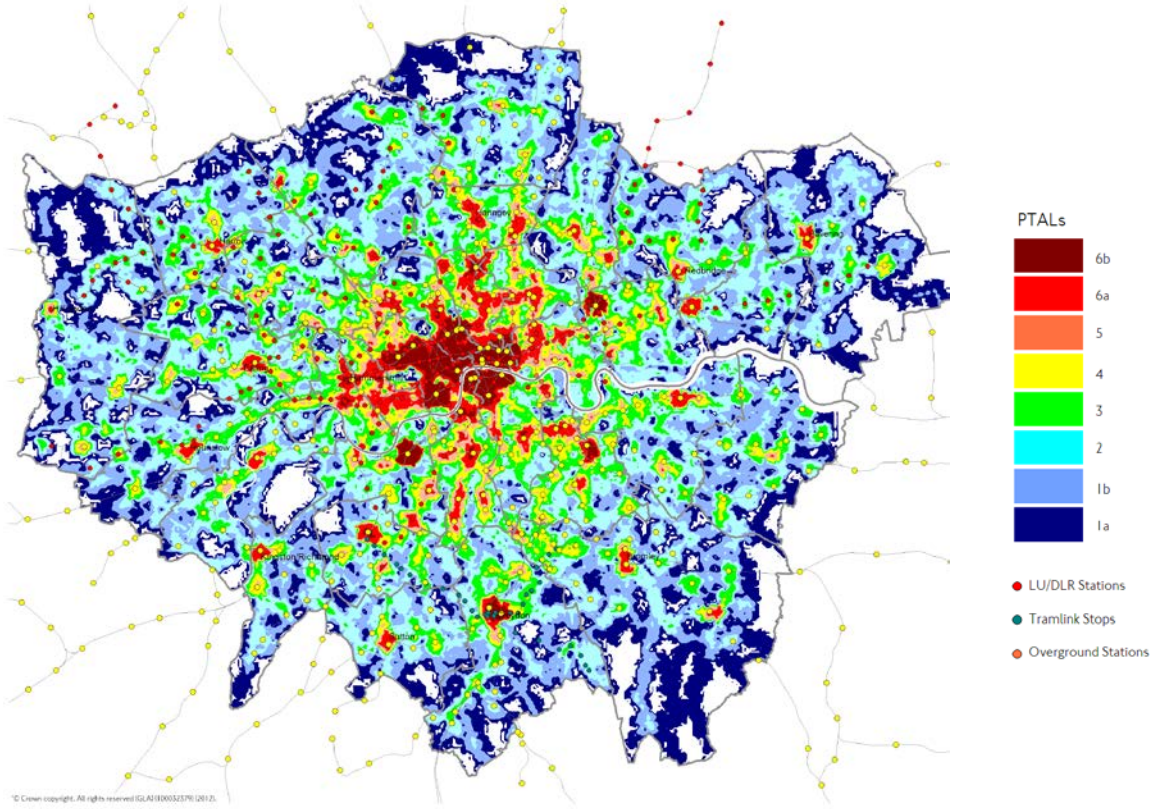
PTALs (public transport access levels) indicate relative connectivity to the public transport network for any location in London. The term 'connectivity to the network' indicates that the PTAL measure focuses on the proximity to public

transport services, and not on where these services take you to or indeed how accessible they are to all members of the population.

PTALs are relatively simple calculations because they only measure access to the public transport network, and ignore what happens once a passenger has 'entered' this network. They do not consider aspects of the journey such as the final destination of the journey, vehicle capacity or service quality. For this reason PTALs should not be used to estimate how many people will actually use public transport. Two sites with the same PTAL scores will most likely offer different levels of public transport service.

Figure 6.2 shows Greater London PTALs for 2014. Clearly central London is dominated by high PTALs, as are other metropolitan town centres, such as Croydon, Kingston and Harrow. The predominant radial orientation of the main public transport corridors is also visible in the figure.

Figure 6.2 Public transport access level, 2014.



Source: TfL Planning, Strategic Analysis.

Access to jobs and services (MTS strategic outcome indicator)

Access to jobs and services is defined as a local area score of average journey time by public transport, walking and cycling to jobs and local services. This indicator relies on comprehensive updates to transport model scenarios, and consequently it is only updated on a circa five yearly basis. The most recent benchmark, reflecting conditions in 2010, was that the average journey time by public transport, walking or cycling to local area jobs and services was 17.4 minutes. This is an average across the whole of Greater London, based on numerous local area scores.

New connectivity assessment toolkit

In 2015, WebCAT, a connectivity assessment toolkit will be introduced on the TfL website. This will replace an older website which planners and developers have been consulting with to check PTAL values at selected locations. WebCAT will include a more modern mapping interface, consistent with the one used in other parts of the TfL website. It will allow checking values of PTAL as before but will also allow the creation of maps of approximate travel times throughout London, from or to user-selected locations. WebCAT will allow users to query these values not only for the current year (as done on the PTAL website), but also for future scenarios that include some committed investments such as Crossrail 1. This should allow planners to examine likely changes in levels of connectivity compared to a future starting point, which may be a more relevant analysis in the context of their work.

Another feature to be introduced in WebCAT is the ability to produce connectivity maps by bus only or by step-free public transport services only. WebCAT will also allow users to look at catchment statistics, for example the number of jobs that can be reached within 45 minutes from a selected location. It is important to note that WebCAT is not a journey planner and only gives approximate and average connectivity figures; it is provided as a new service to those undertaking strategic planning in the London boroughs, GLA, developers and consultants.

6.3 Physical accessibility to the transport system

MTS Strategic Outcome Indicator

Previous Travel in London reports have set out statistics describing the accessibility status of key elements of the transport infrastructure in London. These have been combined into a 'physical accessibility' strategic outcome indicator for the MTS, expressed in terms of a weighted percentage score across the modes. The trend for this indicator is one of slow but continued improvement (table 6.2), and the most recent value for 2013/14 continues this trend, with a score of 50 per cent. Although this score indicates that half of the public transport networks are now accessible, it refers to the extent of the network rather than the intensity with which different parts are used. The speed of progress with this indicator also reflects the generally low level of heritage provision and the large-scale, capital-intensive nature of the changes to infrastructure that are often required.

Table 6.2 Modal composite physical accessibility score.

Year	Composite physical accessibility score (%)
2007/08	(36)
2008/09	(36)
2009/10	37
2010/11	38
2011/12	44
2012/13	46
2013/14	50

Source: TfL Planning, Strategic Analysis.
Note TfL: Values prior to 2009/10 are based on a dataset that differs in minor respects to that used from 2009/10.

Travel by people with a disability

TfL's London Travel Demand Survey (LTDS) can provide a range of data relating to travel by disabled people. Looking at the latest 3 years of LTDS data combined (2011/12 to 2013/14, to maximise sample size) and comparing with the 2001 LATS survey, we can see that:

- Disabled residents made 1.89 trips per person on an average weekday, compared with 2.79 for the whole London population.
- Public transport trip rates by disabled residents are 0.57 per person per day, compared with 0.86 for the whole population.
- Bus trip rates are higher amongst disabled residents than the London population – 0.44 compared with 0.40 per person per day.
- Compared with 2001, disabled residents now make more trips on public transport – 0.57 per person per day in 2011 compared with 0.51 in 2001.

Looking at weekday journey purpose in the latest LTDS data, disabled people make fewer work and education trips than the average London resident. This has an impact on the overall number of trips by disabled people. Improving access to the transport system is an important part of this equation, but unless there is a corresponding increase in employment and training opportunities for disabled people then the number of overall journeys will not increase considerably.

6.4 Customer satisfaction and the journey experience

Summary

Improving the quality of Londoners' overall daily travel experience is a priority for the Mayor. Previous Travel in London reports have described the range of perception and customer satisfaction-based indicators that TfL uses to understand how Londoners view their travel experiences and therefore the impact of the Mayor's transport policies on their quality of life. These indicators are generally relatively slow to change, as the impact of individual specific improvements is often difficult to detect in surveys at the London-wide level. Also, as improvements are made over time, so public expectations also tend to rise. Nevertheless, the positive impact on journey quality of recent large-scale step-change projects such as the transformation of the London Overground network and Tube upgrades has been

clearly seen in indicators at the modal level, and the general trend in the summary indicators over the past five years has been one of improvement.

Recent trends in perception/customer satisfaction based MTS strategic outcome indicators

Previous Travel in London reports have described the suite of surveys that TfL uses to monitor aspects of the journey experience. Results are presented in terms of mean scores out of 100 (these are not percentage scores), based on a response ranking system from zero (lowest satisfaction) to 10 (highest satisfaction). TfL interprets these scores in a semi-subjective way, based on experience (this albeit open to different interpretation by different people) based on the scale shown in table 6.3.

Table 6.3 TfL's interpretation of customer satisfaction scores.

Score	Interpretation
Under 50	Very poor
50 to 54	Poor
55 to 64	Fairly poor
65 to 69	Fair
70 to 79	Fairly good
80 to 84	Good
85 to 89	Very good
90 or more	Excellent

Source: TfL Customer Satisfaction surveys.

Table 6.4 updates the key perception/customer satisfaction MTS strategic outcome indicators for the most recent year, against the longer-term trend, and also shows TfL's qualitative assessment of the position shown by each indicator for the latest year.

The table shows that the trend for all indicators is one of steady improvement. Scores for 2012/2013 reflect the period of the 2012 Games, during which customer satisfaction scores for the principal public transport modes were at their highest-ever levels. A number of indicators have continued to increase into 2013 and 2014.

Perception of journey experience

This indicator looks at how London residents perceive their journeys overall. It complements mode-specific scores reported elsewhere and recognises the complex interaction between modes that is typical of travel in London.

The average satisfaction rating for travel in the Capital among Londoners in 2014 was 70 out of 100, the same as in 2013. This is the highest rating since the survey began, and continues a slow but steady upward trend over the last five years.

Public transport customer satisfaction

This is a composite indicator based on scores for each of the individual modes weighted by their respective share of total public transport travel in London. Scores have improved over recent years, with a particular improvement to a value of 83 in 2012 – a good score that has been sustained in 2013.

Table 6.4 Summary of trends in perception-based MTS strategic outcome indicators. Mean scores out of 100.

Indicator	2010 or 2010/11	2011 or 2011/12	2012 or 2012/13	2013 or 2013/14	2014 or 2014/15	TfL's assessment
Perception of journey experience[1]	66	66	67	70	70	'Fairly good'
Public transport customer satisfaction[2]	80	80	83	83	n/a	Remains 'good'
Satisfaction with public transport crowding[3]	76	78	79	78	n/a	'Fairly good'
TLRN road user customer satisfaction[4]	72	75	76	75	n/a	'Fairly good'
Perception of the urban realm[5]	64	66	65	65	67	'Fair'/slow improvement
Perception of transport-related noise[6]	71	74	76	75	77	'Fairly good'/improving

Source:
Indicators 1, 5 and 6 = TfL Perceptions of Travel Environment survey.
Indicators 2 and 3 = TfL Customer Satisfaction surveys, mode share based upon journey stage estimates from operator data.
Indicator 4 = TLRN users' satisfaction survey (Q3 only).

Satisfaction with public transport crowding

Scores for this indicator have increased gradually over the review period, reaching a value of 78 in 2013. The values correspond to a 'fairly good' assessment according to TfL's criteria.

TLRN road user customer satisfaction

This indicator is defined as the satisfaction of London residents with the operation of the Transport for London Road Network. The survey includes those who travel

on the TLRN by car (as driver), bus, cycle, motorcycle, commercial vehicle or as a pedestrian.

The index for 2013 (that for 2014 is not yet available) decreased by one point from 2012 to an average score of 75 – the same level as in 2011. Looking at specific modes, after the high scores in 2012, overall satisfaction has dropped among car driver, bus passengers and pedestrians. Scores for cyclists remained stable from 2012.

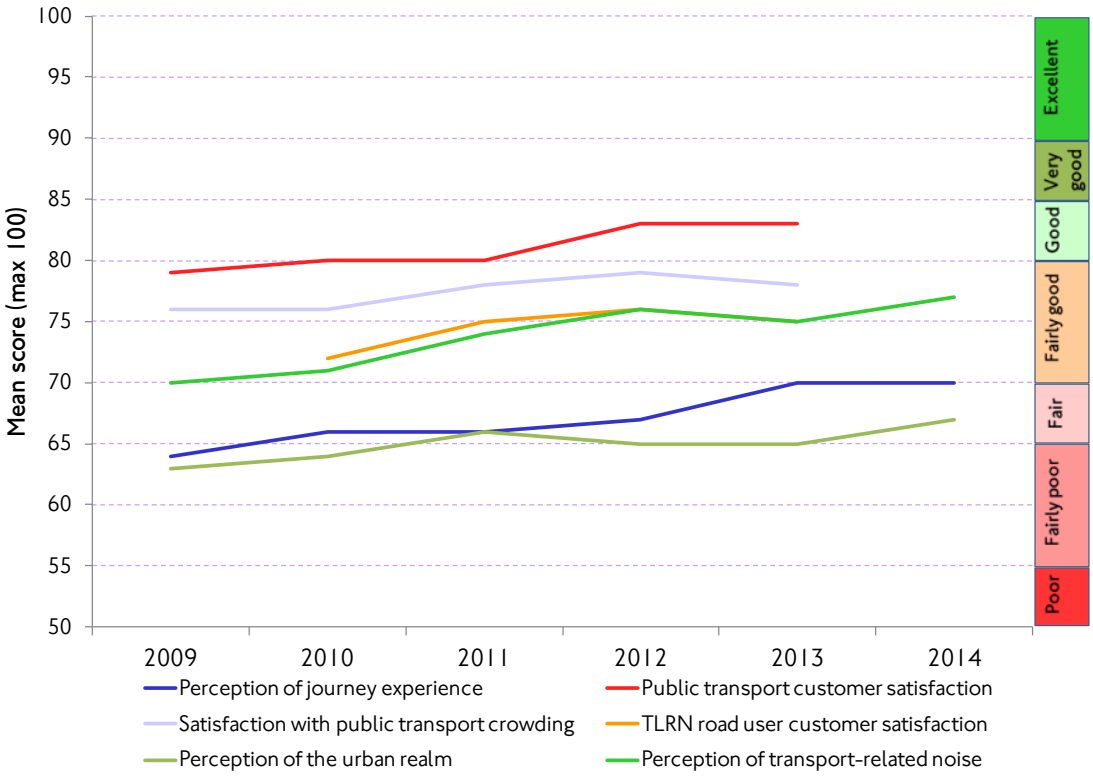
Perception of urban realm

Each year, London residents are asked to rate their satisfaction with the quality of streets, pavements and public spaces in their local area. For 2014 the average satisfaction rating was 67 out of 100. This indicator has shown an overall trend of slow improvement over the review period. Scores are relatively low compared to those that look at aspects of the transport system specifically, reflecting the fact that transport occurs in the context of the wider urban realm, not all of which can be controlled directly by transport providers. Overall respondents felt that the urban realm is improving – 27 per cent feel it has got better over the last 12 months, compared with 18 per cent that feel it has worsened.

Perception of transport-related noise in local area

Thinking about the area where they live, Londoners rate their satisfaction with transport-related noise as 77 out of 100 on average, which is regarded as being 'fairly good' according to TfL's scale, and continues a steady upward trend in this indicator over the previous five years.

Figure 6.3 Summary of trends in perception-based MTS strategic outcome indicators for transport and quality of life. Mean scores out of 100.



Source: TfL Customer Satisfaction surveys.

Assessment of progress against MTS and MAQS goals

Figure 6.3 shows the overall trend for all of these MTS Strategic Outcome Indicators has been slowly upwards since 2009, reflecting increasing levels of customer satisfaction with transport in London, although it is possible to distinguish relatively higher scores for the pure 'transport' attributes, compared to relatively lower scores for aspects of the urban realm, of which transport is a part. Maintaining an upward trajectory in these measures, in the face of increasing customer expectations, will remain a challenge in future.

6.5 Local air quality and greenhouse gas emissions

This section updates, on a provisional basis, MTS strategic outcome indicators relating to the emissions of local air quality and greenhouse gas pollutants from ground-based transport in London.

Primary emissions of local air quality pollutants and carbon dioxide from ground-based transport in London have reduced over recent years.

Comparing estimates for 2013 with comparable estimates from 2010:

- Emissions of particulate matter (PM_{10}) reduced by 30.1 per cent.
- Emissions of nitrogen oxides (NO_x) reduced by 14.7 per cent.
- Emissions of carbon dioxide (CO_2) reduced by 4.8 per cent.

However, the rates of reduction have not been consistent across the different transport sectors, reflecting the different influence of changes to levels of activity and the adoption of emissions reduction/abatement technologies, for example the progressive introduction of Euro emissions standards for road vehicles.

TfL and the GLA are currently updating the London inventories and the above estimates, which are on an interim basis, will be revised once the update is complete.

7. Transport operational efficiency, asset condition and public transport fares

7.1 Introduction

This section considers themes around TfL's operational performance. It firstly looks at 'top-level' indicators of the financial efficiency with which TfL operates its services. It then considers the maintenance of TfL's key assets, including a focus topic describing asset management on London Underground, and looks at trends in public transport fares. A second focus topic also looks at recent developments in TfL's ticketing technology for public transport.

7.2 Transport operational efficiency

Seeking ways to reduce operating and other costs is important as it contributes to the aim of improving value-for-money, limits the demands made upon tax payers and fare payers, and helps to ensure that TfL has a budget that balances income against costs. In a similar way, management of the assets which TfL owns and which underlie services is crucial to ensure that the organisation can meet its objectives of operating a safe, secure and reliable network, while also optimising investment decisions about asset maintenance and replacement.

Operational costs (gross and net expenditure per passenger kilometre)

Table 7.1 shows a segmental analysis of TfL's expenditure on public transport services for the most recent four years. In table 7.1, gross costs are total costs, and net costs are gross costs less fares and other income. Net expenditure effectively corresponds to public transport support provided by TfL to keep services running.

Looking across all four years, both gross and net operating costs per passenger kilometre have been broadly stable. The former has remained in the range of 22 pence to 23 pence over the previous four years, while the latter has also stood at three pence for the most recent three years.

Looking at the most recent year, 2013/14 has seen a continuation of the upward trend in passenger journeys across all modes, following an exceptional year in 2012/13 during which TfL helped deliver the 2012 Games. Gross expenditure per passenger kilometre fell slightly while net expenditure per passenger kilometre remained at three pence.

On an individual mode basis there have been more significant changes, with net expenditure per passenger kilometre for London Overground falling from nine pence in 2012/13 to minus four pence in 2013/14. This has been driven by an increase in passenger kilometres (eight per cent) while gross expenditure has fallen (minus seven per cent). This follows the completion of a significant overhaul of the Overground network in 2012/13, which has made it both more attractive to passengers and more efficient to run.

Table 7.1 TfL's expenditure and revenue on public transport services. 2010/11-2013/14.

2013/2014	Passenger kilometres* (millions)	Gross expenditure (£m)	Gross expenditure per passenger kilometre (£)	Net expenditure (£m)	Net expenditure per passenger kilometre (£)
London Buses[1]	8,420	1,993	0.24	455	0.05
London Underground	10,423	2,222	0.21	263	0.03
Docklands Light Railway	537	116	0.22	14	0.03
London Tramlink	162	29	0.18	(6)	-0.03
London Overground	840	193	0.23	(35)	-0.04
All above modes	**20,350**	**4,553**	**0.22**	**692**	**0.03**

2012/2013	Passenger kilometres* (millions)	Gross expenditure (£m)	Gross expenditure per passenger kilometre (£)	Net expenditure (£m)	Net expenditure per passenger kilometre (£)
London Buses[1]	8,160	1,917	0.23	463	0.06
London Underground	10,099	2,320	0.23	20.6	0.00
Docklands Light Railway	524	139	0.27	8	0.02
London Tramlink	156	35	0.22	12	0.08
London Overground	780	207	0.27	74	0.09
All above modes	**19,729**	**4,618**	**0.23**	**578**	**0.03**

2011/2012	Passenger kilometres (millions)	Gross expenditure (£m)	Gross expenditure per passenger kilometre (£)	Net expenditure (£m)	Net expenditure per passenger kilometre (£)
London Buses[1]	8,133	1,853	0.23	486	0.06
London Underground	9,519	2,180	0.23	19	0.00
Docklands Light Railway	455	104	0.23	0	0.00
London Tramlink	148	30	0.20	8	0.05
London Overground	645	196	0.30	93	0.14
All above modes	**18,900**	**4,363**	**0.23**	**606**	**0.03**

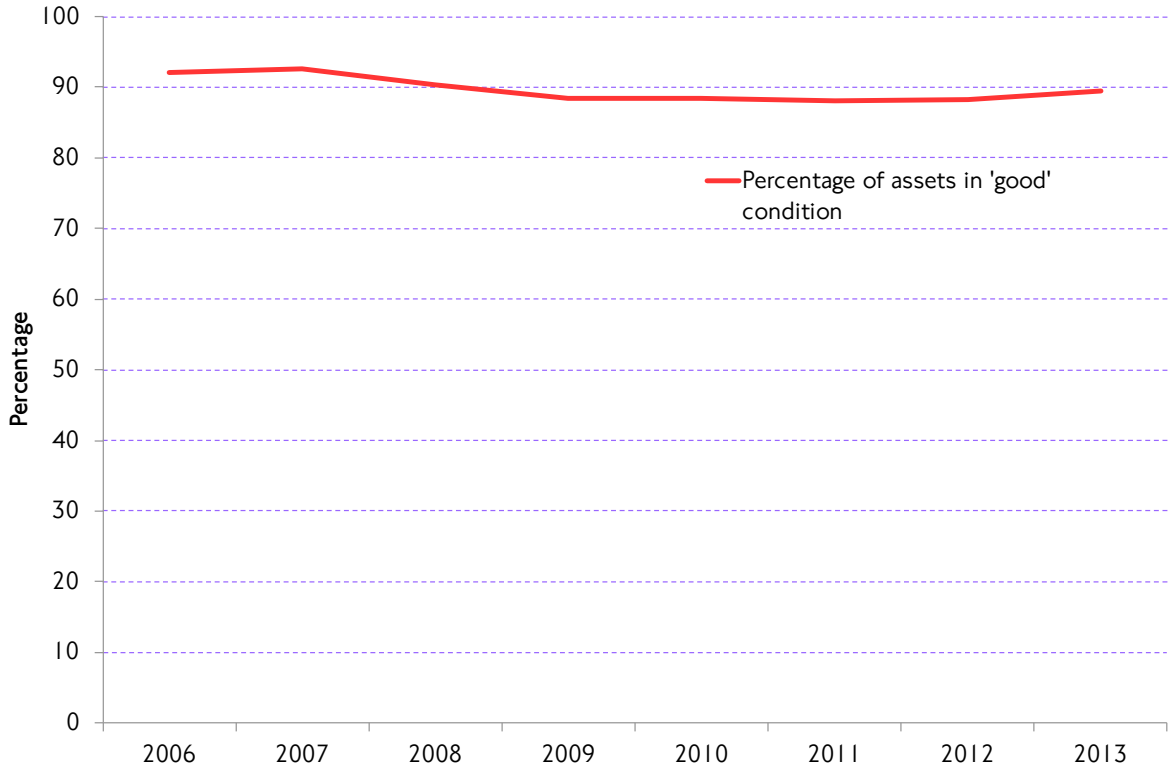
2010/2011	Passenger kilometres (millions)	Gross expenditure (£m)	Gross expenditure per passenger kilometre (£)	Net expenditure (£m)	Net expenditure per passenger kilometre (£)
London Buses	8,082	1,824	0.23	524	0.06
London Underground	8,875	2,050	0.23	109	0.01
Docklands Light Railway	414	92	0.22	3	0.01
London Tramlink	146	29	0.20	9	0.06
London Overground	691	125	0.18	57	0.08
All above modes	**18,208**	**4,120**	**0.23**	**702**	**0.04**

Source: TfL Group Financial Accounting.
Note: Due to accounting conventions, passenger kilometres may not match those in chapter 3.
1.Change in methodology by the Greater London Bus Passengers Survey (GLBPS) to Oyster clicks made in 2013/14 for child journeys 11-15-year-olds to be applied within TfL from 2011/12 data onward.

7.3 Asset condition

Knowledge of the condition of assets that TfL owns and which underlie services is important to enable the organisation to meet its objectives of operating a safe, secure and reliable network, while also optimising investment decisions with regard to asset replacement. For the purposes of MTS monitoring, a composite asset condition measure that describes the condition of TfL's assets across the modes has been developed. This is based on the percentage of key assets meeting basic 'pragmatic' standards, usually in terms of age or state of repair, the specific measures for each mode being weighted according to the relative use made of that mode, as has been described in greater detail in previous Travel in London reports.

Figure 7.1 Composite asset condition indicator. Percentage of in-scope asset that is deemed to be in a 'good' condition (weighted by relative use of each mode).



Source: TfL Group Planning, Strategic Analysis.

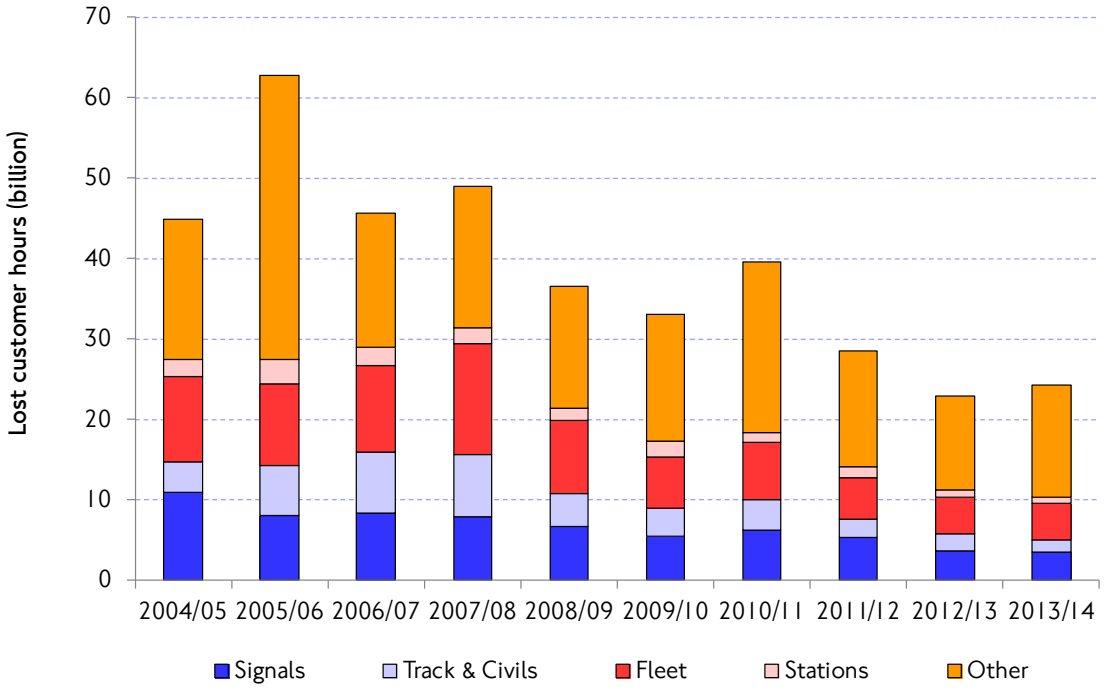
Figure 8.1 shows the available time series for this indicator, in terms of the percentage of in-scope (ie monitored) asset deemed to be in 'good' condition. The indicator has remained consistently close to 90 per cent across the time series, with a 2013 value of 89.5 per cent. It should be emphasised that the passage of time ages all of the assets in the current capital stock. Therefore, to maintain overall assets in good condition, it is necessary to replace a proportion of them every year.

7.4 Focus: Asset management on London Underground

The safe and reliable operation of London Underground is made possible by the extensive asset base underpinning the network. This includes trains and signals, track and power systems, civil structures and stations (and the lifts and escalators within them) and comprehensive communication systems. Overall the cost of maintaining and renewing these assets represents 64 per cent of London Underground's total budget.

Reliability of the Tube has improved considerably over the past decade. Improvements to and effective management of assets has played a major part in achieving this. This is illustrated by figure 7.2, which shows significant declines in lost customer hours due to causes relating to signals, track and civils, fleet and stations – in other words it demonstrates improving asset performance.

Figure 7.2 Lost customer hours by cause (all lines).



Source: London Underground.

Figure 7.2 shows however that asset-related failures still account for about half of total delays on the network. This emphasises the importance of continued effective asset management.

The role of asset management is to select, inspect, maintain, renew, improve and dispose of assets in order to maximise customer satisfaction, maintain high levels of safety, manage risks, minimise whole life costs and enable delivery of TfL's priorities. The goals of London Underground's asset management strategy are summarised by table 7.2 below.

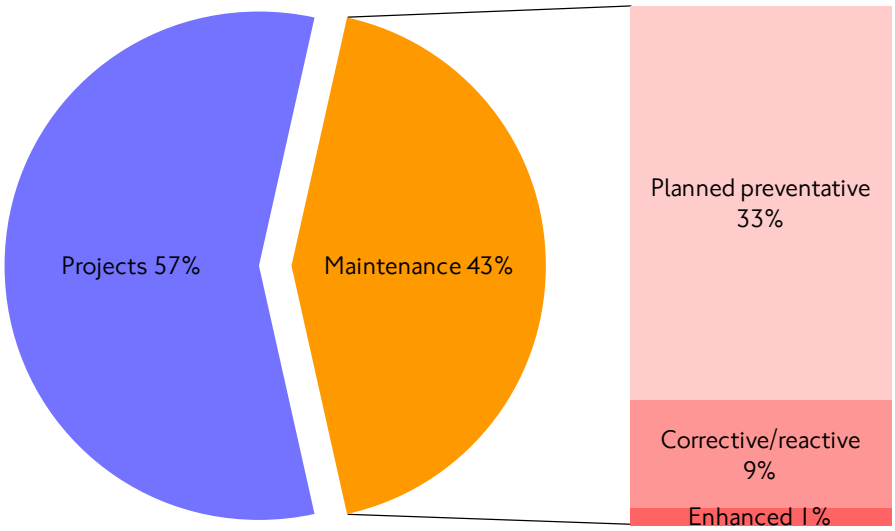
Table 7.2 London Underground's assets and the goals of asset management.

Asset	Extent	Goal
Train systems	600+ trains and four major signalling systems	Deliver a safe, comfortable and reliable train service that unlocks the full capacity of our assets against the potential of the fixed infrastructure.
Power	Extensive systems to support trains, signalling systems and stations	Ensure that there is sufficient power capacity for existing and future train service requirements, maintaining high asset resilience, reliability and safety while optimising and stabilising our energy consumption and contributing to energy sustainability.
Track	1,000km+ of track	Provide a safe, highly reliable track asset base which meets future capacity demand while providing the ability to be efficiently maintained and replaced within short access windows.
Civils	350 km of deep Tube tunnels, 16,000 bridges and structures	Provide a safe, highly reliable civils asset base which meets future capacity demand, which is risk-based and is delivered at the optimum whole life cost.
Stations	272 stations	Provide our customers with a functional, bright, clean and welcoming environment that is safe and accessible to all, while keeping in line with growth demands delivered through our line upgrades. Good station design will be applied that will be attractive, spacious, reflect our heritage, have a local identity while reinforcing the world famous LU brand.
Lifts and escalators	184 lifts and 430 escalators	Provide safe, more efficient and reliable day-to-day means of vertical transportation within the 121 key stations currently served across the network and meet increasing demand.
Communication systems	17,000 cameras, 1,450 radios, public address systems at all stations	Provide highly reliable and resilient communication systems that offer network wide capabilities for intelligent, predictive and adaptive operational control of the railway.

Source: London Underground.

The activity involved in asset management ranges from large-scale line upgrades to day-to-day cleaning and maintenance of trains. Upgrade and renewal projects account for 57 per cent of asset investment with 43 per cent supporting day-to-day maintenance.

Figure 7.3 Breakdown of London Underground's asset spend by type of spend.



Source: London Underground.

It can be seen from figure 7.3 above that the principle focus of spending on asset management is to prevent issues from arising, either through large-scale upgrade projects or planned preventative day-to-day maintenance. Less than 10 per cent of total asset spend goes towards corrective or reactive maintenance.

London Underground's asset management strategy aims to achieve a world-class service, delivering reliable and safe services while introducing new technologies and other improvements on time and to budget. In such a way, the asset management process will enable London Underground's assets to be managed throughout their life to achieve the right balance of cost, performance and risk for the organisation.

7.5 Public transport fares levels

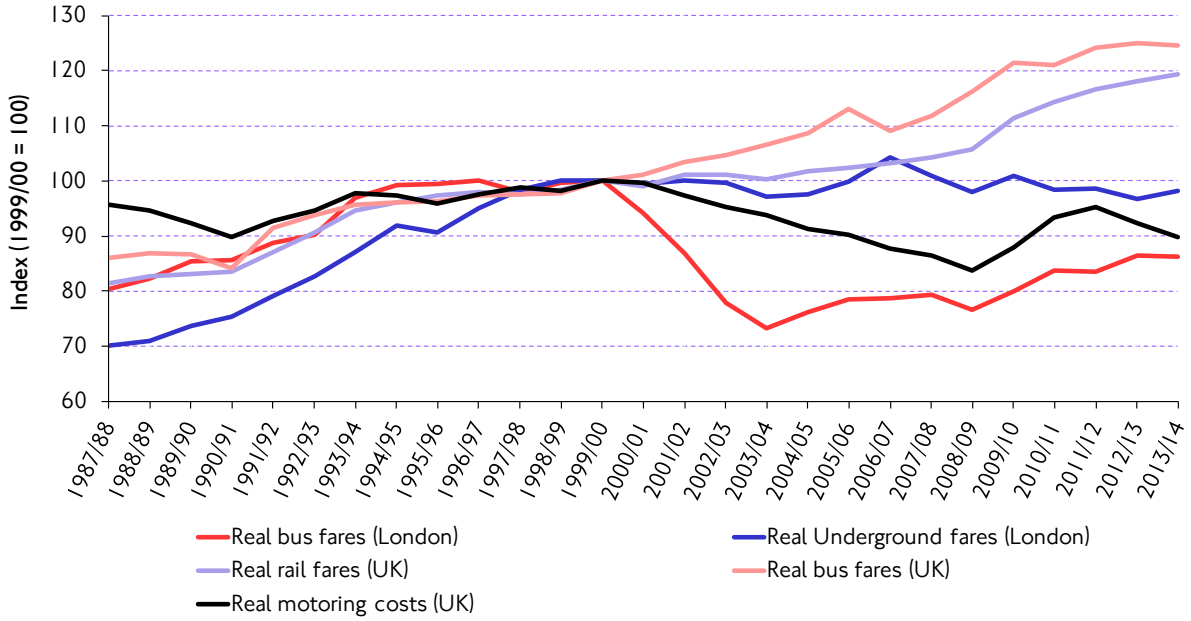
Figure 7.4 shows indexed real public transport fares in London (deflated by the Retail Prices Index) alongside national public transport fares and motoring costs for comparison.

While bus fares in London have been increasing since 2008/09, they still remain 14 per cent lower than in 1999/2000 in real terms following a sharp fall between 1999/2000 and 2003/04. In contrast, real bus fares in the UK as a whole increased steadily over the last decade and have only recently levelled off at about 25 per cent higher than 1999/2000. Similarly, while Underground fares have remained relatively constant in real terms (currently standing two per cent below the value for 1999/2000), real rail fares in the UK as a whole have increased by 19 per cent.

The trend for motoring costs has been much more variable. Real costs declined steadily between 1999/2000 and 2008/09, eventually bottoming out at 16 per cent below the 1999/2000 value. They have since fluctuated, rising to within five percentage points of the 1999/2000 value in 2011/12 before falling again. This period has been marked by diverging trends in the components of motoring costs, with a sharp increase in the costs of vehicle tax, insurance and petrol at the end of

the last decade being compensated for by a slight decline in the costs of vehicle purchase since 2010/11.

Figure 7.4 Public transport fare trends – London and UK compared.



Source: TfL Customer Experience.

Real fares levels (MTS strategic outcome indicator)

The real fares level indicator (part of the MTS strategic outcome indicator set) measures the average actual fare paid in London per kilometre travelled. It is a composite measure, covering bus and Underground only, calculated as the total actual fares revenue for passengers paying full adult fares, adjusted for inflation and divided by corresponding actual bus and Underground passenger kilometres.

In 2013, the average adult composite bus and Underground fare was 22.0 pence per kilometre representing a 1.7 per cent increase on 2012 (table 7.3).

Table 7.3 Real fares levels public transport (pence, 2009 prices).

2007	2008	2009	2010	2011	2012	2013
20.4	18.8	19.8	21.9	21.7	21.6	22.0

Source: TfL Customer Experience.

This indicator has been relatively stable for the past three years following increases in 2009 and 2010.

7.6 Focus: New ticketing initiatives and technologies

Scope

In 2003, transport ticketing in London was revolutionised by the introduction of Oyster on the TfL network. Since then, more than 70 million Oyster cards have been issued and more than nine million are in regular use. More than 85 per cent of all public transport journeys in London are made using Oyster. Oyster cards allow customers to benefit from daily price caps for pay-as-you-go (PAYG) journeys as

well as speeding up movement through ticket barriers. In 2010, the Oyster system was extended to all National Rail routes within London Zones 1-9 where Travelcards were accepted.

Technology is continuously evolving and in late 2012 a new payment option was introduced on London Buses, using contactless payment card technology. As new methods of payment become more widespread, there has been a corresponding decline in cash use across the network. This culminated in the decision to introduce cash-free buses in summer 2014. This section looks at the trends in the use of different ticket types over the past decade, reflecting the changing times as preferences move from cash to smartcard and contactless payment card options.

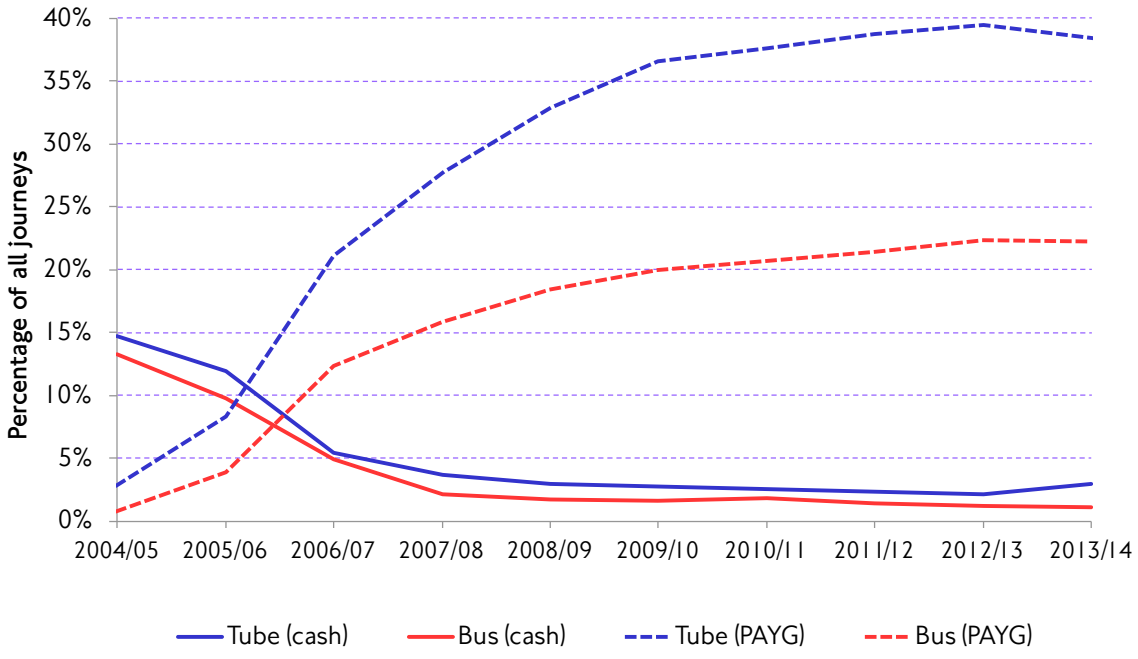
The decline in cash use on public transport in London

Since the roll-out of Oyster for PAYG began in 2004, there has been a significant shift away from cash single fares on both buses and London Underground towards PAYG and other ticketing options. Figure 7.5 shows the percentage of journeys made using cash and PAYG for journeys on London Underground and London Buses since 2004.

PAYG surpassed cash use for both modes in 2006. Since then, cash use on buses has continued to decline, falling below two per cent in 2008 and reaching a historic low of 1.1 per cent in 2013, when total cash journeys on buses fell below those on London Underground for the first time. Over the same period, PAYG journeys have grown to account for 22 per cent of all bus journeys. When considering fare-paying passengers only, PAYG now accounts for one third of journeys by bus.

A similar trend is apparent for London Underground, with cash use declining from 15 per cent in 2004 to between two and three per cent for all years since 2008. As with buses, PAYG has become prevalent on London Underground and now accounts for 38 per cent of journeys.

Figure 7.5 Percentage of journeys by ticket type (cash and PAYG only).



Source: TfL Customer Experience.

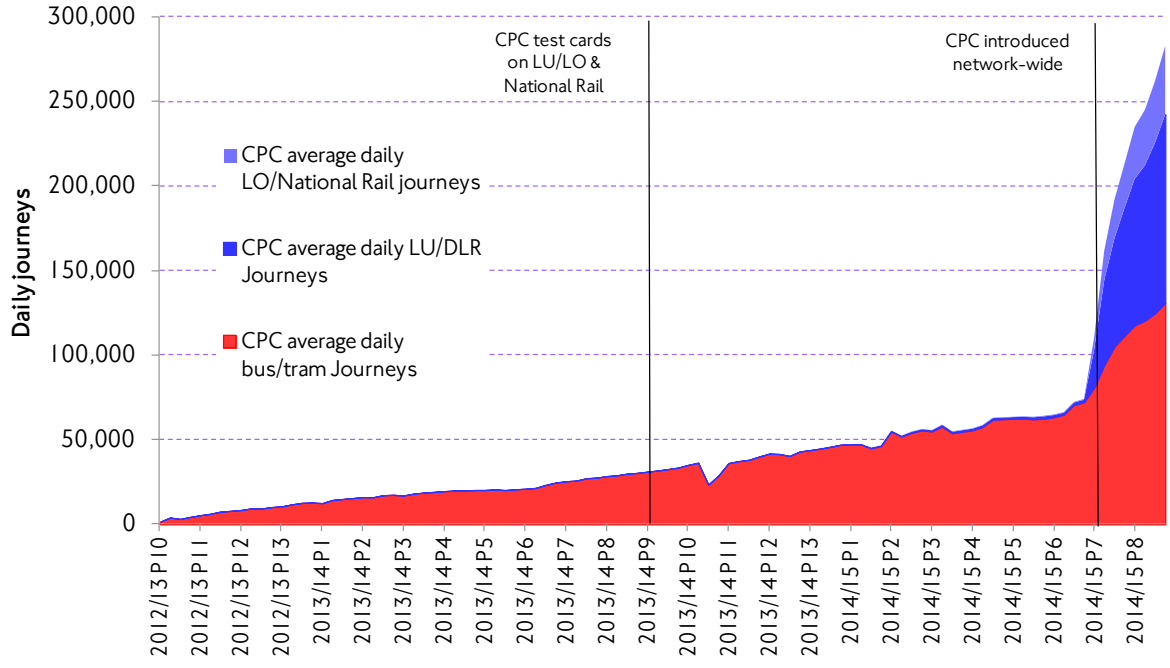
Cash free buses

In the context of low and declining use of cash on buses, significant savings can be made by removing the cash facility and costs of handling it, with the money saved available for investment back into the network. TfL launched a consultation on introducing cash-free buses in August 2013. Going cashless brings the benefits of removing the delays associated with cash transactions, and the costs of collection (including contracts with operators, on-bus kit maintenance and replacement ticket machines). At the time of consultation it was estimated that there would be net savings from 2016/17, building to approximately £24m from 2019/20 onwards.

The bus network became cash-free in July 2014. In order to mitigate the impact of the move to cash-free operations on existing cash users, Oyster 'One More Journey' has been introduced to ensure that vulnerable customers with insufficient credit on their Oyster card won't be left behind. OMJ allows passengers to make one more bus journey if they have insufficient pay-as-you-go credit to travel. In the first six weeks of cash-free operations nearly two million OMJs were made and they accounted for 0.7 per cent of all relevant Oyster journeys, about 48,000 per day. Some 89 per cent of Oyster cards used to make OMJ were subsequently topped up before being used again, suggesting that the facility is being used by customers primarily as an emergency measure, as expected. In addition to this measure, new Oyster Ticket Stops have been implemented, primarily in outer London and outside of London, to make it easier for customers to top-up their Oyster cards.

Contactless payment cards

Figure 7.6 Average daily journeys using contactless payment cards. Four week financial period.



Source: TfL Customer Experience.

1. Change in methodology for calculating bus journeys in 2014/15 P6. This does not affect the overall trend.

There are 48.3 million contactless payment cards (CPCs) in circulation in the UK, with an estimated fifth of these issued within the M25. In the first quarter of 2014, more than half of the UK's total contactless transactions were within the M25. In December 2012, contactless payment was launched on London Buses as a further

option alongside Oyster for PAYG travel. The same price-capping rules that apply to Oyster cards also apply to CPCs.

Figure 7.6 shows that take-up of CPCs as a method of payment for bus journeys increased steadily since their introduction in late 2012. In April 2014 a pilot of the contactless system started on London Underground and the rail network involving around 5,000 customers. Following this successful trial, CPCs have been accepted for PAYG travel on London Underground, tram, DLR, London Overground and National Rail services that accept Oyster since September 2014.

The recent extension of CPC payment to rail services has seen a surge in average daily CPC use, with a quarter of a million daily journeys now being made across the network using this payment method.

While not as dramatic as the sudden surge in CPC use on rail modes, the rate of growth of CPC use on buses also accelerated following the extension of CPC as a method of payment to rail modes. This reflects the new convenience of using the same method of payment on multi-modal trips, and being able to take advantage of price caps. Contactless payments now make up nearly eight per cent of all pay as you go journeys on the network, with the most popular London Underground stations for contactless being Oxford Circus, King's Cross and London Bridge.

Card clash has been monitored closely during the roll-out of CPC across the network. On average there have been 1,564 instances each weekday where customers may have accidentally paid with a contactless payment card they did not intend to pay with and all of these are being automatically refunded by TfL.

7.7 TfL and new media

Providing high quality real-time information to customers and road users is a core part of TfL's job. Rising customer expectations, combined with rapidly advancing technology, is changing the way in which TfL needs to provide these services.

Almost three quarters of Londoners now own a smart-phone and the expectation is that real-time travel information can be obtained on the move. A major upgrade was undertaken to the TfL website in 2014, in part to ensure it configures to fit all forms of device, to meet this demand. TfL's website receives more than 250 million visits a year.

TfL has also expanded its use of social media and now has more than 1.8 million followers on the various social media channels.

TfL provides real-time, free of charge open data, and this has enabled new and innovative ways for customers to obtain travel information and services. Developers have been able to access over 50 data feeds to create apps which complement the information that TfL delivers directly to customers. TfL's data now powers over 360 travel apps, most of which are free of charge. This represents an 87 per cent increase in the number of products available in the last year.

8. The relationship between transport, travel demand and land-use

8.1 Introduction

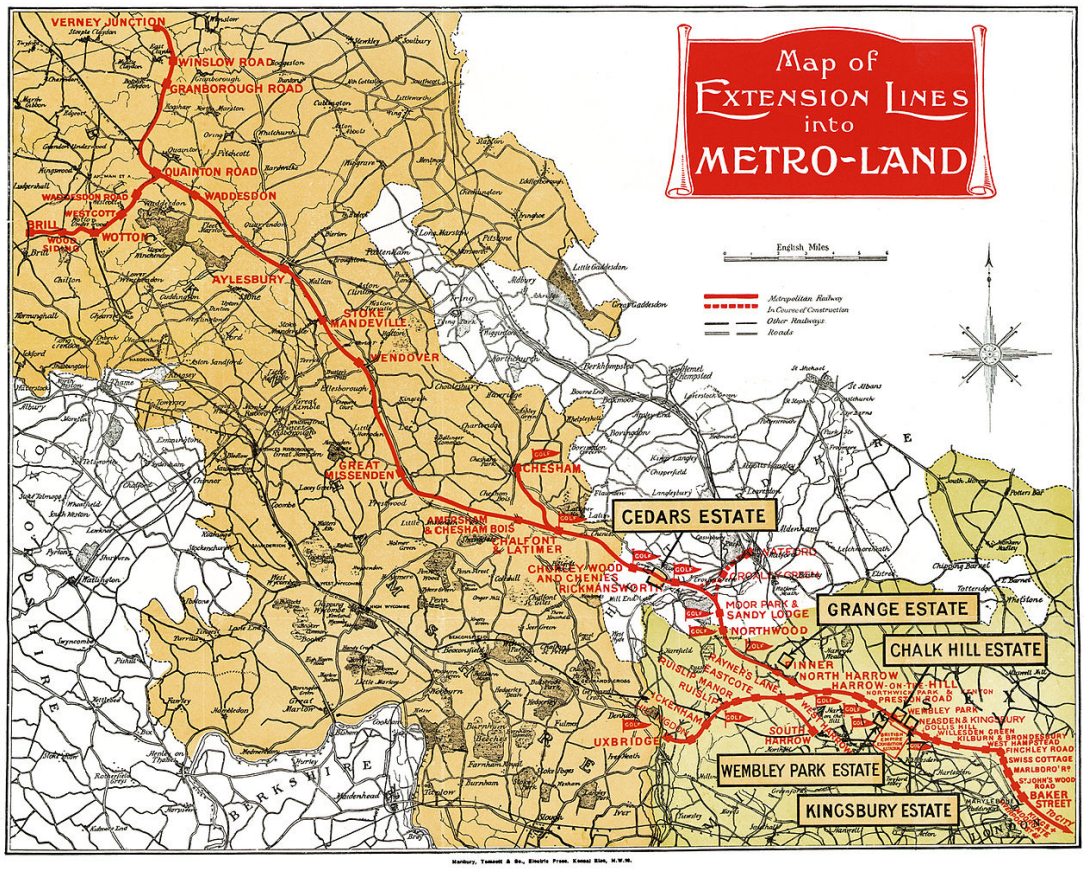
Throughout its history, London has been shaped and influenced by its transport network. The close relationship between land use, development/regeneration and transport is demonstrated in recent large-scale transport schemes, for example in London's Docklands and, more recently, in facilitating the regeneration associated with the London 2012 Games, and these ideas continue to underpin TfL's future plans. This chapter reviews evidence of these relationships, in the context of both historical and more recent regional development initiatives.

8.2 Evidence of land use changes in response to transport investment in London

'Metro-land'

In the early part of the last century, the owners of the Metropolitan Railway Company, understanding the link between transport and land use, set up a sister company to build houses on the surplus land around the railway. These residential developments, given the utopian name of *Metro-land*, proved extremely popular and now make up much of the suburbs of north-west London (figure 8.1).

Figure 8.1 Metro-land and the Metropolitan line in 1924.



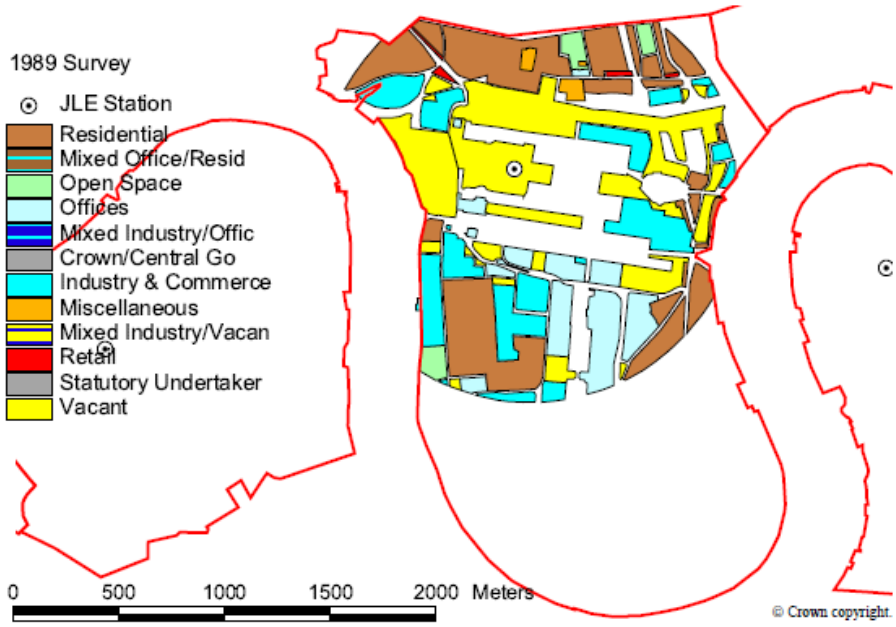
London's Docklands

More recently, public transport has been a catalyst for the regeneration of the Docklands, first with the Docklands Light Railway and later with the Jubilee line extension. After the decline of the London shipping industry starting in the 1960s, the Docklands became a neglected area, before the eventual reinvention of the Isle of Dogs as a second financial centre for London.

The initial transformation of the Isle of Dogs in the 1980s and 1990s could not have taken place without the increased accessibility provided by the DLR, but neither could it have taken place without the London Docklands Development Corporation (LDDC), an arm of the Government charged with overseeing the regeneration of the Docklands. The LDDC used its power and influence to carry out a major development programme, including undertaking large development projects and attracting significant investment from the private sector.

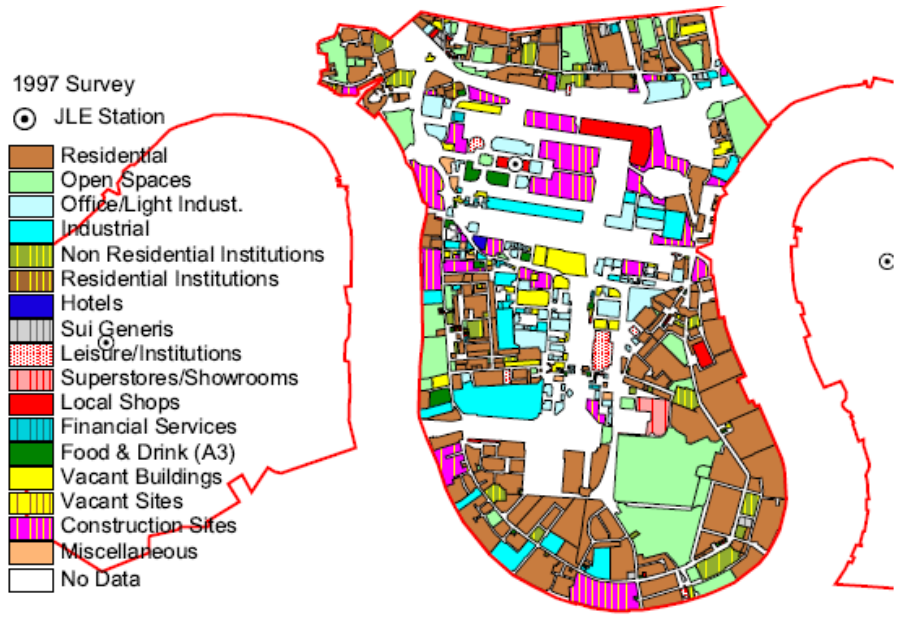
The example of the Docklands illustrates that new transport infrastructure alone cannot be expected to unlock the full potential change in land use. It is a driver of this change, but it must be complemented by a supportive planning policy and a sympathetic political environment.

Figure 8.2 Land use on the Isle of Dogs in 1989.



Source: JLE Impact Study.

Figure 8.3 Land use on the Isle of Dogs in 1997.



Source: JLE Impact Study.

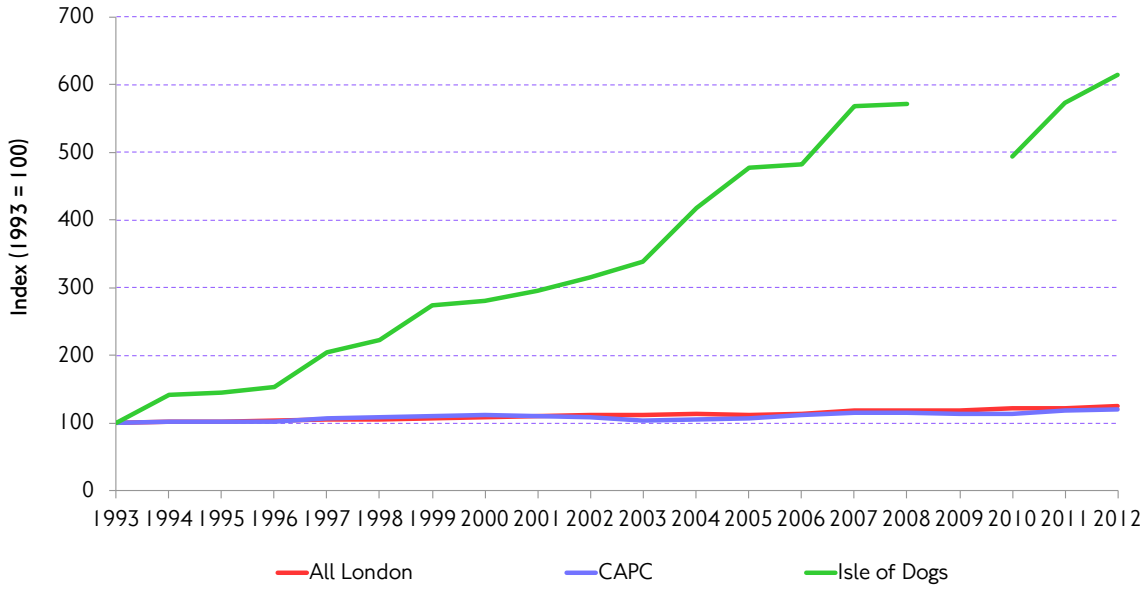
Jubilee line extension (JLE)

The success of Canary Wharf in turn created a situation where a case for further transport investment could be made to support further development. The response to this need for improved transport connectivity was the JLE from Green Park to Stratford, via a route including Waterloo, London Bridge and Canary Wharf. The route of the extension took the Jubilee line through some of the most deprived areas of England at that time, along with some of the largest development areas, including large areas of vacant and derelict land in the Docklands.

The new connectivity provided by the JLE caused the use and value of land in the JLE corridor to change. Even before the extension was built, after the JLE's authorisation in 1992 the average number of applications for residential development in the JLE corridor rose from under 1,000 a year between 1991 and 1993 to more than 2,000 a year between 1994 and 1999 [1].

The increased accessibility of Canary Wharf also led to a rise in commercial developments on the Isle of Dogs. Consequently, the Isle of Dogs has seen increasing levels of travel for a sustained period. The annual Isle of Dogs cordon survey [2] shows that the volume of travel by all modes to the Isle of Dogs during the AM peak had increased to six times the level in 1993. In contrast, AM peak travel to central London, the Capital's long-established historic centre (as measured by TfL's Central Area Peak Count (CAPC) survey), increased by 20 per cent over the same period, while all travel in London increased 24 per cent (Figure 8.4).

Figure 8.4 Trend of AM peak travel volumes for central London and Isle of Dogs, and for all travel in London.



Source: TfL Planning
Note: Survey was not undertaken in 2009.

The success of the JLE, together with the resulting growth in residential development along the JLE corridor and the resulting confidence among developers, then led to commercial and mixed use development along the JLE corridor. Much of this development, such as the Shard at London Bridge, Westfield Stratford City and the Queen Elizabeth Olympic Park at Stratford, would not have been possible without the JLE.

London Overground

Improving existing transport links also has an impact upon property prices and land use in the surrounding areas. In 2007, TfL combined and upgraded several neglected London rail services, creating the London Overground. This proved particularly successful, with passenger volumes on the improved Overground tripling within the first five years of operation.

The high quality of service offered by the Overground significantly increased the appeal of many areas of London previously without fast, reliable transport links (roughly 45 per cent of Overground users in 2012 previously relied on the bus network for travel).

Following the Overground upgrade and extension, house prices along the route increased by more than the average for surrounding areas. According to a report by estate agents Hamptons International [3], a total of £80bn was added to the value of homes near Overground stations between 2007 and 2012. Along with the upgrade, a completely new station (Imperial Wharf) was built near Chelsea Harbour, supporting a new residential and commercial development on an adjacent brownfield site. The developers understood how vital a good transport link was to the success of their project and provided more than half the funds for the construction of Imperial Wharf Overground station, along with overseeing the construction of the station themselves.

Figure 8.5 Highbury and Islington London Overground station.

Source: TfL photo library

Outside London

The relationship between transport and land use outlined above is not unique to London, and can be seen in cities throughout the UK and the rest of the world. In Manchester, research by Nationwide has shown that the price of houses within 500 metres of a Metrolink tram stop are on average 4.6 per cent higher than identical houses more than 1,500 metres away from a tram stop. The Metrolink has also played a role in land use change in Salford, with the 2010 extension to Media City UK helping transform the former Manchester Docks into a new commercial and residential centre [4].

Internationally, a study of various North American cities including San Francisco and Toronto showed the general trend of property prices increasing with proximity to transport links. The commercial impact is also paralleled internationally. For instance, the construction of the RER A line from central Paris to the business district of La Défense in 1970 coincided with the construction of a new wave of skyscrapers. This example also illustrates that transport links require supportive economic conditions to drive land use changes: following the oil crisis in 1973, commercial development in La Défense slowed considerably for several years [5].

Expected impact of Crossrail

Further evidence of the influence of transport investment on land use and value is expected to be seen with the delivery of Crossrail 1 will provide the first direct link between several important locations in London. In particular, London's primary business centres in the West End, the City and Canary Wharf will gain a direct connection to Heathrow airport. Many other town centres

and various suburban locations will also see greatly improved access to a wide range of destinations.

The property consultancy GVA has produced a report detailing the expected impacts of Crossrail on land use along the Crossrail route. This was done by establishing zones of influence around Crossrail stations and forecasting the expected amount of investment and development in these zones over the period 2012-2021 in both a baseline case and the Crossrail case. The zones of influence are up to 1,000 metres from the station entrance for residential developments (corresponding to a 15 minute walk) and up to 500 metres from the station entrance for commercial developments. In the case of residential developments, a distinction is drawn between the inner zone of influence (between zero metres and 500 metres from the station) and the outer zone of influence (between 500 metres and 1,000 metres from the station). [6]

According to the report, the projected total amount of residential and commercial investment in the area around Crossrail between 2012 and 2021 that can be attributed to Crossrail is £5.5bn, which is 16 per cent of the total projected investment on such developments in the area over the period.

Figure 8.6 Farringdon Crossrail station under construction.

Source: flickr.com

Many of the locations that Crossrail will serve in its central section (between Paddington and Canary Wharf) are already densely developed, with property markets characterised by high demand and high prices. The GVA study predicts that Crossrail is unlikely to have a major impact on property values in these prestigious areas, and will reinforce, rather than transform, the property markets in these locations.

The report forecasts that Crossrail will have a large impact on property markets in suburban areas such as Southall and Ilford, however, with property prices in the

Southall zone of influence rising from an average of £290,000 to an average of £540,000 and property prices in Ilford rising from an average of £210,000 to an average of £325,000 between 2011 and 2021.

As the route travels away from London, the relative impact on house prices in the surrounding areas becomes more pronounced. As a general trend, growth in the property market is seen in the entire zone of influence for each station, but the growth is stronger and more rapid in the inner zone of influence.

The area around Abbey Wood station is an interesting exception, with house prices in the Crossrail zone of influence rising from an average of £200,000 to an average of £275,000. This makes Abbey Wood the only property market in the eastern section of Crossrail which is not forecast to exceed the average house price of £380,000 along the eastern Crossrail route (including those that do not have Crossrail access). This is potentially because Abbey Wood is not ready to support the growth potential offered by Crossrail and will require more investment and development in the local area to do so. Of course, this is a forecast based on certain predictions and assumptions, and may not take into account all potential future development in the Abbey Wood area.

In terms of commercial developments, Crossrail will provide the increased transport capacity and wider employee catchment area required to support further commercial growth at existing business centres such as Canary Wharf. In central London, the report forecasts that Crossrail will drive a significant increase in commercial developments at Paddington, Tottenham Court Road, and Farringdon.

Impacts anticipating construction

As was the case with the JLE, the impacts on land use and value are being seen before Crossrail has opened. There has already been a significant shift in land use and values in Crossrail areas following the announcement and especially the start of construction of the railway. Developers are aware of the impact that Crossrail will have on the desirability of Crossrail areas, and many property investors have added these areas to their portfolios. Since construction began in 2011, there has been a steady rise in property prices in all Crossrail zones of influence. Some of this rise can be attributed to the general rise in London property prices since 2011, but the GVA analysis shows that property prices in Crossrail zones of influence have outperformed the average for their line section.

The project has also already helped attract significant commercial investment: for instance, Goldman Sachs has obtained planning permission to build a large new London headquarters next to Farringdon Crossrail station. In the Docklands, Crossrail has helped attract £1bn investment from ABP China, which is aiming to build an international business centre in the Royal Albert Dock, which will be served by Crossrail at Custom House.

Consideration of impacts associated with other schemes

TfL has held consultations on a number of potential future transport schemes that would be expected to have impact on land use and value. One such example is the Bakerloo line extension (BLE), for which a consultation on route options was held between September and December 2014.

Bakerloo line extension [7]

Research commissioned by TfL found that the BLE would be likely to increase property prices and drive residential developments in areas such as New Cross, Lewisham and Catford by providing these locations with direct access to the London Underground network. It is less likely that the BLE would lead to major commercial development in these areas, although it is possible that the increased connectivity of these locations will drive commercial development around existing Bakerloo line stations in central London.

Proposed new river crossings in east London [8]

In east London, the difficulty of crossing the Thames has contributed to the lower land value and development opportunities compared to west London, where it is relatively easy to cross the river. The proposed river crossings package, which includes a tunnel at Silvertown and bridges at Gallions Reach and Belvedere, will help to level this disparity by dramatically increasing the connectivity of local businesses in the area. While not expected to drive large external residential or commercial developments in the area, the river crossing package will unlock significant economic benefits, which may lead to land use change from within as local businesses expand.

Crossrail 2 proposal [9]

A consultation was held between May and August 2013 on Crossrail 2, a major railway project linking north, south and central London similar in scope and ambition to Crossrail. Because of the scale of the project, it is likely that Crossrail 2 would have a similar impact to Crossrail on residential and commercial developments. If Crossrail proves to be a success, then it is likely that there will be even more change in land use along the Crossrail 2 route during development and construction, as the original Crossrail will provide a clear reference case for investors to estimate the impact of Crossrail 2 on house prices and commercial developments.

Opportunity Areas [10]

The impact of public transport on land use will also be vital to the success of the Opportunity Areas described in the London Plan. These are areas of London that have been identified as able and likely to support large-scale residential or commercial developments. Key to unlocking the full potential of an Opportunity Area will be providing the developments with appropriate public transport links. Residential developments will require reliable connectivity to the wider TfL network, and commercial and business developments will require a wide catchment area and an appealing commute for employees.

For instance, the Barking Riverside residential development [11] will provide 10,800 new homes, but will only be able to attract residents and further development if these homes are provided with a new public transport link (in this case, in the form of an Overground extension).

Figure 8.7 Barking Riverside development.

Source: TfL Planning.

There is a circular dependency between the development of homes at Barking Riverside, which requires the delivery of the Overground, and the need for the area to be developed to make the case for the Overground. For any Opportunity Area to be a success, suitable transport infrastructure must be provided, but many Opportunity Areas were initially identified for socioeconomic and geographic reasons. Similarly, the funding mechanism for the BLE relies on financial contributions from potential new development along the line. Without this development, the extension cannot take place.

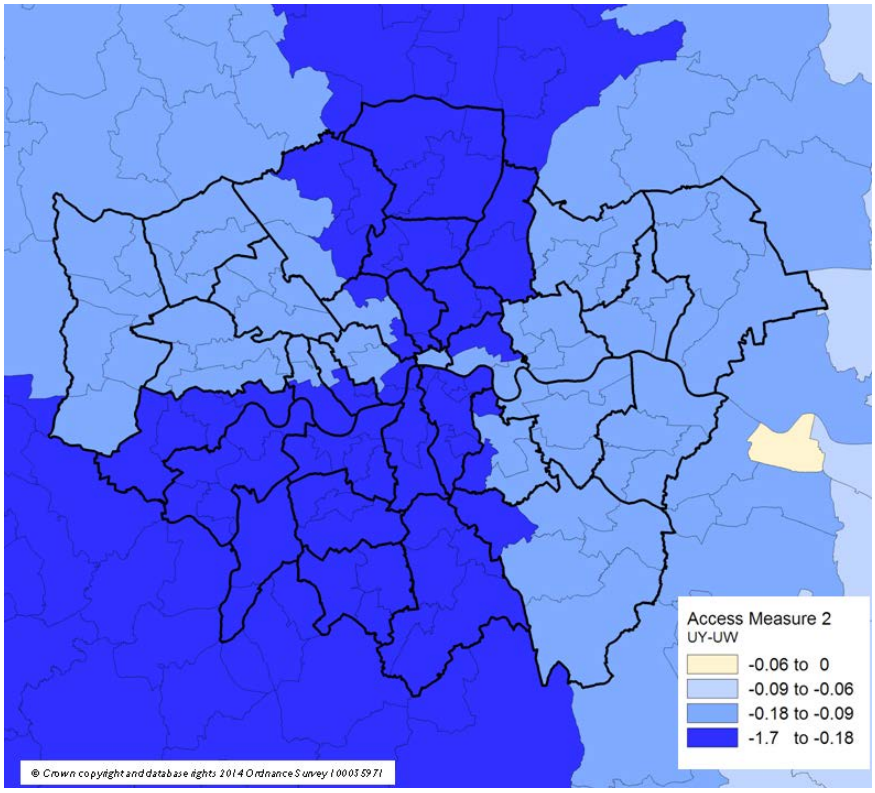
It can be seen that the link between public transport and land use is not a one-way process: land use affects the case for transport investment, too. This highlights the importance of a coordinated approach to transport and development policy.

Forecasting land use and transport interactions (LonLUTI model)

TfL has the capability to model the interaction between transport and land use through its land use and transport interaction model, known as LonLUTI. This model covers the whole of the Greater South-East, namely London, the South-East and the East of England. The model is linked to TfL's strategic transport model, LTS, and uses conditions on the transport network to forecast future land use changes.

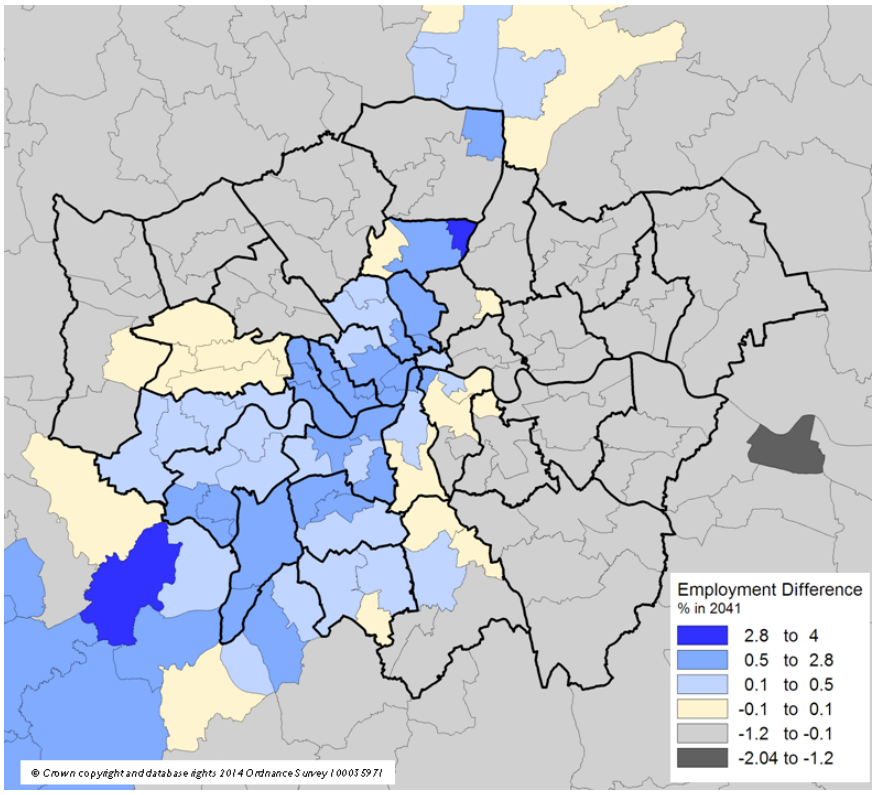
LonLUTI models urban, economic and transport change across this region, taking into account costs of transport, consumer demand for goods and services, and commercial rents (from the urban model). Where significant changes to the transport network are planned, the model can generate forecasts of annual incremental changes in land use in areas that benefit from improved accessibility.

Figure 8.8 Accessibility to work.



Source: TfL Planning.

Figure 8.9 Impact on percentage change in employment.



Source: TfL Planning.

Figures 8.8 and 8.9 show an example of outputs generated by LonLUTI based on the regional option for Crossrail 2, one of the options for the scheme that TfL held a consultation on in 2013. From figure 8.8 it is apparent that large areas of south east and north London would see improvements in accessibility. Figure 8.9 shows the forecast change in employment as a consequence of these accessibility changes, with employment growth stronger in some areas than others due to other characteristics of these areas such as commercial rents.

Monitoring the impacts of transport on land use

As well as forecasting the impact of transport policy on land use, it is important to monitor the actual impact of the policy once implemented. Historically, this has been done by identifying the indicators of change (for example, house prices and the amount of commercial development in an area), collating existing data about the affected areas, carrying out surveys and collecting data after implementation and then finally calculating the amount of change in each indicator that can be attributed to the effect of the policy.

The last stage can be done by preparing a baseline forecast of the affected area, although it was found in the JLE impact study that this is a time-consuming process, which is in some ways of limited use. The difficulty of predicting the performance of a large, complex area over a long period of time can lead to major inaccuracies in the forecast, making it of minimal use as a reference case.

Instead, it is better to identify a reference area: an area with similar makeup, prospects and pressures to the area being monitored, although this is also not ideal. This can then be used to compare the performance of the two locations and determine the effects of the transport policy. The JLE impact study found that working purely statistically posed difficulties, and emphasises the need for a qualitative form of monitoring to complement quantitative monitoring.

It is also important to recognise that different impacts will take different amounts of time to become apparent. Change in the behaviour of passengers is likely to happen relatively soon after new transport links open, for instance, as commuters switch to use the new route. On the other hand, land use changes are likely to continue and develop over a long-term period, and so any monitoring scheme must take this timeframe into account. TfL's own benefits realisation programme for Crossrail takes this into account, with various assessments starting between 2014 and 2018, including an examination of commercial land prices and rents and house prices.

8.3 The transport legacy of the 2012 London Games

The Mayor's Transport Strategy of 2010 set out a prospectus for supporting the London 2012 Olympic and Paralympic Games, and for securing their longer-term legacy. Travel in London report 5 contained extensive coverage and analysis of travel demand patterns during the Games themselves, and highlighted the exceptional role performed by transport in making the Games a great success.

Travel in London report 6 picked up the Games legacy and described and base-lined a set of quantitative indicators and other evidence that would be used by TfL, over the long term, to help track progress and ensure that the transport goals of the legacy were being met.

These longer term transport goals were grouped around supporting regeneration in east London and the achievement of social and economic convergence between the six Growth Boroughs and the rest of London over a 20-year period. The transport legacy is an opportunity for TfL and its partners to continue to deliver improved transport services, maximising new infrastructure and ways of operating, sustaining the lessons learned and encouraging the behavioural and cultural changes that occurred during the Games for the future benefit of London.

As well as updating progress against these indicators in Travel in London report 8, to be published in late 2015, TfL will be developing wider studies that, over the longer term, attempt to identify the role of transport in facilitating overall change in the growth boroughs.

8.4 Travel Demand Management

Scope

Travel Demand Management (TDM) initiatives were deployed successfully by TfL and partners during the London 2012 Olympic and Paralympic Games to help manage demand on the transport networks at critical times and in critical locations. The ways in which this contributed to a successful transport outcome were described in Travel in London report 5. TfL has since taken forward this approach, with the aim of preventing and managing congestion on the transport networks in relation to specific disruptions or events, and also to help manage demand over the longer term on particularly congested parts of the networks. This section summarises progress with these initiatives.

TfL's TDM programme

TfL's TDM programme builds on the lesson identified during the London 2012 Games that strategic, operational and customer benefits can result from using information and communication to influence customer travel choices and behaviour. The programme, in development since Spring 2013, has changed the way that TfL approaches the management of large-scale events and planned disruptions.

TDM enables customers to avoid congestion on the transport networks where possible, resulting in a direct benefit to them and relieving pressure on London's networks. The scope of TDM is multimodal and multi-operator. It responds to actual or probable congestion resulting from patterns of demand, disruption due to events or engineering and 'background' population growth. The emphasis is on significant congestion impacts that require customer behaviour change.

TfL employs a cross-cutting approach that brings together operational plans and experience, forecasting and analysis and customer insight in order to present information and options to customers so that they can rethink their travel choices. It is a collaborative process that operates across TfL and our partners.

TDM supports the planning process for events by working with colleagues in modal operations to co-ordinate and issue a weekly events calendar, identifying events of concern and categorising them according to scale of impact. This calendar is used as an internal and external planning tool and is issued to a growing circulation list. Consistent packages of communication are delivered that relate to the nature and scale of the expected impact.

For every event requiring intervention a TDM factsheet is developed. The TDM team work with operational teams and event organisers to establish a single source of truth on the facts of the event and the optimal customer behaviour. This is then turned into advice, messaging and products (e.g. maps), which are then incorporated into the factsheet. The events process has been in operation for over a year and typically deals with 3-4 planned events a month. It has also recently started to support unanticipated events, such as crowding at the Tower of London during the remembrance poppy installation in late 2014.

Recent examples – short term events

- **Tour de France (TdF) July 2014.** The widespread road closures required for most of the working day on Monday 7 July as part of TdF's Stage 3 required a concerted TDM response via a TfL integrated marketing team and through coordination with train operators, host boroughs, the Highways Agency, the event organiser and Essex, Cambridgeshire and Cambridge City councils. Monitoring indicated that the programme was successful in reducing traffic flows by 4 per cent in Greater London with the effects focussed in central areas targeted by TDM, where 15-25 per cent reductions in flow were observed. This resulted in a significant reduction in the congestion that would have otherwise taken place and resulted in improved journey times for customers.
- **Thameslink: Redevelopment at London Bridge station August 2014.** This required a nine day part closure of one the UK's busiest National Rail stations. Although this was not a TfL project it could have had a significant direct and indirect impact on TfL's customers. Research showed that the majority of customers believed that TfL should be responsible for communications around it. The blockade was successfully delivered without significant disruption and post-blockade analysis showed that TfL's impact information was accurate and behaviour change achieved. Initial analysis of ticketing data suggests that customers moved to other parts of the networks.
- **The Tower of London poppy installation** attracted unprecedented and unanticipated numbers of visitors to the Tower Hill area during late 2014. The TDM team responded in an agile manner to support the operational business, the Tower of London authorities and Historic Royal Palace to mitigate the impacts of the crowds of the transport network. TfL did this by preparing robust and timely customer travel advice and information to advise visitors of the best route to reach the display on different days and manage the risks to both the operation of Tower Hill Station and the road network in the area. Disruption to TfL services was unavoidable given the exceptional number of visitors; however, this was kept to a minimum through detailed involvement, coordination and collaborative work by teams across the whole of TfL.

Longer-term potential

Although the above examples achieved changes over the short-term, the hypothesis, based on customer research, is that appropriate TDM initiatives can help create a culture in which travelling flexibly and using provided information, becomes more habitual. Although TfL continues to invest in capacity, the rate of population growth in London means that the road and public transport networks will be congested at certain times and places.

Customer insights research suggests that customers regard everyday congestion differently to events and other short term disruptions. Nevertheless, there is scope to influence travel choices if a sufficiently compelling offer can be developed and practical constraints overcome. A first attempt to test this using a sustainably low-cost approach was piloted on the Northern line in 2013.

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Spotlight topic

9. Spotlight on: Improving the evidence base for health and transport

9.1 Introduction and context

In February 2014 TfL published 'Improving the health of Londoners; Transport Action Plan' [1] – a report that brought together, for the first time in London, a synthesis of the connections between transport, streets and aspects of public health. These connections were shown to be both fundamental and multi-faceted. Yet hitherto their treatment in transport appraisal, and their recognition among transport professionals, had been relatively poorly-developed.

To support the development of this work, analysis of London-specific data is needed for characterising the nature of these relationships and indicating policy solutions.

This chapter develops the evidence base for the two priority areas referred to in TfL's report – active travel and 'healthy streets'. In so doing, we learn more about the detailed nature of these relationships – the kind of things that should be developed in an appraisal for a transport policy or scheme – and highlight several new findings that will have relevance to the elaboration of future transport policies, such as those arising from the Roads Task Force 'The Vision and Direction for London's Streets and Roads' [2].

9.2 Active travel

The importance of active travel

The transport system in London plays a very important part in people's health by enabling them to be physically active through everyday walking and cycling. Everyday active travel (walking, cycling and accessing public transport) is the main way that many people stay physically active, which is vital to preventing a wide range of illnesses including heart disease, type 2 diabetes, depression and some forms of cancer, which are among the biggest health challenges facing London. It follows that lack of physical activity is one of the biggest threats to the health of Londoners. Increasing their active travel is likely to be the easiest way for relatively inactive Londoners to incorporate more activity into their daily routine to meet their physical activity needs.

To gauge the importance of this, it is estimated that if Londoners swapped motorised modes for short journeys that could be walked or cycled, this would deliver 60,000 years of health benefits from physical activity each year.

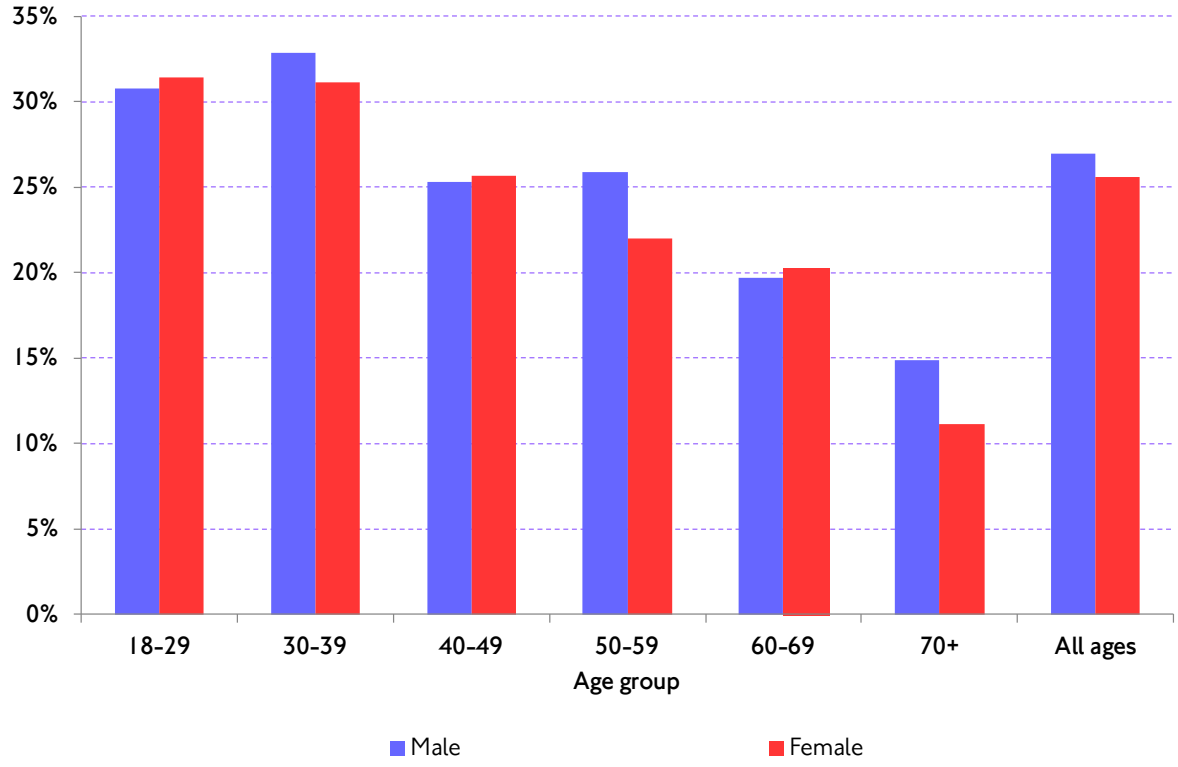
Physical activity targets

Adults aged 19-64 years are recommended to do a minimum of 150 minutes of physical activity (in periods of 10 minutes or more) per week to stay healthy. Evidence has shown that sessions of 10 minutes or more are sufficient to improve cardiovascular fitness and lessen the risk of heart disease, type 2 diabetes and other conditions [3]. This can be achieved through work tasks, chores, leisure activity as well as active travel.

The Health Survey for England [4] shows that in total, from all types of activity, only 67 per cent of men and 55 per cent of women living in London are estimated to achieve the recommended 150 minutes of physical activity per week. Using data from TfL's London Travel Demand Survey (LTDS), figure 9.1 shows that, in 2013/14, more than a quarter of Londoners achieved the recommended 150 minutes of physical activity in periods of 10 minutes or more through active travel alone. There is little difference by gender with 27 per cent of men and 26 per cent of women (of all ages) meeting the requirement.

Levels of physical activity through active travel are higher amongst younger people. Just over 30 per cent of 18-29-year-olds and 30-39-year-olds meet the target through active travel in periods of ten minutes or more, compared to 20 per cent or less for over 60s. The percentage of the population meeting the requirement through active travel alone generally decreases with age, although at a less steep gradient than other types of activity.

Figure 9.1 Percentage of the population meeting the 150 minute physical activity requirement through travel alone per week, by age group and gender, 2013/14.



Source: TfL London Travel Demand Survey.

Around 27 per cent of people meet the requirement when only continuous 10 minute blocks of active travel are counted, however, if all active travel is included (regardless of the length of time) then the proportion increases to 37 per cent. Whilst this does not contribute to the required activity target, these additional shorter periods spent being active contribute to reducing the sedentary nature of many people's daily lives. Such sedentary lifestyles are associated with a range of health conditions independent of whether people are meeting their 150 minutes of activity [3]. Active travel is a major contributor enabling people to meet the physical activity requirement and to prevent the health impacts of sedentarism.

Reducing inactivity

A further consideration in terms of physical activity is the contribution transport can make in avoiding a sedentary or wholly inactive lifestyle. The Health Survey for England defines people as 'inactive' if they achieve less than 30 minutes of physical activity per week.

In addition to the 27 per cent of Londoners who meet the physical activity requirement through active travel alone, the London Travel Demand Survey shows that the majority of people undertake at least some physical activity as a result of travelling in London. Over 90 per cent of Londoners achieve at least 30 minutes of physical activity per week through active travel in periods of 10 minutes or more. This means they are not in the 'high risk' group of people who achieve less than 30 minutes per week of physical activity and are thus categorised as 'inactive'. This data is more encouraging than the Health Survey for England (2012) report which found that nationally 74 per cent of women and 81 per cent of men achieve 30 minutes of physical activity per week (through all activity, not just active travel). This suggests that travel patterns in London support Londoners in undertaking higher levels of physical activity than those typically found in the rest of the country.

This analysis focuses on meeting the 150 minutes per week physical activity requirement, so inactivity has not been explored in depth. However, it is expected that rates of inactivity will vary for different parts of the population. For example, people who have a disability that limits their daily life are less likely to meet the physical activity requirement through travel (14 per cent) and less likely to achieve at least 30 minutes per week of physical activity through active travel in periods of 10 minutes or more: 44 per cent compared to 91 per cent of all London residents. Some of this difference may be explained by lower trip rates: in 2013/14 disabled people made an average of 1.7 trips per person per day compared to 2.4 trips per person per day for non-disabled people.

The influence of socio-demographic characteristics on physical activity

The London Travel Demand Survey shows that there is a lot of scope to increase the proportion of London residents who meet the physical activity requirement of 150 minutes per week through active travel. This section looks at the influence of selected socio-demographic features on propensity to achieve the physical activity target through active travel, as a pointer to beginning to understand to whom initiatives to increase active travel are best directed.

Age and gender

Figure 9.1 showed that the proportion of the population meeting the activity requirement through active travel decreases with age, whilst there was little difference by gender. Although men are considered to be more physically active than women for other activities, there is not a statistically significant difference in the percentage of males and females meeting the physical activity target through active travel.

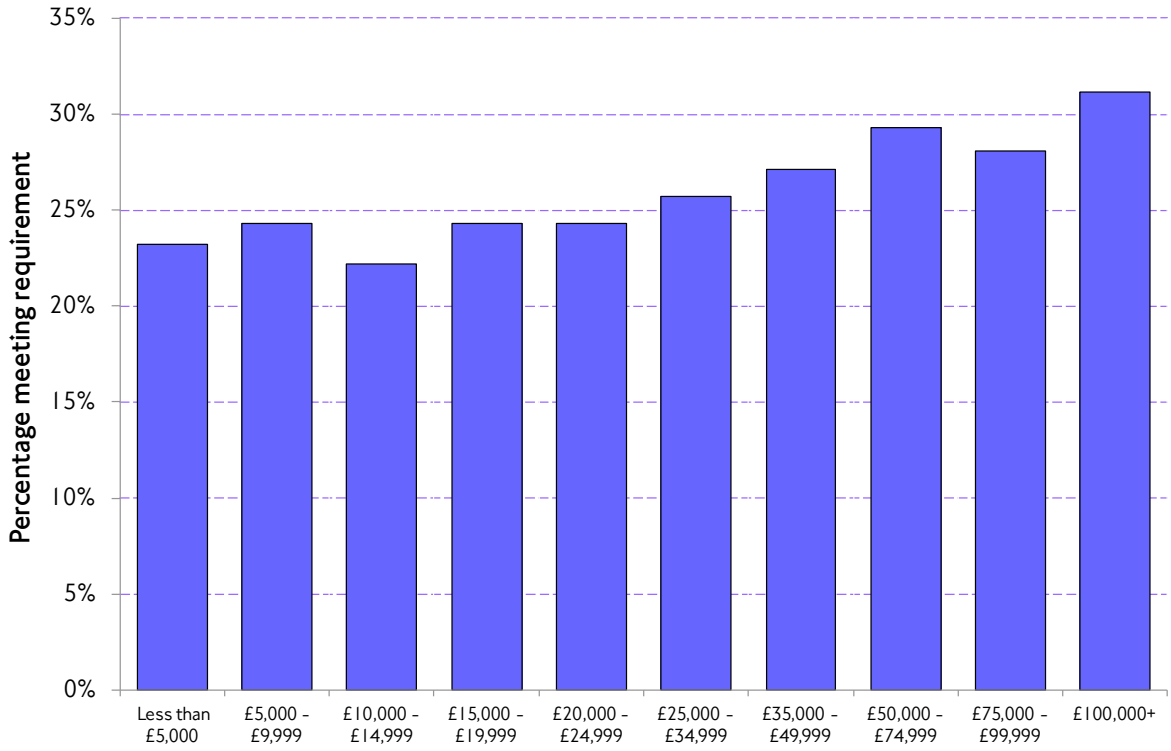
Household income

The percentage of the population meeting the 150 minute physical activity target through active travel alone is relatively consistent (at around under 24 per cent) for people with an annual household income of less than £25,000. Above this point,

the proportion generally increases as income increases to a peak of 31 per cent in households with an annual income over £100,000.

This could be due to higher trip rates for people in households with higher incomes; there is a strong positive correlation between trip rates and household income. This is particularly true for work-related trips and leisure trips which are made more often by people in households with higher incomes. By making more trips, people in higher income households are likely to walk more as part of public transport trips, and they are also more likely to cycle.

Figure 9.2 Percentage of the population meeting the 150 minutes per week physical activity requirement through active travel, by household income, 2013/14.



Source: TfL London Travel Demand Survey.

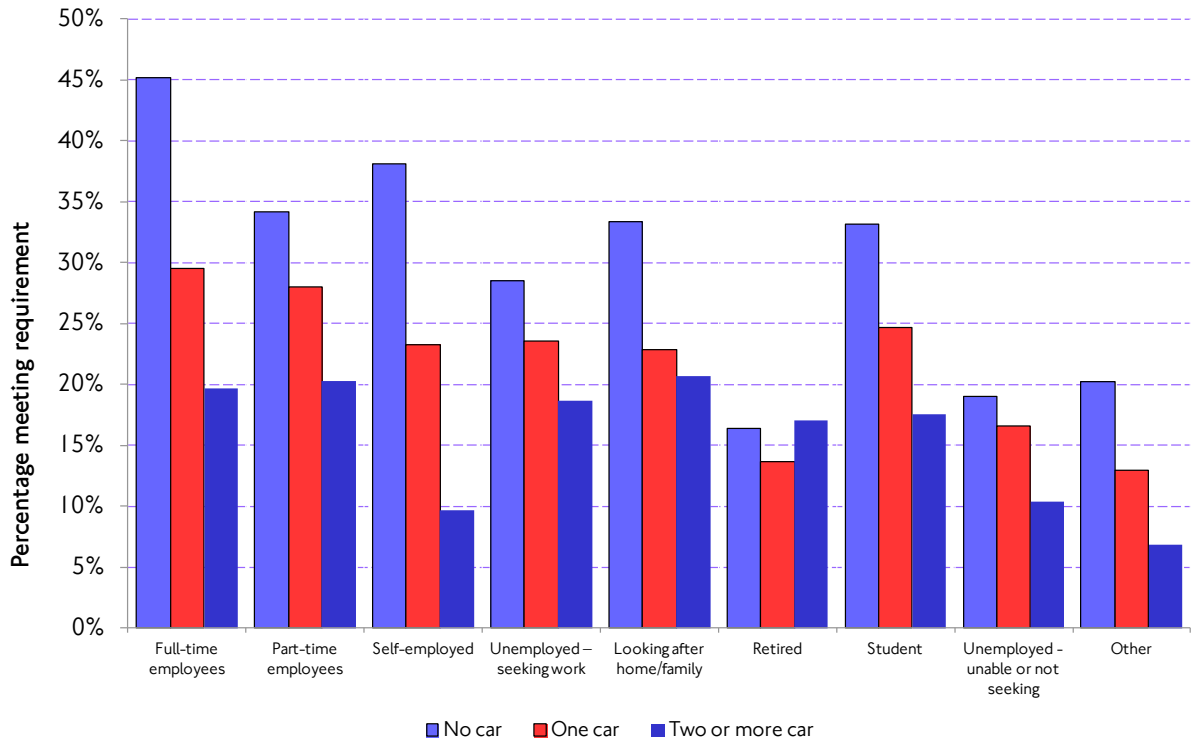
Working status and household car ownership

The percentage of the population who meet the physical activity target solely through active travel decreases with car ownership. Around 34 per cent of people who live in households without access to a car meet their physical activity target through travel alone. This proportion decreases to 25 per cent for those with access to one car and falls further to 18 per cent for those who live in households with access to two or more cars.

This pattern of decreasing active travel with car ownership is true for people of all working status except retired individuals. Approximately 15 per cent of retired people meet the physical activity requirement through active travel, regardless of car ownership. Some 45 per cent of full-time employees with no car meet the 150-minute target solely through active travel compared to just 20 per cent of full time employees from households with two or more cars.

Although people who have access to cars are less likely to meet the physical activity target through travel, they may compensate for this by being physically active in other ways. As can be seen from the previous chart this is an entirely separate effect from income alone – generally physical activity increases with income but decreases with car ownership and both of these effects appear to act independently of each other.

Figure 9.3 Percentage of the population meeting the 150-minutes per week physical activity requirement through active travel, by working status and household car ownership, 2013/14.



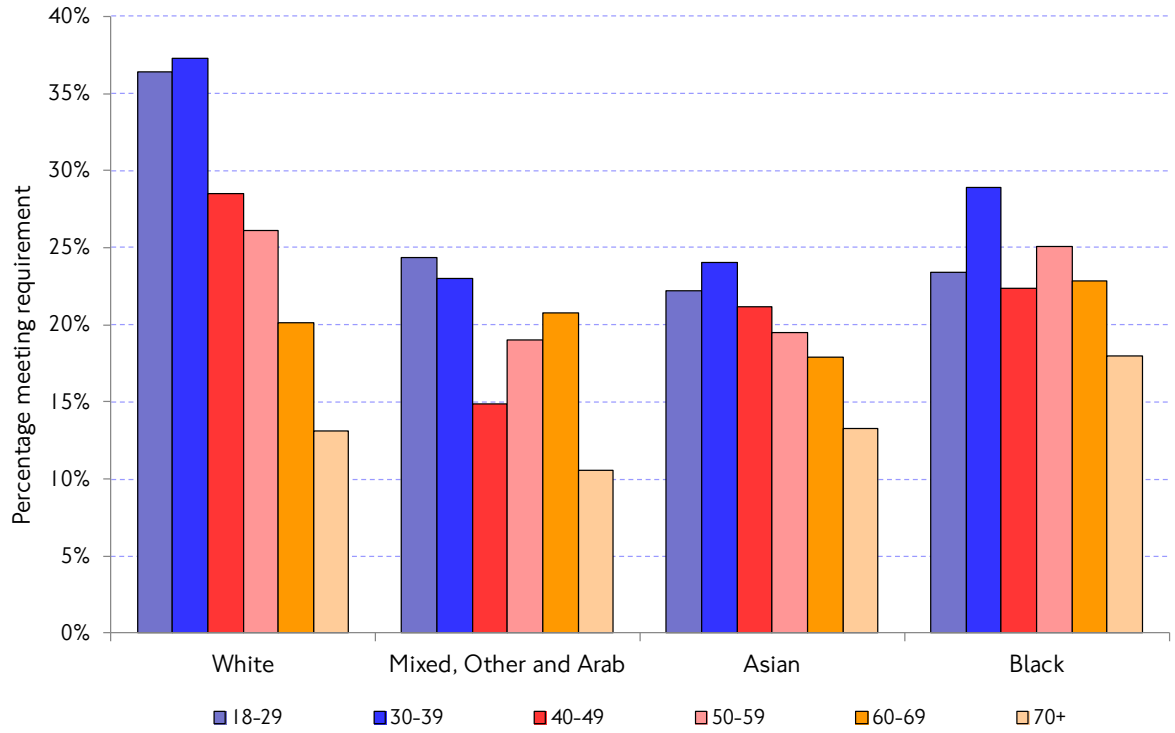
Source: TfL London Travel Demand Survey.

Ethnicity

There is some variation in the proportion of the population meeting the physical activity requirement through active travel in terms of ethnicity, with between 21 per cent and 29 per cent of the ethnic groups shown in figure 9.4 meeting the requirement. This means that two or three people in every ten are meeting the requirement by walking and/or cycling at least 150 minutes per week in ten minute blocks.

People in the 'White' ethnic group are more likely to meet the physical activity requirement through active travel than other ethnic groups. This is particularly noticeable for younger age groups with the difference between ethnic groups becoming smaller as age increases (figure 9.4). White people aged 18 to 39 years are most likely to meet their physical activity needs through active travel alone, at over 35 per cent compared to 27 per cent of the whole population.

Figure 9.4 Percentage of population meeting the 150 minutes per week physical activity requirement through active travel, by ethnic group and age group, 2013/14.



Source: TfL London Travel Demand Survey.

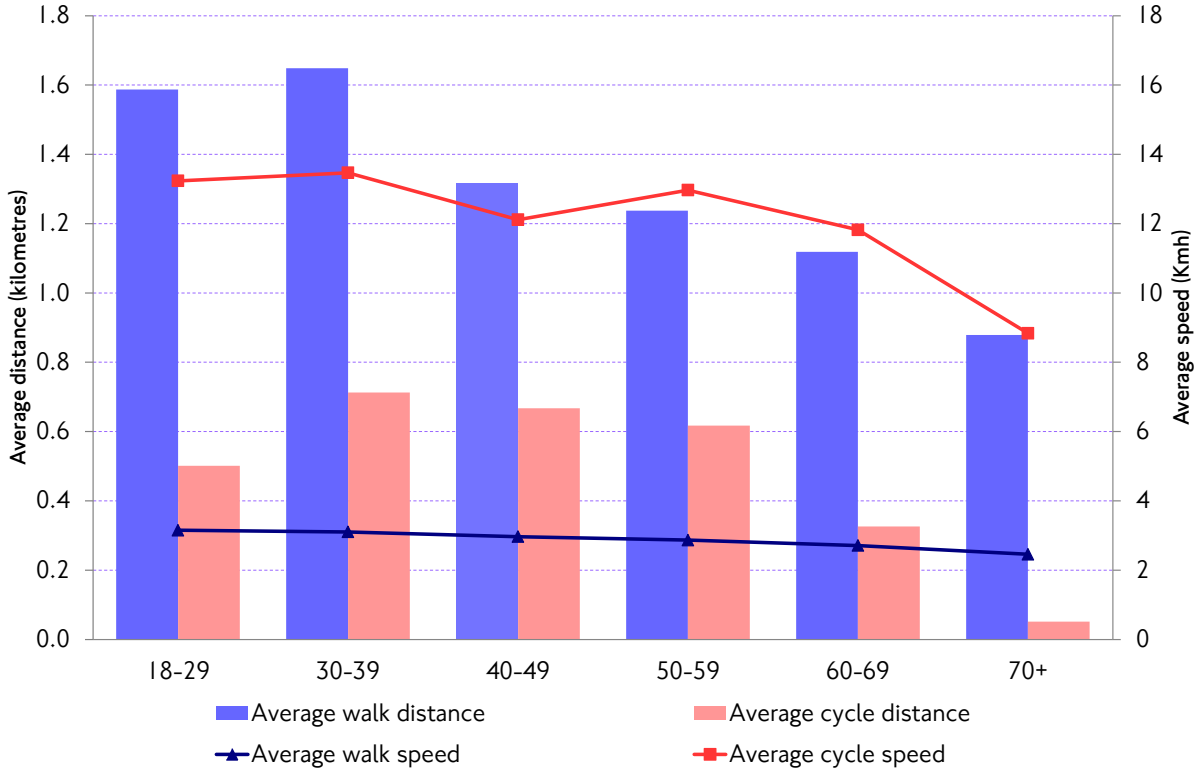
Relationship of walk and cycle speeds and distance travelled to age

Figure 9.5, shows how average walking and cycling distances and speeds vary with age. Average daily walk distances are highest among the under 40s (at around 1.6km per person per day) and decrease by 34 per cent between 18-49 year olds and the over 60s. This pattern is relatively similar to the decreasing proportion of the population that meets the 150 minute physical activity requirement through active travel as age increases (figure 9.1). Walking makes the most important contribution to levels of physical activity through active travel: almost one-quarter of all trips in London are made by walking, and two per cent are made by bicycle. As explored in Chapter 2, there is a strong relationship between age and trip rate by mode, and the high walk distances found for 30-39 year olds coincide with high walk trip rates for this group.

Average cycle distances are also highest among 30-39 year-olds (at 0.7km per person per day) and remain above 0.6km per person per day through to the 50-59 age group. Average cycle distances drop substantially in the 60-69 age group and again to almost zero amongst people over 70. This reflects the very low cycling trip rate amongst people over 60. In contrast to cycling trip rates, the walking trip rate is higher for children and those of retirement age, so average walking distances do not fall so dramatically amongst older people. This highlights walking as a particularly important activity as it is something that people are more likely to do consistently throughout their life.

Average walking speeds remain relatively consistent over the life course, declining only slightly with age. Cycle speeds also remain relatively consistent up to about age 60, but with a substantial decline in the 70+ age group.

Figure 9.5 Average walk and cycle distances per person per day and walking and cycling speeds, by age, 2013/14.



Source: TfL London Travel Demand Survey.

Characteristics of active travel

This section looks at the nature of active travel in London, exploring the 'hidden' role of public transport, and illustrates geographic variations in the prevalence of active travel.

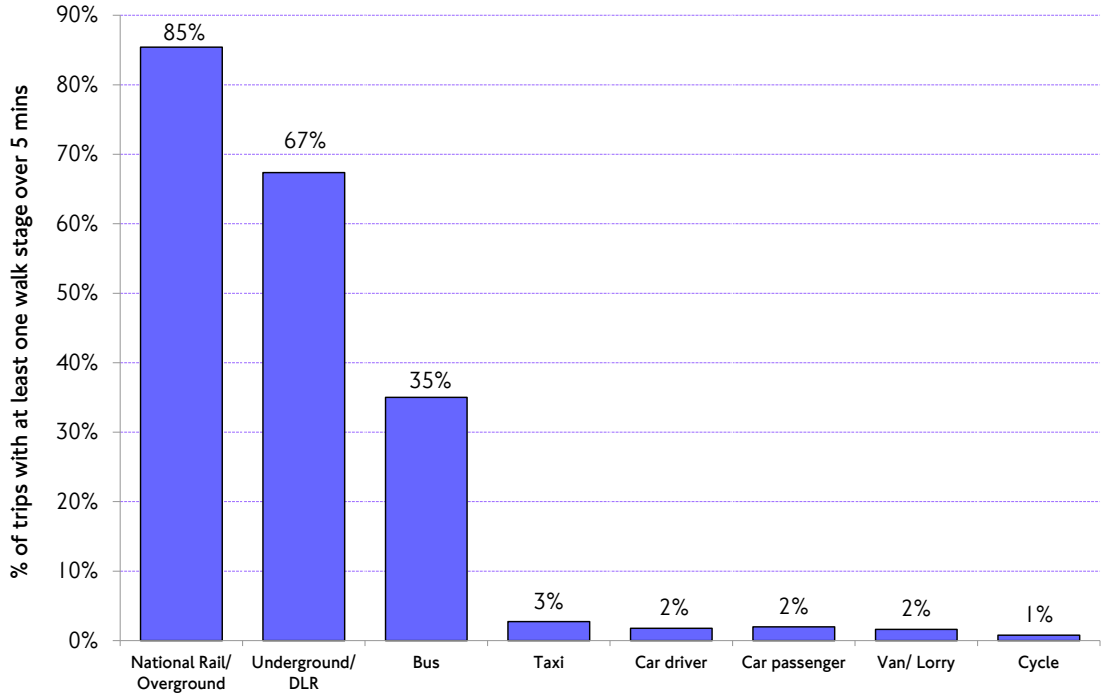
Active travel as part of travel involving other modes

Whilst active travel is normally thought of as walking and cycling trips, there is often an element of physical activity involved in accessing other transport modes, particularly public transport. The majority of cycle trips are cycled all the way (from origin to destination without using another transport mode), however walking is commonly done as part of a trip that involves other modes. These are known as walk stages, and include short incidental stages (eg a one-minute walk from a rail station to the bus stop outside or a two-minute walk between bus stops) as well as longer, more substantial walk stages (eg a ten-minute walk from home to the rail station).

This topic was explored in Travel in London report 6. Trips by public transport are much more likely to include a substantial walk stage (defined as being greater than five minutes in duration) than trips by private vehicles. Some 85 per cent of National Rail and Overground trips and 67 per cent of Underground trips included at

least one walk stage of more than five minutes, typically a walk between home and the nearest station. In contrast, very few trips by private vehicles include a walk stage, because cars and bicycles are usually parked close to the ultimate trip origin or destination. It is important therefore to encourage trips by public transport, as well as trips by active modes, as this will help more people meet the physical activity requirement through travel.

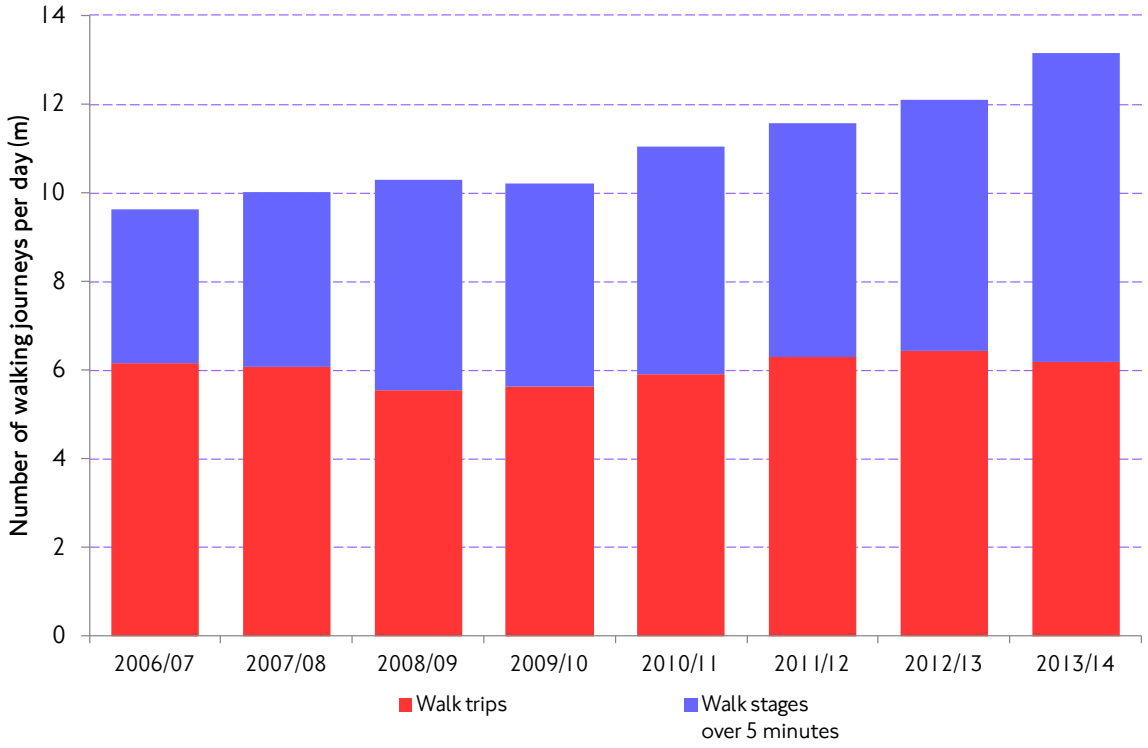
Figure 9.6 Percentage of trips that include at least one walk stage of over 5 minutes by mode, excluding walk only trips. 2011-2014 data combined.



Source: TfL Strategic Analysis.

Combining the number of walk all the way trips and the number of walk stages of more than five minutes made as part of other modal trips provides an estimate of the total number of walk 'journeys' made in London by London residents. Figure 9.7 shows that the total number of recorded walk journeys in 2013/14 has increased to 13.1 million per day. While the number of walk all the way trips has remained relatively stable at around six million trips per day and declined slightly in 2013/14, the growing height of the blue part of the bars shows that the number of walk stages have consistently increased since 2006/07. This shows that the increase in walk journeys is entirely due to an increase in walk stages made as part of trips by other modes.

Figure 9.7 Number of total walking journeys (walk trips and walk stages over 5 minutes).



Source: TfL Strategic Analysis.

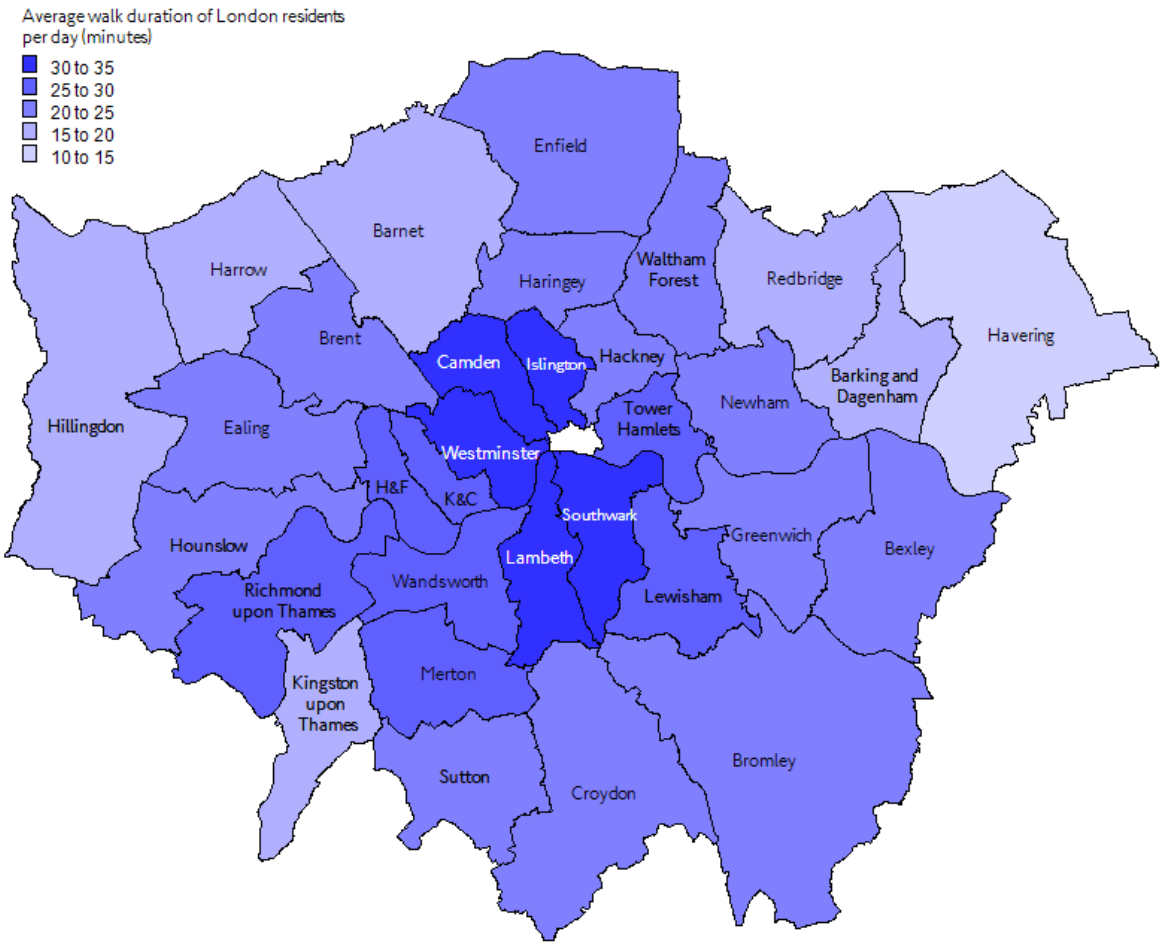
Spatial variations in active travel

As well as demographic factors that affect physical activity, such as car ownership and age, there are some pronounced variations in the degree to which residents of different parts of London achieve their physical activity targets through active travel. These spatial variations generally reflect 'structural' factors such as the provision of public transport and density of land use. From a public health perspective, the policy prescriptions might vary considerably for different parts of London. This section explores some of these dimensions.

Walking durations by borough of residence

Figure 9.8 shows the amount of time, on average, that residents of each borough spend walking per day. At the aggregate level the distinctions are quite stark – residents of the most 'active' boroughs walk on average more than twice as long as residents of the least active boroughs – 14.9 minutes per day in Havering as opposed to 34.9 minutes in Camden. There is also a clear concentric pattern, with higher levels of walking amongst residents of inner London boroughs. This would be expected because public transport provision and urban density are higher in inner London than in outer London; factors which are associated with higher levels of active travel. There are also population differences which contribute to more active travel, with lower levels of car ownership and a younger population in inner London.

Figure 9.8 Average time spent walking per person per day for London residents by borough, 2013/14.



Source: TfL London Travel Demand Survey.

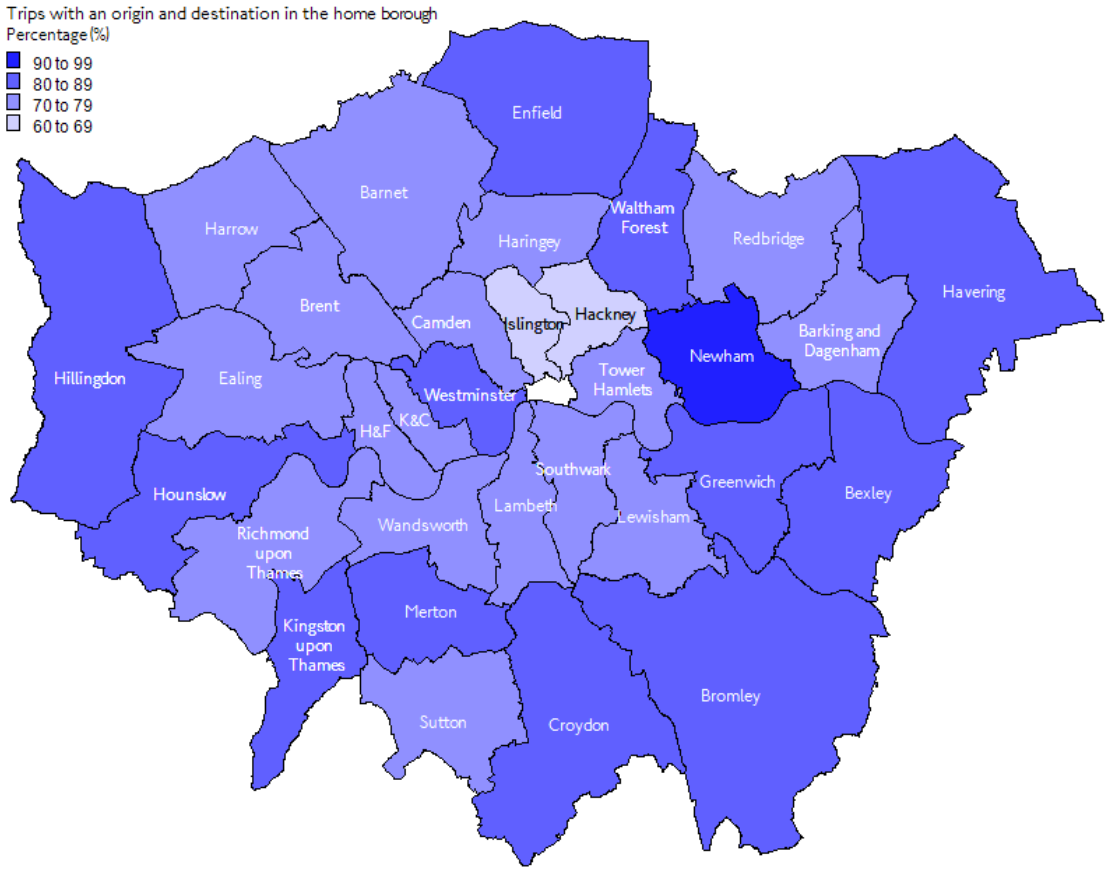
These observations are important in directing policy interventions. For example, if walking durations for residents of all boroughs were raised to at least 20-25 minutes per day we could expect that the majority of Londoners were meeting the physical activity requirement (of 150 minutes of activity per week). It is estimated that if all Londoners achieved the recommended 150 minutes of physical activity this could prevent up to 4,000 deaths a year (18 per cent of all deaths). Public Health England's Health Impacts of Physical Inactivity (HIPI) tool predicts further health benefits, including estimates that each year 1,500 fewer people would be diagnosed with Coronary Heart Disease (11 per cent of all cases) and 44,500 fewer people would be diagnosed with diabetes (14 per cent of cases) [5].

Walking locally

Not all of the walking portrayed in figure 9.8 is undertaken locally. Respondents to the London Travel Demand Survey are asked to complete a daily travel diary which records all trips (including walking) wherever they took place. This means it is possible to look at the location of walk trips using origin and destination data.

Figure 9.9 shows the percentage of daily walk trips (of all durations) with an origin and destination within the 'home' borough. This shows that individuals make most of their walk trips locally, in the borough where they live. This is more common in outer London where people typically make more than 80 per cent of walk trips within their home borough. Newham has the highest proportion of intra-borough walk trips: 95 per cent of residents' walk trips have an origin and destination within the borough. Islington and Hackney are at the other end of the scale with around 65 per cent residents' walk trips made within their home borough. This may be due partly to the smaller geographical size of these inner London boroughs, compared to the larger outer London boroughs, as well as a reflection of better transport connections which make it easier to make trips to and from other inner London boroughs.

Figure 9.9 Percentage of daily walk trips undertaken within the borough of residence, 2013/14.



Source: TfL London Travel Demand Survey.

These observations are important since both walking and cycling are eminently suited to local, short-distance travel, such as visits to local shops, and initiatives to increase active travel are most likely to be successful in the context of these trips.

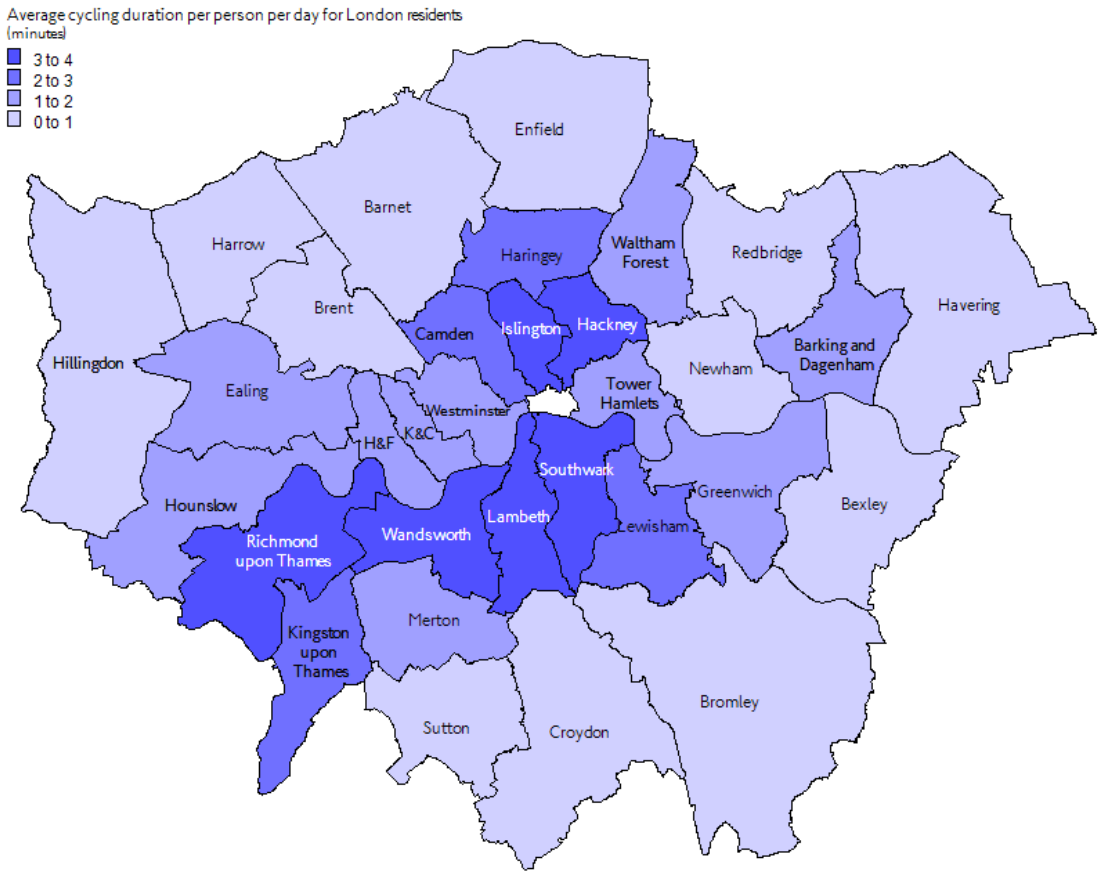
Cycling durations by borough of residence

Figure 9.10 shows the average amount of time spent cycling by residents of each borough (including those who do not cycle). The proportion of Londoners who

cycle on a daily basis is low (just two per cent of Londoners cycle on five days a week or more in the summer) which means that, when cycle time is averaged across the whole borough population the average cycling duration is just a few minutes per person per day. Nevertheless, some clear spatial distinctions are evident, with higher levels of cycling in inner London and along an axis to the outer south-west. These patterns are well known, and similar for levels of walking and cycling: the pattern of time spent cycling is similar to the pattern of walking per day shown in figure 9.8.

What is more important about this map is the very low absolute average durations of cycling – less than one minute, on average, per person per day for the majority of outer London, and only one or two minutes more than this for most London boroughs. At around five minutes per week or less of 'cycling time', residents in outer London are deriving less than one-thirtieth of their weekly physical activity target from this mode. As identified in TfL's Analysis of Cycling Potential [6], the greatest unmet potential for cycling growth is in outer London. Additional cycle trips in this area which increase levels of physical activity would be associated with substantial health benefits.

Figure 9.10 Average time spent cycling per person per day for London residents by borough, 2013/14



Source: TfL London Travel Demand Survey.

The mini-Hollands programme, part of the Mayor's Vision for Cycling in London, is one initiative that is specifically targeted at increasing levels of cycling in outer London. In spring 2014, Enfield, Kingston and Waltham Forest were selected for full mini-Holland status, each receiving up to £30m for cycling infrastructure and improvements (see also chapter 3 of this report).

This analysis has shown the important role that transport has to play in improving the health of Londoners through supporting physical activity. Just over one quarter of Londoners meet the physical activity requirement through active travel alone. Car ownership seems to be the socio-demographic factor that most affects an individual's likelihood to undertake at least 150 minutes of active travel each week, and age and ethnicity also have an influence. Walking as part of trips by public transport is increasing the amount of walking and physical activity undertaken in London. Spatial variations in active travel are thought to reflect public transport accessibility and urban density, with residents of inner London spending longer walking, whereas outer London residents make more local walk trips within their home borough.

9.3 Healthy streets

The role of streets in the health of Londoners

London's streets provide the opportunity for people to stay active, and access healthcare and other services. However, in many cases aspects of the street environment can be directly harmful to health as well as being uninviting – discouraging their use and meaning that the health benefits of active travel are not fully realised. Reducing air pollution, noise and crime, improving safety (both actual and perceived), and providing pleasant environments and facilities for rest and social interaction can all improve health directly and help break down barriers to use, contributing to the healthy and vibrant streets envisioned by the Mayor's Roads Task Force [2].

TfL's report [1] advocates a 'whole street' approach to improving streets, recognising that, although many streets in London have one or more characteristics which make them good for health and attractive places to walk and cycle, it may take multiple positive characteristics to enhance the experience of using the street. TfL has developed the 10 'indicators of a healthy street' (figure 9.11), which encompass many aspects of the experience of using streets. Using this framework, it is potentially possible to assess how healthy a street is by spending time on the street, observing how it looks and feels, and how it is being used by people.

Figure 9.11 The 10 indicators of a healthy street.

Indicator	How it relates to health
Pedestrians from all walks of life	Everybody needs to be active every day. If the mix of people walking in the street does not include certain groups such as children, older people or those with disabilities then the street environment is excluding some people from staying active.
People choose to walk and cycle	Some people walk or cycle not out of choice but due to poor access by other modes of transport. This can have negative impacts on their health and wellbeing. Success should be measured by people choosing to walk and cycle, rather than levels of walking and cycling.
Clean air	The health impacts of air quality include cardiovascular disease and respiratory disease.
People feel safe	People need to feel that they will be safe from injury and crime when they are on the street.
Not too noisy	Noise has a range of health impacts including stress and high blood pressure. It also discourages people from walking and cycling.
Easy to cross	If streets are difficult to cross because of physical barriers or traffic, people will be discouraged from using the street, particularly on foot. This can be socially as well as physically restricting.
Shade and shelter	Some people have difficulty moderating their body temperature, and this can put their health at risk in hot weather. Shade is needed on streets to enable people to keep cool.
Places to stop	Many people can only walk short distances without taking a rest, particularly those who are older, young, pregnant, injured or who have a disability or health condition such as chronic obstructive pulmonary disease. Providing seating at regular intervals is necessary to enable these people to incorporate much needed physical activity into their daily routine.
Things to see and do	Street environments need to be stimulating and engaging to invite people to walk and cycle more. This highlights the importance of good urban design and maintenance of public spaces in delivering health benefits.
People feel relaxed	Walking or cycling in the street should not be a stressful experience. If people are not relaxed it indicates that issues such as noise, insufficient space or fear of danger have not been addressed.

Source: Improving the health of Londoners: Transport action plan, 2014. TfL Planning Strategy and Policy.

An example of this 'whole street' approach has been used in street audits carried out using the Pedestrian Environment Review System (PERS) [7]. PERS was developed by the Transport Research Laboratory (TRL) and the London borough of Bromley as a way to evaluate the quality of the pedestrian environment systematically and objectively. It is used by Transport for London and other authorities and looks at a range of aspects, including effective width, permeability, legibility and user conflict to identify interventions to improve the quality of the streetscape. However, recognising that the experience of individuals may differ from that of a 'trained professional observer' and is affected by a broader range of factors, it is also preferable to understand the range of experiences of the general public, and the frames of reference being used by them to assess aspects of the quality and healthiness of London's streets.

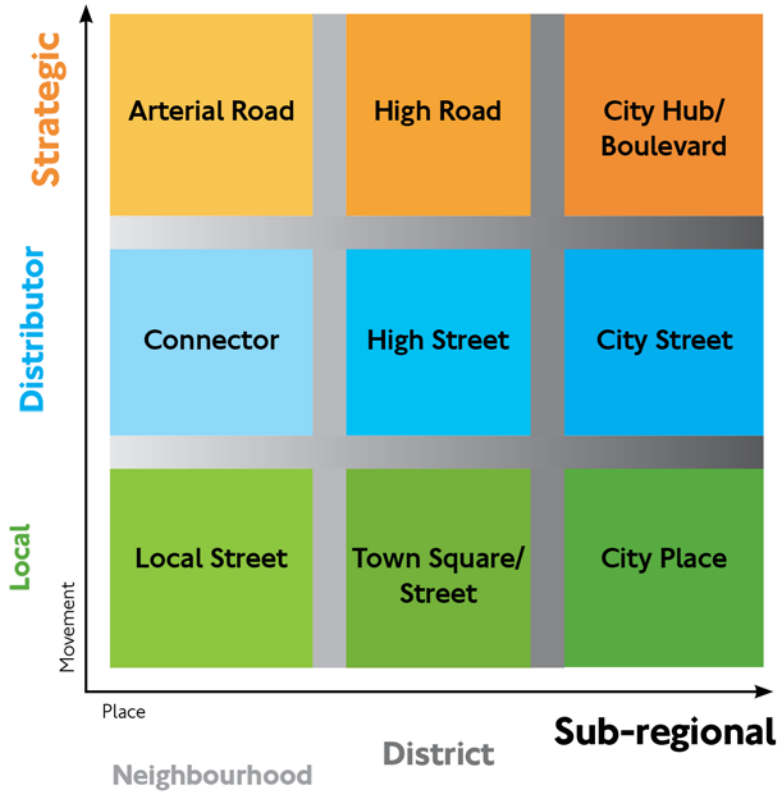
The Roads Task Force Vision for roads and streets

In July 2013, the Mayor produced his Vision for Roads and Streets in London. Summarising the work of his Roads Task Force, this set out a prospectus for improving London's roads, and a framework or 'toolkit' for addressing the many different (and sometimes competing) challenges faced by London's streets. Underlying this framework was the concept of 'street types', where each street could potentially be classified into one of nine 'types' according to the balance between the degree of vehicle movement (of people and goods) occurring on that

street, and the extent to which the street also performed 'place' functions. 'Place' was assessed through factors such as pedestrian volumes, the occurrence if social activity and lingering, the functional character of the street (eg whether it has destinations like shops or tourist attractions), and other aspects of the street environment.

Figure 9.12 shows this conceptual framework. Interestingly, it will be observed that high-traffic roads do not necessarily have to be poor places, and can have strategic significance as a 'place' (for example the top-right square). They may not currently perform particularly well as places and there are clearly some practical trade-offs implied between the two core functions of streets.

Figure 9.12 Classification of streets by degree to which 'movement' and 'place' functions are served.



Source: TfL Planning Strategy and Policy.

Classifying streets according to this matrix will allow the appropriate mix of RTF 'toolkit' interventions to be applied in each case to improve the operation of a street within its functional context (ie cell). It will also provide, in certain cases and over the longer term, a framework and guidelines for identifying interventions that would change the functional status of a street (ie move cells) where this is considered to be desirable.

As part of TfL's work rolling out the RTF approach, TfL is currently holding workshops with London boroughs to classify streets into this framework. A powerful difficulty in attempting to do this is a lack of data determining the 'place' aspects of streets. A street's facilities and environment will be primarily conditioned by the function that the street currently serves and the degree to which it is maintained to do so, and is not necessarily a good guide to what might be required were the street to be performing it's 'place' functions more optimally.

Furthermore, the extent to which the perceptions of the public relating to their experience of streets accords with what might be prescribed as 'good' on the basis of such objective measures is not clear. For example, there might reasonably be expected to always be a broadly linear relationship between volumes of traffic and air quality, albeit that it is clearly important to prioritise measures to improve air quality overall, such as the proposed Ultra Low Emission Zone in central London. A more complicated example is that, while the public might prioritise 'places to sit and rest' in large numbers on all street types, the extent to which they would be used would be expected to vary enormously depending on the functional role of the street. Neglect of such facilities, where not widely used and suffering from breakages, graffiti etc., might only further harm the perceived 'place' aspects of the street.

TfLs exploratory survey of the health aspects of streets in London

The role of streets in maintaining and improving human health is an important aspect of the street environment, and the 10 indicators of a 'healthy street' also serve more broadly to highlight how a street is performing in relation to environmental sustainability and economic prosperity. The recent publication of both the Vision for London's Streets and Roads and TfL's Transport Health Action Plan offers an opportunity to further explore and characterise these aspects. As part of the work to monitor the long-term impacts of the Roads Task Force interventions, introduced in Travel in London report 6, TfL commissioned an exploratory survey in autumn 2014.

The survey was carried out in October 2014 across all days of the week at 27 locations in inner north London (three sites for each street type). There was a total of just over 2,000 completed surveys with at least 200 respondents at each of the nine street types identified by the RTF. Pedestrians were intercepted by interviewers and asked to complete the survey 'on the spot' relating their answers to their immediate surroundings. Interviewers also undertook pedestrian counts to ensure that surveys were representative of the general population at that location.

Street 'health' was measured using 11 questions, reflecting the 10 indicators identified as necessary for a healthy street in TfL's Transport Health Action Plan shown in figure 9.11. These 10 indicators are considered equally important for improving health. 'People feel safe' was split into two questions to ensure information was captured on feelings of safety from crime and anti-social behaviour as well as from traffic injuries. Two indicators: 'Pedestrians from all walks of life' and 'People choose to walk and cycle', were assessed through on-street counts and assessing the demographics of survey respondents, rather than asked about in a specific question. The analysis presented here reflects only the results of the 11 questions asked in the survey which asked pedestrians their opinions of:

- How attractive the street is
- How clean the air is
- How noisy the street is
- How enjoyable the street is to be on
- The ease of crossing the road
- How easy it would be to find somewhere to sit or rest
- How easy it would be to find shelter (for example, if it was raining)

- How intimidated from road traffic people feel
- How stressful the street is to be on
- How safe from crime and anti-social behaviour people feel
- How safe from being involved in a traffic collision people feel

Respondents were asked to rate both their actual experiences of being on the street and their expectations of what they thought the street ought to be like bearing in mind real world constraints as well as its location and what it is used for. There was no reference made in the survey to the RTF street types and respondents were not told what 'type' of street they were on. Instead questions were focused on the current street at the present time, ie 'this street, today'.

Demographic information such as age, gender, working status and disability was also collected to see whether this had any bearing on the answers given.

Survey aims

There were three main aims of carrying out this exploratory research:

- To develop the empirical evidence base for health, in relation to the notion of 'healthy streets', following on from TfL's recent report on that topic.
- To gather material to help explore the RTF concepts of 'street types' and how people who use London's streets experience different types of street.
- To trial a new survey methodology which, if successful, could be used to develop an appropriate methodology to assess the wider 'liveability' aspects of London's streets.

When analysing the results, the primary question has been whether people can differentiate (even if subconsciously) between different types of street. Further analysis has looked at the following key research questions:

- To determine the extent to which expectations and experiences of the health indicators were determined by the 'movement' and 'place' functions of a street.
- To compare the expectation scores with the experience scores to see if street types or health indicators are performing above or below users' expectations and try to identify the main factors contributing to this difference.

Survey respondents

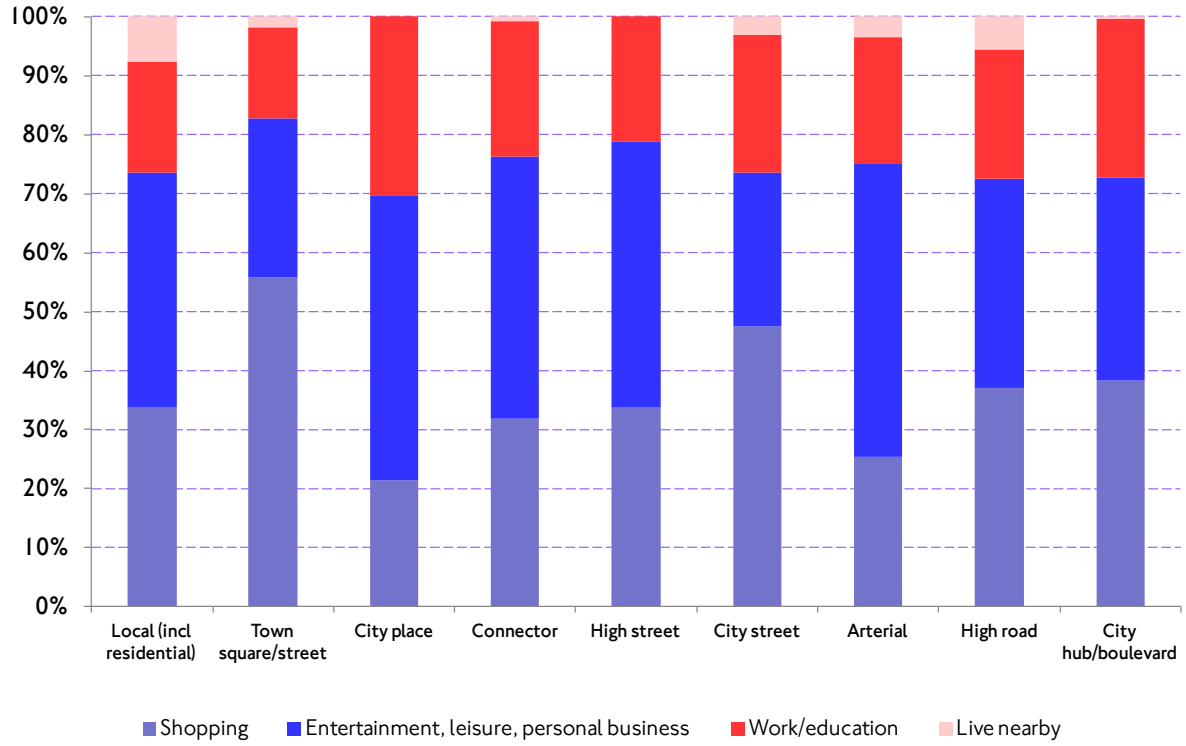
Slightly more than half (52 per cent) of respondents were female. The age group with the largest representation was 25 to 44 year-olds who made up 43 per cent of survey responses. Thirteen per cent of respondents were aged between 16 and 24 and 13 per cent were aged above 65. The age and gender of respondents reflected the characteristics of pedestrians counted on the street so it was not necessary to apply weighting to the survey responses. A little more than nine per cent of survey respondents reported some sort of physical or mental impairment that limited their daily activities.

Survey results - journey purpose

Just over a third (36 per cent) of respondents said their main journey purpose was shopping at the time they were surveyed. This varied by time period with 40 per cent of surveys at the weekend being conducted with shoppers compared to less

than 30 per cent of weekday morning surveys. Figure 9.13 shows there was also variation in journey purpose by street type: the street type with the highest percentage of shopping trips was Town square/street at 56 per cent. The smallest proportions of shopping trips were on City place and Arterial street types at just over 20 per cent.

Figure 9.13 Journey purpose of survey respondents by street type.



Source: TfL Planning Policy Analysis

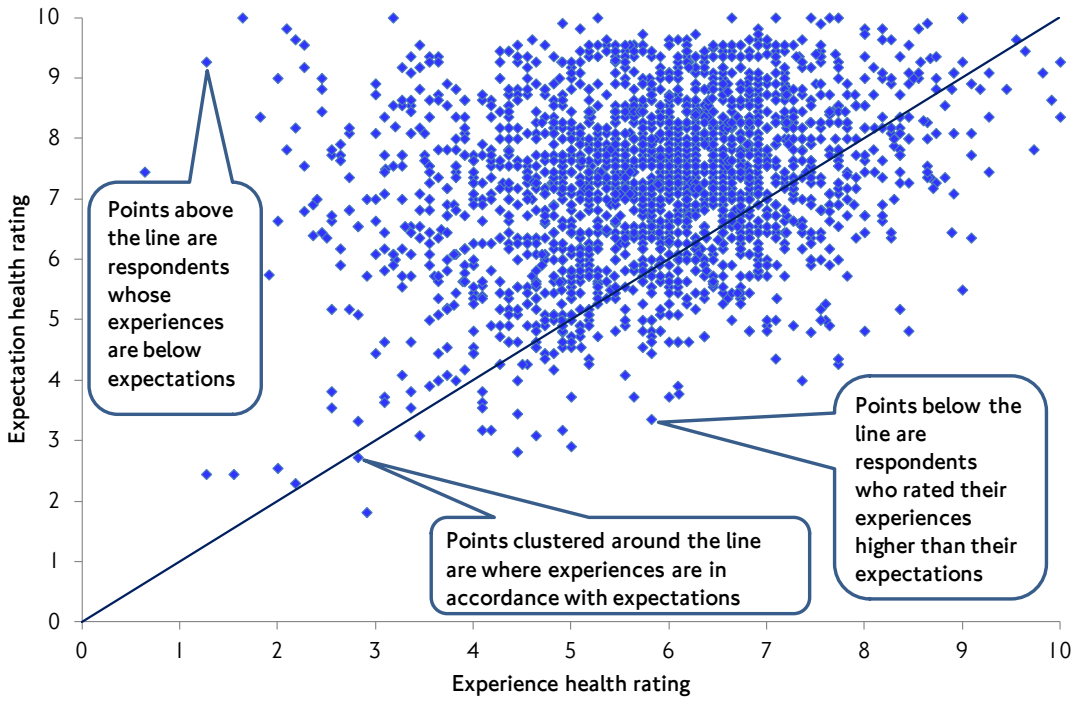
The journey purposes of respondents seem to reflect the nature of the streets as described in the RTF document. For example, City places, which are described as being pedestrian friendly with high levels of vibrancy, commercial activity and entertainment venues, had the highest percentage of trips undertaken for entertainment purposes (48 per cent). Local roads were more likely to be used by people who live nearby, as would be expected for residential streets. It is worth noting that respondents were asked 'What is your main reason for being on this street today?' and responses include those who had a destination on the street where the survey took place, as well as those who were passing through, en route to their destination.

Expectations and experience

Pedestrians were asked about their expectations for the street as well as their current experiences of using it. Responses were given on an 11-point scale from 0 to 10. A higher score for any indicator reflects a more positive result, ie a score of 7 is always a better assessment than a 6. This means that high scores for 'Not noisy', 'Not intimidated by traffic' and 'Not stressful' are positive as they show a lack of these negative factors.

There were significant differences between the expected health scores and the experienced health scores for all streets. Figure 9.14 shows that there is also a statistically significant correlation between respondents' expectations and their experiences of the health of streets, which suggests a consistency in the responses and support for the methodology.

Figure 9.14 Scatter plot of 'expected' and 'experienced' health scores.



Source: TfL Planning Policy Analysis.

Responses to the 11 questions were averaged to give an overall health expectation and health experience score out of 10. Figure 9.15 summarises the average scores for each street type. In general, pedestrians' expectations and experiences increase as the place function increases, and decrease as the movement function increases. The following sections explore differences in the combined health scores and between the individual health indicators, looking first at expectations then experiences, and finally comparing the two.

Figure 9.15 Summary of average experience and expectation scores for each street type.

Source: TfL Planning Policy Analysis.

Expectations for health by street type

Average expectations vary between street types and all give a reasonable score of between 6.4 and 7.9 out of 10. In general, expectations increase along the 'place' axis and decrease along the 'movement' axis, although there are differences when comparing the interaction between movement and place at different levels.

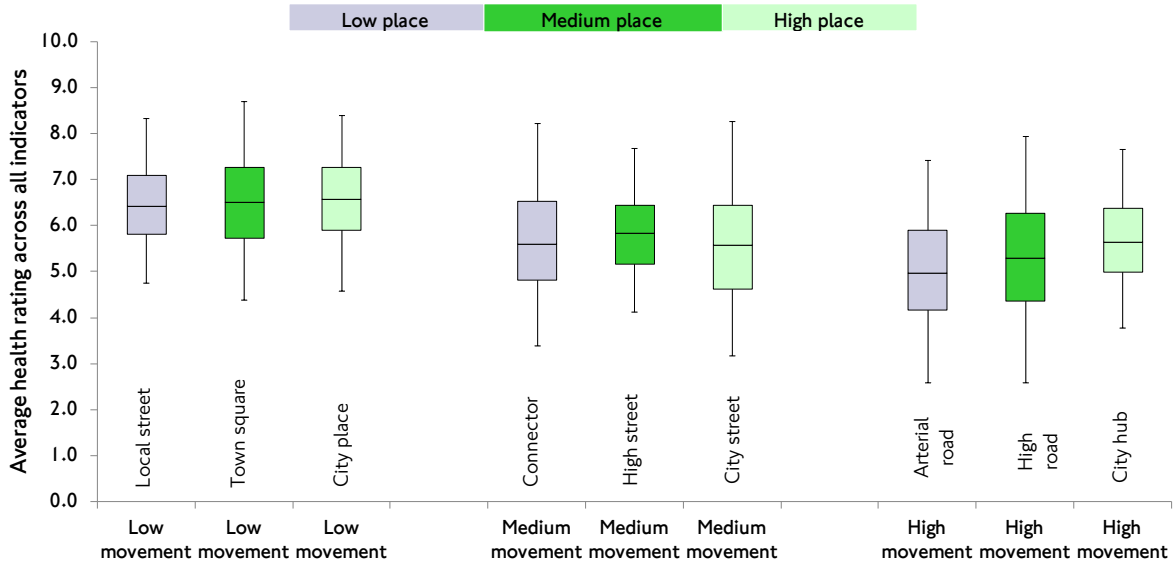
Figure 9.16 shows the distribution of average expectation scores across the nine street types using a Low / Medium / High ranking to group the street types according to their position on the 'movement' and 'place' axes (as labelled on the RTF conceptual framework in figure 9.12).

The midpoint represents the mean of the combined health scores for that street type; the boxes either side of the mean denote the inter-quartile range, that is 50 per cent of the expected health scores fall within the range specified by the boxes; the 'whiskers' represent the most extreme values within a tolerance of 1.5 times the inter quartile range.

In all street types the range represented by the chart covers approximately 95 per cent of the observed values. This shows that whilst responses varied between respondents, approximately 95 per cent fell within a three or four point range, with half of expected health scores falling within a one or two point range. This suggests that people broadly agree on what different types of streets ought to be like. This

also shows that the mean is a suitable measure to use to summarise responses and for further analyses.

Figure 9.16 Box plot of average health expectation scores by street type.



Source: TfL Planning Policy Analysis

The average health expectation scores range from a low of 6.4 for high movement / low place streets to a high of 7.9 for medium movement / high place street types. This suggests that pedestrians can differentiate between different types of street, and adjust their opinion of what they would reasonably expect a street to be like given the functional reality of the street. The similar scores for 'low movement' streets suggest that an increasing 'place' function does not increase users' expectations of how healthy a street should be. Average health expectations for Local streets, Town square/streets and City places do not differ significantly, although there are differences between the individual health indicators explored in the following section.

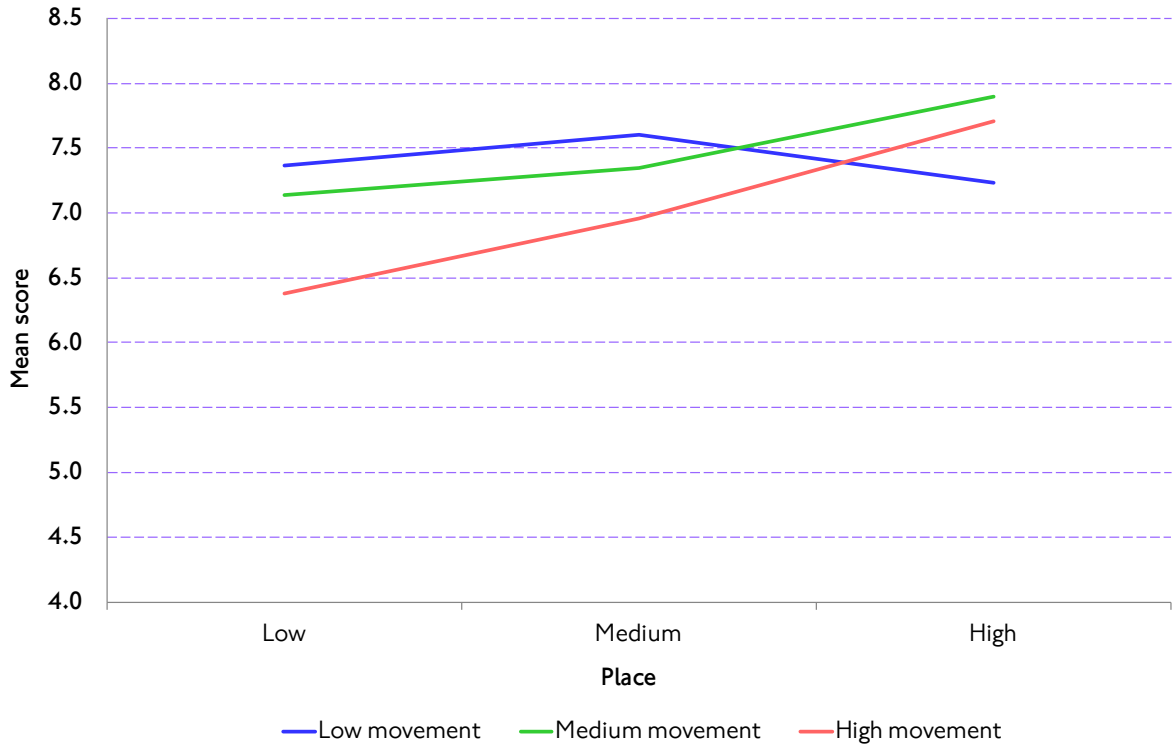
Within the 'medium movement' category there is little difference between the average values for the low place (Connectors) and medium place (High streets) street types. High streets have a much narrower range of expected values, suggesting people have more consistent views of what a high street should be like.

For street types with a low or medium movement function, neither 'movement' nor 'place' functions seem to have an impact on users' expectations. However, as streets become busier in terms of traffic (and fall into the high movement category), both place and movement functions materially affect responses. Average expectation scores increase along the 'place' axis: from 6.4 for low place (Arterial roads) to 7.7 for high place (City hub/boulevard).

Pedestrians had lower expectations for low and medium place street types within the high movement category compared to the low and medium movement categories. In other words, people's expectations of Arterial roads and High roads are lower than for Connectors and High streets (medium movement), which in turn are lower than expectations for Local streets and Town squares/streets (low movement).

Figure 9.17 presents mean health expectation scores for each level of movement and place, grouping together the three street types within each category. It shows the relative importance of place and movement at each level - both 'place' and 'movement' appear to have a significant effect on people's expectations of a street.

Figure 9.17 Mean health expectation scores by movement and place.



Source: TfL Planning Policy Analysis.

The chart shows that there is not a wide range of mean scores. For both medium and high movement streets there is an upward trend in expectations as place increases, but a different pattern for low movement streets. In the low movement category people have lower expectations for high place streets. One reason why the low movement streets follow a different pattern may be because of the wide variety of streets within this category. From low to high place function, this group includes Local streets (quiet, residential), Town squares / streets (focus for retail and leisure activity) and City places (high levels of street activity and vibrancy and a concentration of commercial and cultural activity): streets that will be used in very different ways. This may make it more difficult to represent these street types in a single 'low movement' group.

Expectations for individual health measures

This section presents findings related to the individual survey questions, rather than a combined health score. The results suggest that pedestrians can temper their expectations of how a street should be in relation to its reality, for example where it is located and how it is used.

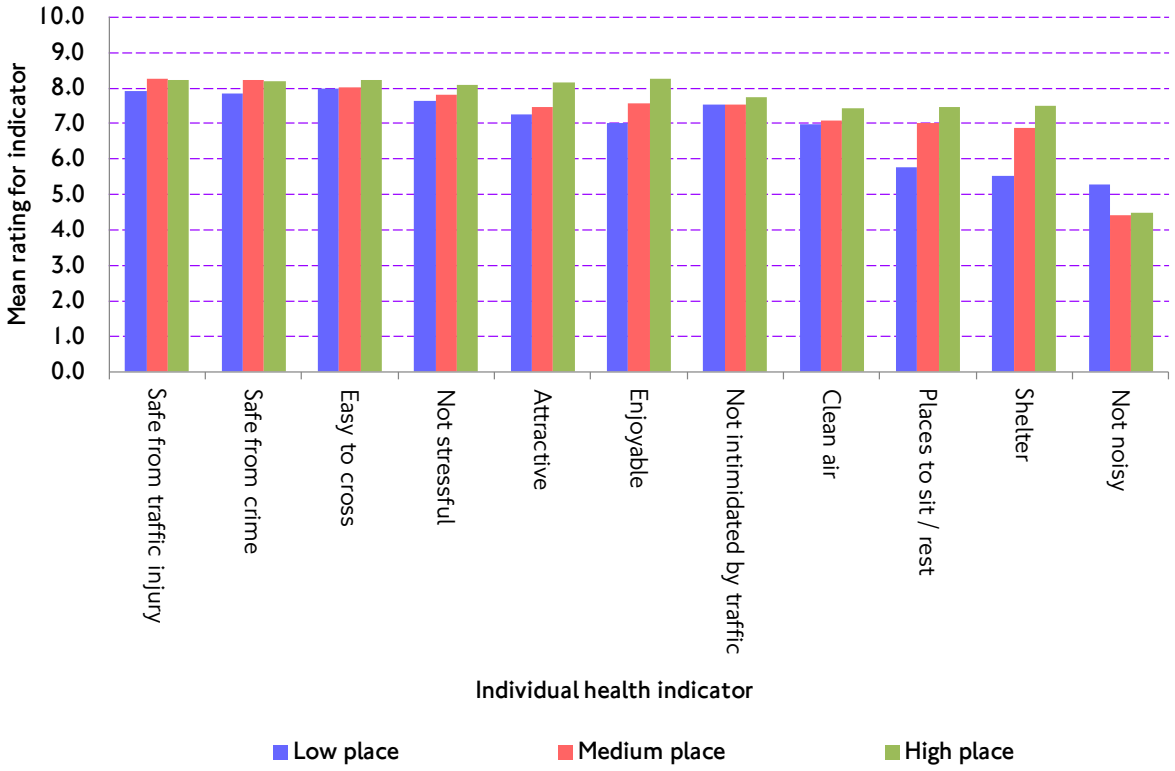
Figure 9.18 shows that people have lower expectations for low place streets compared to medium and high place streets. This is true for all 11 indicators except for lack of noise, which is not surprising as this shows that people expect low place

streets to be less noisy (ie more 'Not noisy') with a mean of 5.3 compared to 4.4 for medium place streets and 4.5 for high place streets.

Expectations regarding road traffic factors (that a road should be easy to cross, that people should feel safe from traffic injury and that they should not feel intimidated by traffic) differ little across the place axis - people expect to have their basic needs of feeling safe from traffic fulfilled regardless of the place function the street performs. This differs for the movement axis where expectations of road traffic factors decrease with progression up the movement scale: this is perhaps not surprising as these questions relate to the amount of traffic, which by definition increases up the movement scale.

People expect streets with a higher place function to be more 'attractive' and 'enjoyable' than streets that are lower down the place scale. There is also greater expectation that high place streets should make it easy to find somewhere to sit or rest, and shelter if you needed to.

Figure 9.18 Mean health expectation scores by individual health indicator and place category.



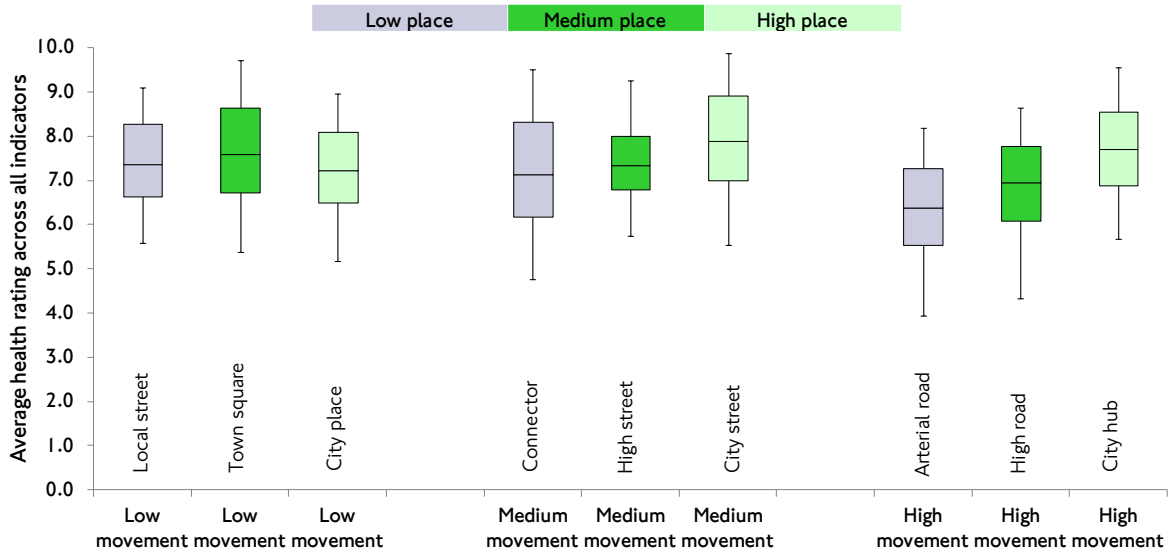
Source: TfL Planning Policy Analysis.

By looking at individual indicators, it is possible to assess the relative importance of each in contributing to the overall difference between the movement categories. Health expectations for low and medium movement streets are higher than for high movement streets: most of this difference is accounted for by the increased expectations that a low/medium movement street should be easy to cross, attractive, enjoyable and not stressful. Compared to high movement streets there is also more expectation that a low movement street should feel safe from crime.

Experiences of health indicators by street type

This section presents the reported on-street experience of respondents, and could be interpreted as an assessment of the current 'performance' of the streets from the point of view of pedestrians. As with expectations of health, the average of the 11 health questions were taken to give an overall health experience score for each street type. Figure 9.19 shows that average scores range from a low of 5.0 for high movement/low place (Arterial) streets to a high of 6.4 for low movement/low place (Local) streets. Compared to pedestrians' expectations of health there is a clearer downward trend in experience scores from the low to medium to high movement categories. As with expectations there is a clear upward trend in experience scores as the place function increases within the high movement category.

Figure 9.19 Box plot of average health experience scores by street type.

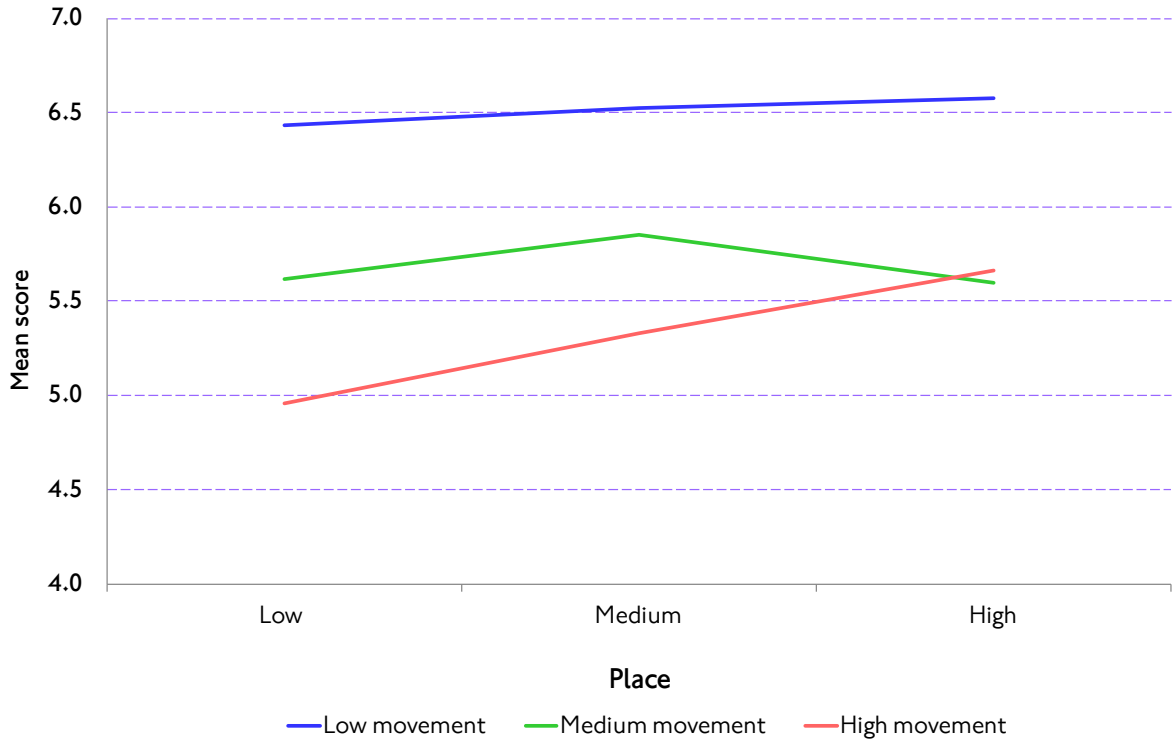


Source: TfL Planning Policy Analysis.

Interestingly for both expectations and experiences the street type with the narrowest range of health scores is the High street. This could be in part due to the familiarity people have with this type of street and the specific function it performs.

Overall, streets with low movement provided a healthier perceived street environment. Figure 9.20 shows the relative importance of place and movement separately to assess interactions between the two factors. It shows that health experience scores increase along the place scale for both low and high movement streets. There is a less clear pattern in the medium movement category, with High streets (medium place) performing better than City streets (high place). Within the low place category there is an increase in experience scores with a lower level of movement.

Figure 9.20 Mean health experience scores by movement and place.



Source: TfL Planning Policy Analysis.

Experiences for individual health measures

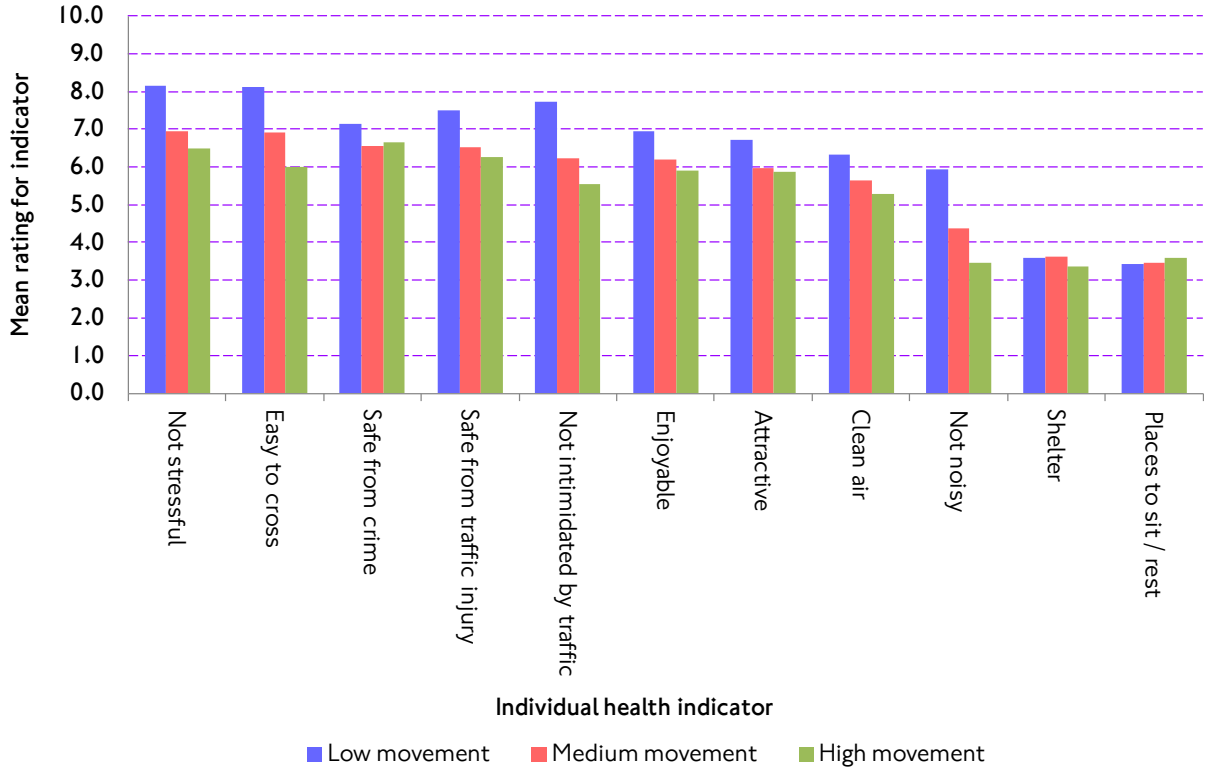
Peoples' experiences seem to be affected more by the movement functions of a street. For the majority of health indicators, people reported better experiences on low movement streets. Two indicators do not follow this pattern: ease of finding somewhere to sit or rest (where both medium and high movement streets receive higher scores), and ease of finding shelter (where medium movement streets receive higher scores).

Figure 9.21 shows the mean health experience scores across the different movement groups by individual health indicator. Three indicators stand out as performing much better on low movement streets compared to medium and high movement streets:

- Not noisy – an average score of 5.9 for low movement streets compared to 4.4 for medium movement and 3.5 for high movement streets.
- Not intimidated by traffic – 7.7 for low movement streets compared to 6.2 for medium movement and 5.5 for high movement streets.
- Easy to cross the road – 8.1 for low movement streets, 6.9 for medium movement and 6.0 for high movement streets.

These three indicators together account for around half of the overall difference in health experience scores between low and medium and low and high movement categories, and around 60 per cent of the overall difference in health experience scores between medium and high movement streets.

Figure 9.21 Mean health experience scores by individual health indicator and movement category.



Source: TfL Planning Policy Analysis.

There was not a clear pattern in terms of overall pedestrian experiences according to the place function. Looking at individual health factors, streets with a low place function were found to be less noisy and less stressful than streets with a medium or high place function. As might be expected, high place streets were perceived to be the most attractive and enjoyable to be on.

The lowest rated aspects for all street types were the ease of finding somewhere to sit or rest, and the ease of finding shelter. Provision was particularly poor on low place streets which were scored an average of 2.9 for ease of finding a place to sit or rest and 2.3 for ease of finding shelter. These two indicators are the main drivers of the low ratings for low place streets, and are in fact the main factors in lowering health experience scores across all place and movement categories: for all nine street types they are rated lower than the average health experience score for that street type.

Summary of health expectations and experiences by street type

Figure 9.22 shows that the distribution of average health expectation and experience scores by street type follow plausible and intuitive distributions. As might be expected, expectations are always higher than experiences. For each street type there is a distinction between expectations and experiences although some are less pronounced than others.

Looking at specific street types, City place, Local streets and High streets show a similar pattern of a narrow distribution of results for both experiences and expectations (although they do centre on different means). This may be because the

form and function of these types of streets is more consistent and easily understood. Less easily understood seem to be Arterial road and Connector street types where there is a wide, and almost bi-modal, distribution of expectation scores compared to the experience scores. More variation in responses to the expectation questions may be because respondents interpreted the definition of 'expectation' differently (a more abstract concept than a question about your current experience) depending on the interviewer and the survey location, leading to a wider range of results.

Figure 9.22 Distribution of average expected and actual health scores by street type.

Source: TfL Planning Policy Analysis.

Table 9.1 is an interpretative graphic that summarises the key findings from the survey, for example:

- Pedestrians reported the best overall health experiences for street types in the low movement group: Local streets, Town square/streets and City places.
- These three low movement street types also perform well compared to people's expectations, and have the narrowest gaps between mean expectation and experience scores.
- People have higher expectations of streets with a more significant place function. Two of the three street types with the highest expected health scores are in the high place group (City street and City hub / boulevard), with the third (Town square/street) in the medium place group.

- On streets with a high movement function, the best performing aspect was feeling safe from crime.
- The low and medium movement street types scored best in terms of not being stressful, and ease of crossing the road.
- For eight of the nine street types people's lowest expectations were related to noise, with average scores of less than 5.0 for the street being 'not noisy'.
- Due to this, noise was also the indicator which, despite having low scores for experience, performed best on six of the nine street types in terms of meeting expectations, ie had the smallest gap between expectation and experience. In some cases the experience outperformed expectations.
- In terms of experiences not meeting expectations, being able to find a place to sit or rest, or somewhere to shelter were the worst performing aspects of all nine street types. It should be noted that these two questions were somewhat different in their construction: they asked about a hypothetical situation where you needed to find a place to sit or take shelter, ie 'How easy do you think it would be for you to find somewhere to sit or rest on this street if you needed to?' and 'How easy do you think it would be for you to find shelter, for example if it was very sunny or raining?'. This meant it was less grounded in the present time than the other questions which focused on the here and now in terms of perceptions of noise, clean air, safety etc.

Table 9.1 Summary of key findings from TfL's exploratory survey of healthy streets.

Movement	Place	Street type	Average health rating	Average health expectation rating	Difference between expectation and experience	Highest experience (mean rating)	Lowest experience (mean rating)	Highest expectation (mean rating)	Lowest expectation (mean rating)	Best performing aspect (smallest 'expectation gap')	Worst performing aspect (largest 'expectation gap'
1 Low	1 Low	Local Street	6.4	7.4	0.9	Not stressful (8.8)	Shelter (1.7)	Easy to cross (8.7)	Shelter (4.4)	Not stressful	Places to sit / rest
	2 Medium	Town Square / street	6.5	7.6	1.1	Easy to cross (8.0)	Shelter (4.2)	Safe from traffic injury (8.7)	Not noisy (4.3)	Not noisy	Shelter
	3 High	City Place	6.6	7.2	0.7	Easy to cross (7.7)	Places to sit / rest (4.3)	Enjoyable (8.4)	Not noisy (4.3)	Not noisy	Places to sit / rest
2 Medium	1 Low	Connector	5.6	7.1	1.6	Not stressful (7.2)	Shelter (2.8)	Safe from traffic injury (8.3)	Not noisy (4.8)	Not noisy	Shelter
	2 Medium	High Street	5.8	7.3	1.5	Not stressful (6.9)	Not noisy (4.3)	Safe from crime (8.2)	Not noisy (4.9)	Not noisy	Shelter
	3 High	City Street	5.6	7.9	2.3	Easy to cross (7.3)	Places to sit / rest (2.1)	Easy to cross (8.7)	Not noisy (4.4)	Not noisy	Places to sit / rest
3 High	1 Low	Arterial Road	5.0	6.4	1.4	Safe from crime (6.3)	Shelter (2.5)	Easy to cross (7.3)	Not noisy (4.1)	Not stressful	Shelter
	2 Medium	High Road	5.3	7.0	1.6	Safe from crime (6.9)	Not noisy (3.3)	Safe from crime (8.0)	Not noisy (4.0)	Not stressful	Shelter
	3 High	City Hub / Boulevard	5.6	7.7	2.1	Safe from crime (6.8)	Places to sit / rest (3.7)	Safe from traffic injury (8.5)	Not noisy (4.8)	Not noisy	Places to sit / rest

Source: TfL Planning Policy Analysis.

Note: the best performing aspect refers to the indicator with the smallest negative gap between experience and expectation, also called the 'expectation gap'.

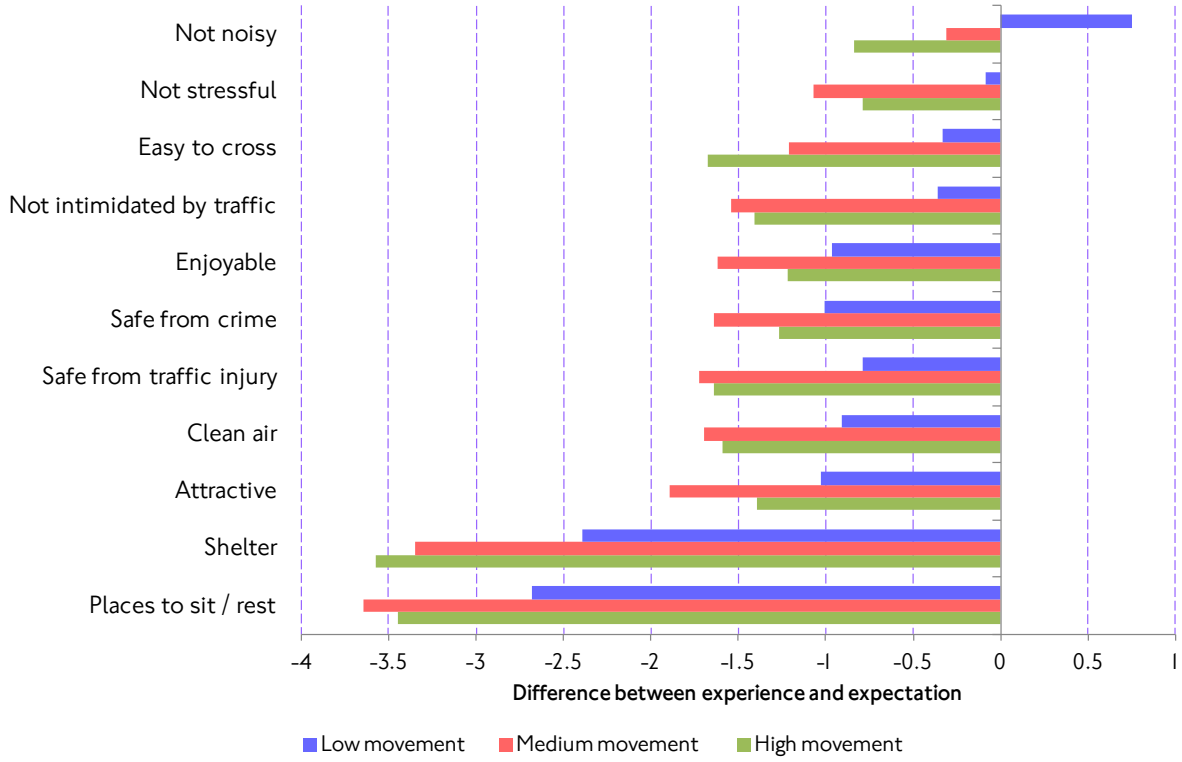
Explaining the difference between health experiences and expectations

Table 9.1 shows that on average there is a difference of about 1.5 points between the expected and experienced health scores for each street type. This 'expectation gap' ranges from 0.7 points for City places to 2.3 for City streets. Looking at the 'expectation gap' for the individual health aspects helps understand the importance of each element in driving the overall difference between expectations and experiences.

Figure 9.23 shows the health indicators in order of those with the smallest to the highest gap between pedestrians' experiences and their expectations. Expectations exceed experiences for all health factors at all levels of movement, except for 'Not noisy' which is perceived as being better than expected on streets with low movement. Low movement streets tend to perform better than those with medium or high movement – this is reflected by a smaller disparity between what people would expect and what they experience. Low movement streets perform particularly well in terms of almost meeting pedestrians' expectations for being not stressful, easy to cross and not being intimidated by the traffic.

For all nine street types the biggest 'expectation gap' is for the ease of finding places to shelter and places to sit or rest: people expect better provision of these facilities. Streets are not perceived to be as attractive and enjoyable as pedestrians would expect, resulting in dissatisfaction with these elements for all movement categories. There is also dissatisfaction related to expectations for clean air and safety from traffic injury. 'Safety from crime' has a greater relative expectation gap on low movement streets, but is less of a driver of dissatisfaction on high movement streets – the lack of other vehicles and people may reduce feelings of safety.

Figure 9.23 Differences between experience and expectation scores for each health indicator, by movement category.



Conclusions

The findings suggest that the conceptual framework outlined in the RTF which defines streets on the Place and Movement axes has real world significance. People's expectations and experiences of health indicators vary according to the type of street they are on – showing that people can differentiate (even if subconsciously) between different types of street. Furthermore respondents appear capable of tempering their expectations of what a street should be like taking into account what would be reasonable given the location and function of that street. For example expectations of how clean the air should be and not finding the street too noisy fall as the movement function increases. People do not expect an Arterial road to be as quiet as a Local street, conversely they would not expect it to be as easy to find somewhere to sit or rest on a Local street as they would on a City street or High street. It is worth remembering that all results are from the perspective of pedestrians on the pavement, not those travelling in vehicles on the street.

Both movement and place functions were found to affect people's experience and expectations of the street environment to varying degrees. For example, people both expected and perceived that high place streets were more attractive and enjoyable to be on. People reported better experiences on low movement streets, especially in terms of not being noisy, not feeling intimidated by traffic and ease of crossing the road, although they did not perform well in terms of offering places to sit or rest and shelter. People expected low movement streets to be attractive, enjoyable, easy to cross, not stressful and safe from crime.

Whilst there are differences between the performance of individual health indicators, they are inter-related: typically as the score for one factor increases, so do scores for the other factors. This reinforces the idea of a 'whole-street' approach when assessing the street environment and a need to understand which factors are most important in driving people's experiences and expectations.

This is important when considering areas for improvement; where there was a wide disparity between expectations and experiences it is not simply that experiences were bad *per se*, it is that they had performed worse than expected. Respondents are perhaps likely to naturally expect more than the current levels of service they are getting. Analysis has identified ease of finding places to sit or rest and ease of finding shelter as the biggest drivers of the 'expectation gap'.

Finally, the exploratory survey methodology appears to have been successful in assessing people's on-street experience in a particular place and time, as well as their expectations for different types of streets. It has provided data to explore how a small sample of London's streets are currently performing in terms of identified health indicators, as well as areas for improvement. It could therefore potentially be developed to measure changes in these aspects over time, or applied to other aspects of 'place' functionality, in addition to health.

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