

Mayor's Transport Strategy: Supporting Evidence

Challenges and Opportunities for London's Transport
Network to 2041

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Challenges and Opportunities for London's Transport Network to 2041

Executive Summary

The Mayor's Transport Strategy is the statutory document that sets out the Mayor of London, Sadiq Khan's, policies and proposals to reshape transport in London over the next 25 years. It is an ambitious strategy that puts people's health and quality of life at the very heart of planning the city's transport. Along with the new London Plan and the Mayor's other strategies for economic development, the environment, housing, health inequalities and culture, it provides the blueprint for making London a city that is not only home to more people, but is a better place for all of those people to live in.

TfL has collected evidence to identify the challenges and opportunities facing London's transport network over the next 25 years. This has formed the basis of the strategy development process, and helps us understand why the priorities and policies outlined in the strategy are relevant and necessary for London. The analytical work presented here includes analysis of past trends, current conditions and modelling of possible futures. It looks at the challenges facing London from the perspective of those who live and work in the city, as well as in terms of the operation of the transport network itself.

The key conclusion is that for London to grow and thrive, it is essential that London's residents, workers and visitors walk, cycle and use public transport more to improve their health and the environment, to make streets work more efficiently & keep London moving.

London's transport network has been transformed since 2000, delivering a better experience for customers.

Since TfL was formed in 2000 and the first Mayor of London was elected, London has experienced unprecedented population growth, supported by an expanding and improving transport network. All public transport modes have seen significant increases in capacity and service quality; with innovations on the street network such as congestion charging, cycle hire and superhighways, and technological innovation from Oyster to apps.

Since 2000, there has been substantial mode shift away from the car, bucking national trends for many years.

London has grown rapidly leading to increased demand on the transport system: an average of 26.7 million trips per day were made in London in 2015, 18 per cent more than in 2000. In the period since TfL was formed in 2000, London has achieved an unprecedented shift in travel patterns, with the proportion of trips made by car falling from 47 per cent to 36 per cent and a real terms fall in car travel despite rising

numbers of people travelling in the capital. London has become one of the most sustainable major cities in terms of mode share and whilst many other world cities have seen increased car use, we have achieved the reverse.

This shows that change is possible, but the recent rise in car traffic is an urgent reminder that much more needs to be done to deliver mode shift from the car.

This achievement reflected a massive commitment to improving the public transport network, delivering better connectivity, more capacity and a transformed customer experience on London's rail and bus services. Investment in cycle infrastructure has also paid off, with cycling now the fastest growing mode of travel in London. At the same time, it became less appealing to travel by car as fuel prices and insurance costs rose, congestion increased and parking became more constrained. In central London, the introduction of the Congestion Charge in 2003 reduced traffic by 15 per cent overnight.

Wider societal factors, not all of them positive or desirable, had the effect of making it more likely people would travel by sustainable modes. A disproportionate amount of the population growth took place in denser inner London, and amongst younger working-age adults, particularly non-UK born Londoners, who are less likely to use the car. Amongst the youngest group, license holding fell considerably so that today's young adults drive less than their predecessors. And although at an aggregate level the London economy was growing, incomes in outer London, where most of the car travel happens, remained stagnant from the early 2000s. In total, nearly all of the factors that influence the patterns of travel demand contributed to the rise of sustainable travel; in future, changes in any of these trends could make it more difficult to continue to reduce car use and help Londoners travel sustainably.

In future, travel patterns will be influenced by what we do, but also by factors outside our control. There is emerging evidence that car traffic is increasing, suggesting the balance of factors influencing demand may be changing.

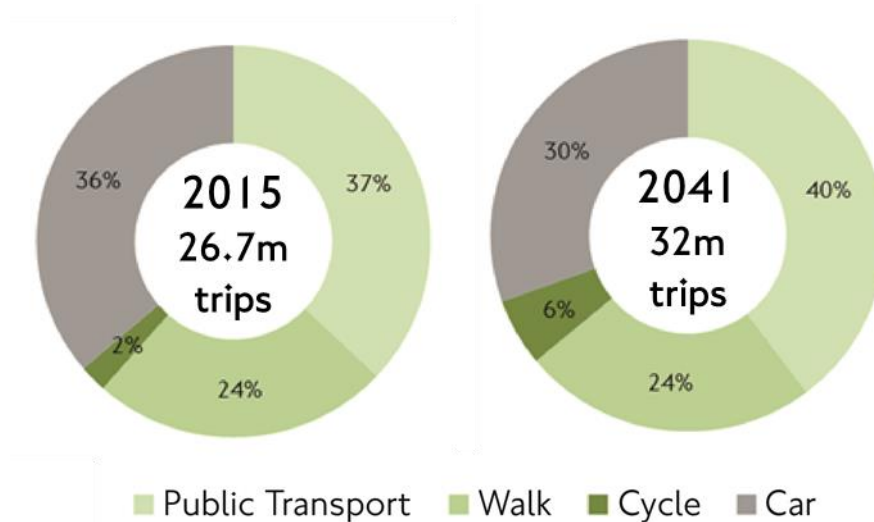
London is bigger than it has ever been and growing rapidly with the population expected to reach 10.5m by 2041, accompanied by 6.8 million jobs.

This is equivalent to adding two double decker buses full of new residents every day. The shape of the capital is changing, with more older people - the population over 70 is growing between two and three times as fast as average - and 1.8 people with accessibility needs will be living in London by 2041. Employment is also expected to grow, with more than a million additional jobs by 2041, concentrated in central London.

Inevitably, growth on this scale will place significant pressure on the transport network. Total travel will increase by 23 per cent, with 5 million more trips per day by 2041 than today. Analysis has been undertaken to understand how people might travel in future, based upon current trends and the existing investment programme, which includes the opening of Crossrail 1 – the Elizabeth line – and the funded London Underground upgrade programme, as well as HS2 and the delivery of the HLOS and Thameslink upgrade programmes on national rail, but excludes unfunded major projects such as Crossrail 2. This analysis suggests that mode shift from the car will continue, albeit more slowly, with the car mode share falling from 36 per cent

to 30 per cent by 2041 based on the current programme. Despite the falling car mode share, traffic will continue to rise if left unchecked.

Figure E1 Trip-based mode share for travel in London, 2015 and 2041, funded programme without the interventions proposed in the MTS



Source: City Planning

The life expectancy of Londoners has been increasing but adults are living more of their lives in poor health. Most Londoners do not do enough activity to be healthy and travelling actively is the best way to achieve this.

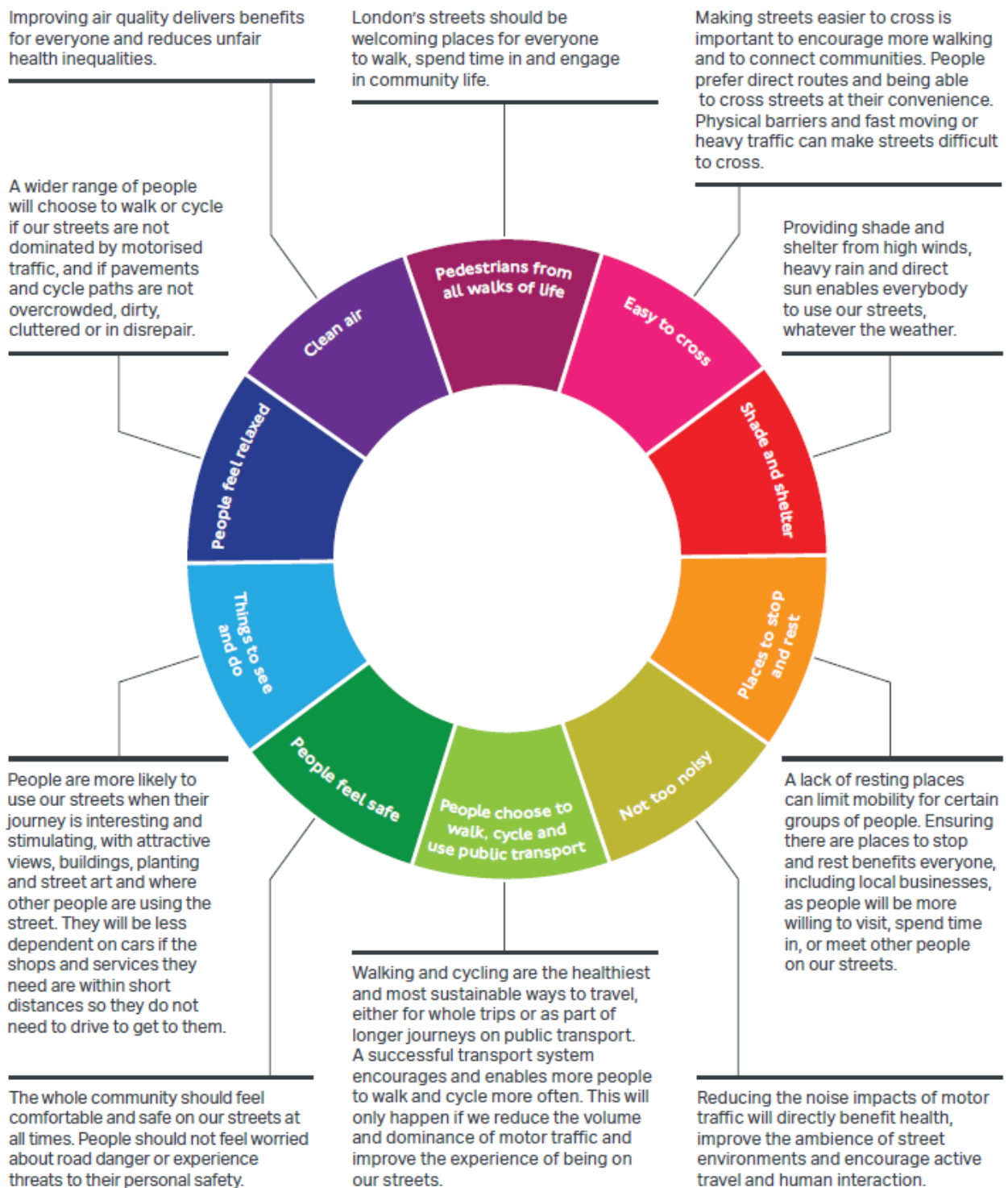
Transport plays a vital role in improving health, and particularly in helping people to be physically active – adults need at least 150 minutes and children 420 minutes of physical activity a week to stay healthy and reduce their risk of common, preventable diseases.

Walking or cycling is one of the best ways to stay active and healthy as it provides regular physical activity integrated into people’s daily routines, particularly for groups who may struggle with more vigorous activity, but can manage to walk a journey. Currently, a third of Londoners achieve their recommended level of physical activity from active travel alone. If everyone in London walked or cycled for 20 minutes each day - including travel to and from public transport stations and stops - this could save £1.7bn in NHS treatment costs over 25 years.

Healthy Streets are safe, inclusive and encourage activity but London’s streets fall short of expectations.

Streets make up 80 per cent of London’s public space so improving the street environment can dramatically improve quality of life in the city. TfL and the GLA have identified ten indicators of a Healthy Street - shown below - necessary to create a safe, inclusive space where people will choose to walk and cycle and spend time. Research shows that London’s streets fall short of the expectations of those using them. As the city gets busier, the street experience could worsen.

Figure E2 Ten Indicators of a Healthy Street



Source: Lucy Saunders

Healthy Streets and healthy people

Walking is an active and enjoyable way to travel and more people could walk rather than drive.

At present, Londoners walk more than people living elsewhere in the UK, with 30 per cent of all trips in London made on foot. The shift from the car to public transport has brought with it huge increases in the amount of walking done to access stations and stops, but the share of journeys walked all the way has remained the same for several decades. Nevertheless, there is potential to deliver mode shift to walking, particularly for short journeys in outer London currently made by car. Doing so will mean meeting expectations for a Healthy Street environment. Whilst the car remains a cheap and convenient option, people will continue to drive walkable journeys

Cycling is an efficient and healthy way to get about and there is considerable potential for growth in cycle travel.

Cycling is now a major transport mode in London, with 670 thousand journeys made each day. Cycle growth has been particularly strong in central London, with flows across the central cordon increasing by more than 200 per cent since 2001. The rise of cycling has reflected considerable investment in infrastructure to make the experience safer and more appealing but there is much more to be done in order to truly make London feel like a city for cycling. Cycling is the mode of transport with the greatest untapped potential in London. There are 8.2 million trips currently made by a motorised mode that could feasibly be cycled, with a further 1.6 million that could be cycled part of the way. Many journeys could be cycled in under 20 minutes, and for many journeys cycling would be quicker than the current mode of travel used. Cycling is cheap, efficient and reliable, and most people agree that cycling can be a pleasant way to get about. People that don't currently cycle in London can be concerned about safety and worried that cycling may not be a convenient option for them – to help them start cycling means overcoming a range of practical and attitudinal barriers. More high quality, safe and pleasant routes, supported by plentiful and secure parking, will encourage new people to start cycling and existing cyclists to cycle more.

Vision Zero for London means our long term vision is to reduce road danger so that no deaths or serious injuries occur on London's streets – in 2015, nearly 2,100 people were killed or seriously injured on London's streets

In 2015, 2,092 people were killed or seriously injured (KSIs) on London's streets, 42 per cent below the 2005-09 baseline. The previous target was met six years early and London is on-track to achieve the target established in 2015 of a 50 per cent reduction in KSIs by 2020. Current forecasts show that if progress continued at a similar rate, KSIs would continue to fall to around 1,000 by 2040.

However, the proportion of KSIs made up of vulnerable road users has risen, as the greatest reduction has been amongst car occupants, and more than 2,000 people were killed or seriously injured on London's roads in 2015. Delivering Vision Zero will only be achieved through reducing the dominance of motorised traffic on London's roads and tackling all sources of road danger.

Buses and coaches are disproportionately involved in collisions with pedestrians and cyclists and in the last three years there were on average 200 people killed or seriously injured in collisions involving buses or coaches.

Improving the safety and security of transport and travelling in London remains a priority

The recent terror attacks in London and Manchester have highlighted the importance of ongoing efforts to reduce the likelihood and impact of these terrible incidents on London's streets and public transport networks and to improve the safety and security of transport and travelling.

Crime on the TfL public transport network fell more than 50 per cent between 2005/06 and 2016/17. Concerns about the risk of crime and disorder can act as a barrier to travel – surveys carried out in 2016 found that 18 per cent of Londoners could recall an incident in the last three months which had made them feel worried about their personal safety, and women, black and minority ethnic and disabled Londoners are more likely to be concerned about their safety. In future, reducing crime and improving people's confidence to travel will be challenging in the context of the threat of terrorism, financial constraints, growing passenger numbers and the changing risk and nature of crime

Rising traffic and falling road capacity for private vehicles means that congestion will rise for essential traffic

Congestion causes stress and frustration, and limits the amount people can travel because journeys are slow and unpredictable. For businesses, congestion costs money as workers spend time queuing in traffic, it is difficult to make deliveries on time, and an unreliable road network harms the reputation of London. Bus journeys become slower and less reliable. Despite a falling car mode share, without further action traffic is expected to rise across much of London, with 8.6 million more kilometres travelled by road on average day in 2041 compared to 2015. Over the same period, the amount of space available for use by general road traffic is expected to reduce by 3 per cent, more in central London. By 2041 the average Londoner could waste two and a half days a year sitting in congested traffic.

In central London, weekday daytime congestion has now returned to levels not seen since the introduction of the Congestion Charge in 2003 and outside of charging hours, traffic, speeds and congestion on the central London road network in the evenings and at weekends are as bad or worse than during charging hours, affecting central London's appeal as a shopping, leisure and entertainment destination.

Industry trends and economic growth will lead to more freight traffic, especially vans

London's continued success critically relies on safe, reliable, sustainable and efficient goods delivery and servicing – it is estimated that freight adds approximately £7.5 billion to the GVA of London. As London grows, the demand for freight activity will grow accordingly but, as with all travel, we must ensure that this need is met in a way that minimises its negative impact on the rest of the city. Between 2015 and 2041, van traffic is expected to increase by a quarter as a result of trends in ecommerce, an increase in just-in-time deliveries, and lengthening supply chains.

For Healthy Streets, we need to achieve population and jobs growth without a matching rise in car travel

Since its invention, the car has provided welcome connectivity and opened up new opportunities. Even in a densely populated city such as London, some journeys can only reasonably be made by car. But the amount of space that can or should be taken up by private road transport is limited, and the population is growing. Over the past 15 years, car use has been falling despite a rising population. Furthermore, car ownership is linked to inactivity – 70 per cent of people without a car do some active travel in a day, compared to 40 to 50 per cent of car owners – and car traffic causes emissions damaging to health and the environment and road danger. Traffic clogged streets deter people from walking and cycling and damage quality of life. Underlying the challenge of delivering Healthy Streets and healthy people in London is a basic need to deliver population and jobs growth without a commensurate rise in car travel.

Three quarters of car trips could be made by a more sustainable mode, but many people are reluctant to change

There remains great potential to deliver mode shift from the car to more sustainable modes across London, and particularly in outer London – 74 per cent of all Londoners' car trips and 93 per cent of car trips under 2km could feasibly be made by an alternative mode. Some people are more amenable to change than others – the challenge is that the greatest amount of car use happens in places where people are most committed to travelling by car and least willing to change. Delivering mode shift requires changing people's preferences. In practice, realising the potential that has been identified would mean car travel becoming less appealing and other modes more appealing in terms of their cost, convenience and freedom from stress.

Poor air quality damages health and causes the equivalent of up to 9,400 deaths per year

Transport is the biggest source of emissions damaging to health in London - around half of emissions (NO_x and particulate matter) come from road transport. These pollutants are collectively estimated to cause around 9,400 equivalent deaths every year in Greater London and impose an economic cost somewhere between £1.4bn and £3.7bn a year. London is in breach of legal limits on NO₂ and while there is no safe level for particulates, does not meet levels recommended by the World Health Organisation of PM smaller than 2.5 micrograms (PM_{2.5}). The communities suffering most from poor air quality are often the most vulnerable and at least 360 primary schools are in areas exceeding safe legal pollution levels.

Under the most recent government plans, London will not comply with legal limits for NO₂ until 2025, 15 years after the original deadline and will exceed World Health Organisation levels of PM_{2.5} until well after 2030. About a quarter of London's roads are forecast to be non-compliant with NO₂ levels in 2020 and of these, four in ten require traffic reductions of at least 25 per cent. Three quarters of road transport particulate matter comes from tyre and brake wear. There are limited technological solutions so only a reduction in road traffic can effectively tackle PM in the medium/long term.

Action must be taken to reduce carbon emissions so London can play its part in tackling climate change

Climate change is a serious threat to global quality of life. Carbon dioxide concentration is 40 per cent higher than in pre-industrial times and between 1880 and 2012, the earth's surface warmed 0.85 degrees Celsius. London's transport providers must play their part in delivering reductions in carbon emissions. The Mayor's ultimate ambition is to make London a zero carbon city by 2050 and yet the current situation is that CO₂ emissions from road transport are forecast to reduce by around 50 per cent in 2050 compared to 2013. London's public transport services are on a pathway to zero emissions; emissions from the largely electrified rail network will fall in line with the decarbonisation of the energy supply. Technological advances will reduce vehicle emissions but this will be made quicker and more feasible if the distance travelled by car is reduced.

London's transport CO₂ includes emissions arising from the taxiing, take-off and landing of aircraft at Heathrow and City Airports. There is no national policy to fully decarbonise aviation and the expansion of Heathrow would significantly increase CO₂ emissions.

Noise from transport causes stress and damages the health of Londoners

The World Health Organisation identifies environmental noise as the second largest environmental risk to public health in Western Europe. More than 1.6 million people in London are exposed to road traffic noise levels during the day above 55dB, the level defined by the World Health Organisation as causing health problems. Heathrow alone exposes 750,000 people to significant aircraft noise – the majority of whom reside in west and southwest London – and which amounts to 28 per cent of all those exposed to noise by airports across Europe. With a third runway, that number could increase to almost a million people.

A biodiverse natural environment is good for nature and good for people

Transport land accounts for 14 per cent of land in London and how this land is used has a significant impact on biodiversity in London. Nationwide, the goal is to conserve biodiversity. This will be challenging given competing demands for land for housing and transport infrastructure. As London becomes more urban, access to green space will become more important, and transport land can contribute.

The transport network must be resilient to extreme weather and the adverse effects of climate change

London is already suffering from the adverse effects of climate change as summers are getting warmer and winters are getting wetter. Major flooding has occurred in London in three of the last four years, causing significant disruption to transport and having a detrimental impact on the economy. For London to remain an attractive place to live, work and visit, the transport system must be resilient to the extreme weather conditions likely to become more common as a result of a changing climate.

A good public transport experience

London has become more unaffordable as housing and travel costs have risen faster than incomes

Whilst the economy of London has grown, not all Londoners have shared in the benefits. London is one of the most expensive places to live in the world and yet more than a fifth of working Londoners do not receive the London Living Wage. In the early years of TfL, average earnings rose faster than fares, particularly bus fares which were frozen or reduced each year between 2005 and 2008. However, between 2008 and 2015, single Tube and bus fares increased by around 60 per cent. While this allowed for significant investment in transport networks, those on the minimum wage saw their pay rise just 17 per cent, making travel costs a larger proportion of their spending. The Mayor has frozen fares to make travel more affordable. Travel costs becoming unaffordable could make it harder for Londoners to make the journeys they need and want to by public transport.

A good customer experience means consistently getting the basics right and being innovative

A good customer experience means consistently getting the basics right and being innovative. Customers should be able to trust their transport providers to provide a good experience across the network, but overstretched services may struggle to deliver what customers want. Customers will expect services to respond to emerging technology and reflect cultural change - as expectations rise, it will become increasingly difficult to deliver the basics consistently in a crowded and congested environment. In particular, customers expect and deserve a consistent experience and yet satisfaction varies considerably between different rail operators, with customers on Southern and Thameslink services the least satisfied.

An inclusive, accessible, affordable transport network benefits all Londoners. But despite significant improvements, 41 per cent of the public transport network is still not accessible

Journey times are longer on the step-free network and a number of barriers to travel remain. In particular, whilst everyone finds travelling on crowded services unpleasant, for those with accessibility needs crowded services can act as a total barrier to travel. With a fast growing population with accessibility needs - 1.8 million people by 2041 - and more intensely crowded rail services, accessibility risks becoming a more acute challenge as time moves on.

Buses are a space-efficient and affordable mode of transport but falling speeds worsen the experience for users

London's bus services provide the most extensive public transport network in the capital, offering low cost, accessible travel across London's residential outer areas as well as a dense network of services in inner and central London. Investment in new services, increased frequencies, bus priority and improved customer experience meant that demand for bus travel grew by 71 per cent between 2000 and 2015 and 3.9 million bus journeys are made in London every day.

However, passenger volumes have started to fall in recent years, largely as result of slowing bus speeds and also reflecting changes to travel patterns. It is vital that the huge achievements of the past 15 years are not lost and London does not see a return to car travel. In fact, there is enormous potential to deliver mode shift from car to bus, with around three million journeys that could feasibly be made by bus. Modelling suggests that increasing bus connectivity in outer London in particular could deliver this mode shift; emerging forms of demand responsive bus services could provide a cost effective solution in some cases. To realise this potential, buses will need to provide connectivity and convenience to compete with the car, and bus speeds will need to improve once again.

Despite tube and rail upgrades and the opening of the Elizabeth line, demand will increase faster than supply by 2041, exacerbating crowding

In the next five years, London will experience the opening of the first entirely new rail line in a generation and the completion of significant upgrades to the London Underground network. As a result, by 2021, the rail network will be less crowded on average than today, although many lines will still experience very crowded trains. But by 2031, the funded programme will have drawn to a close, and population growth will be placing renewed pressure on the rail network. By 2041, demand will have outstripped supply and in the absence of new rail capacity we can expect to see severe crowding across almost all of the Tube and rail network as it approaches central London, and spreading much further in many cases. Crowding will increase by 50 per cent on London Underground and 90 per cent on national rail services by 2041.

Crowding in stations causes delays and frustration and will become more common as London grows

The same demographic and economic factors that lead to busier trains will result in increased passenger numbers at stations across the network. The most significant challenge will arise in central London, where demand for travel at peak periods will rise substantially, placing pressure on key destination stations and interchanges. Congestion within stations leads to delays as passengers move slowly through the station, are forced to wait to board trains, or are held outside the station as safety concerns force temporary closures. By 2041, planned station control measures may be required at 30 key stations, including London Underground stations serving each of the six major National Rail termini. The closure of a London Underground station at a terminus, even for a short time, adds significant pressure to the wider network.

Passenger safety should always be a top priority

In recent years, the number of people killed or seriously injured on the London Underground has remained broadly stable, set against growing passenger numbers, and the safety of bus and coach passengers has improved considerably. After many years of safe operation, there was a major tram derailment at Sandilands Junction in November 2016 in which seven people lost their lives and over 50 people were injured. This tragedy serves as a reminder that safety is paramount and that it is vital to work to continuously improve passenger safety despite growing demand for services.

The Thames Vision sets a goal of doubling river patronage

Over the last ten years, river patronage has doubled with over 10.5 million people travelling on the river in 2016/17 and the Port of London Authority (PLA) Thames Vision has set a target to double annual river patronage to 20 million and underlying intra-port freight carried by water to over four million tonnes by 2035.

In recent years, there has been an unprecedented rise in the number of licensed private hire drivers and vehicles, leading to concerns around congestion, air quality and compliance

Whilst the number of licensed taxis and licensed taxi drivers in London has remained stable for many years, the number of private hire vehicles (PHVs) has increased by 58 per cent since 2008/09, with the number of licensed drivers increasing by 81 per cent over the same period.

Coaches provide affordable long distance transport options; Victoria Coach Station currently operates at or close to capacity and is in need of substantial refurbishment.

Coaches provide affordable long distance transport options; however, TfL does not operate services directly but has historically provided the London terminus at Victoria Coach Station. 14 million passengers a year travel by coach in and out of Victoria Coach Station, to 1,200 destinations in the UK and abroad. A study has concluded that a central hub in zone 1 needs to be maintained, with supporting hubs around London.

New homes and jobs

London is vital to economic growth across the UK – it is the most productive region and is the UK's only global centre

London sits at the heart of the UK economy, accounting for just under a quarter of national economic output. It plays a unique role as a global employment hub, one of a small number of very large cities around the world. The centre hosts a cluster of globally competitive sectors, and accommodates a third of London's jobs in just 2 per cent of its area. 45 per cent of GVA was generated in just six central Boroughs, making this the most productive part of the UK. Central London has grown more than elsewhere, yet compared to other similar cities there remains scope to increase its density and productivity.

Jobs in central London depend on rail capacity; by 2041 demand will outstrip supply, possibly limiting growth

All of London's key employment centres are in locations which can be reached by more than two million people within 45 minutes and this is where the most growth is expected, with three quarters of a million additional people expected to be working in central London and the Isle of Dogs by 2041.

Transport capacity constraints can limit this connectivity and may lead to lost economic potential if crowding starts to deter people from working in the centre. A crowded network, with the frustrations and inefficiencies this brings will eventually act to constrain the available labour market and encourage businesses to look elsewhere to invest. New rail capacity will be required to meet demand and ensure London's economy can continue to thrive.

Beyond the centre, travel is more car dependent but town centres could become sustainable travel hubs

At least four in ten journeys made by London residents start or end in a town centre and town centres also act as transport hubs, with larger town centres all served by Tube or rail services and multiple bus routes. Whilst London residents are less likely to drive to town centres than other destinations, nevertheless, on an average day, there are 1.5 million car trips to town centres. As our shopping habits change, the role of town centres is changing, with retail consolidating in larger centres.

London needs 50,000 new homes a year but is delivering half that - transport investment can unlock development

To meet the needs of London's current and future population, 50,000 new homes are needed every year, equivalent to a new home every 11 minutes, 24 hours a day for the next 25 years, but only around half this have been delivered in recent years. A constrained housing supply means people are paying more to live in worse conditions. In the long term, a constrained housing market will deter people from living and working in London and threaten economic growth.

Transport has a key role in unlocking housing development. Homes in the best connected areas command a price premium, currently 2.5 per cent for Crossrail 1 above surrounding areas, and a disproportionate amount of development has taken place in very well connected areas.

Many of the areas with the greatest capacity for development have poor transport connectivity, hampering development

London's Opportunity Areas are the largest reservoir of developable land, but many suffer from poor transport connectivity at present. Investing in new public transport capacity could unlock the delivery of hundreds of thousands of homes that may not otherwise come forward for development. In particular, it is estimated that Crossrail 2 alone could support 200,000 new homes and 200,000 jobs along its route. TfL as a landowner can contribute directly to the supply of housing; TfL is the owner of 5,700 acres of public land in London and sites have been identified that could potentially deliver 10,000 homes over the next five years.

London's low density sprawl has contributed to high car use, new developments should make it easy to travel sustainably

Where people live to a large extent determines their travel patterns: car ownership and use is higher in places where access to jobs, shops and services depends on the car. People living in more densely populated areas, close to shops and services, and with access to good public transport services are more likely to travel by public transport, cycling and walking and less likely to travel by car. The car mode share for those living the furthest from a town centre is nearly three times that of those living very close to a town centre. Similarly, commute patterns are determined by how well served workplaces are by public transport. How people commute is particularly

important because people who need a car for work are far more likely to drive all their other journeys as well.

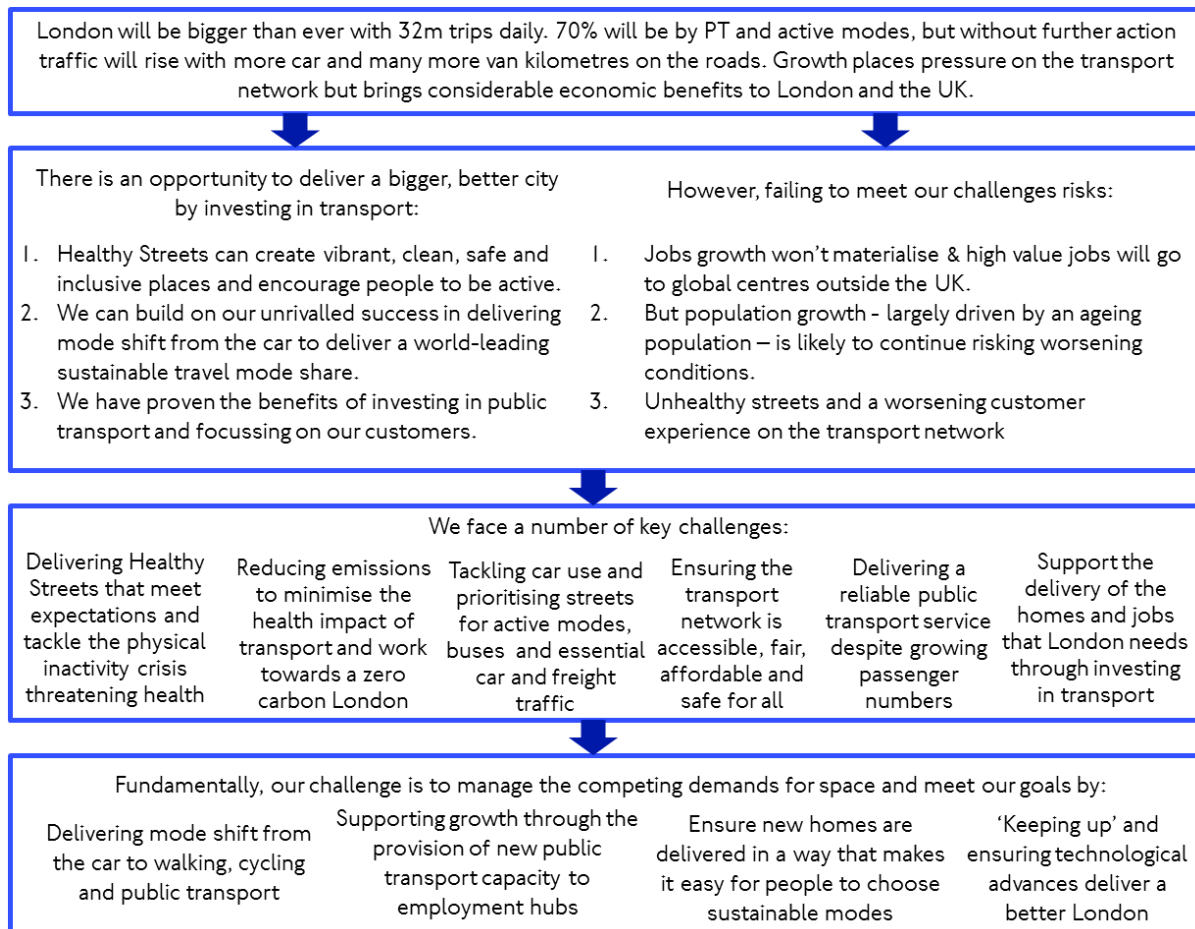
Car ownership and use also tends to be higher where there is better parking provision, based on the assumption that off-street parking is better than on-street, and that unpermitted parking is better than permitted. In inner London, there is some evidence that the cost of parking is deterring people from owning and running a car. In new developments, there is clear evidence that more parking means more car use than would be seen otherwise.

In summary, it is clear that the situation and design of new housing will determine the travel patterns of its residents. Higher density, well connected housing, offering a good quality environment for walking and cycling, and with limited parking provision, will encourage people to travel sustainably. Equally, in order to prevent rising car travel, new employment should be well connected by public transport and active modes to the potential workforce, with limited parking, to deter commuting by car.

Conclusion

Figure E3 summarises the challenges and opportunities London’s transport network will face over the next 25 years. Analysis of the challenges and opportunities facing London provides the evidence base for the draft Mayor’s Transport Strategy.

Figure E3 Challenges and opportunities facing London’s transport network between 2015 and 2041



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1 Introduction

The Mayor's Transport Strategy is the statutory document that sets out the Mayor of London, Sadiq Khan's, policies and proposals to reshape transport in London over the next 25 years. It is an ambitious strategy that puts people's health and quality of life at the very heart of planning the city's transport. Along with the new London Plan and the Mayor's other strategies for economic development, the environment, housing, health inequalities and culture, it provides the blueprint for making London a city that is not only home to more people, but is a better place for all of those people to live in.

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The key conclusion is that for London to grow and thrive, it is essential that London's residents, workers and visitors do more walking and cycling and use public transport more to improve their health and the environment, to make streets work more efficiently & keep London moving.

The structure of the report is as follows:

Chapter 1 introduces the purpose of the report and its structure.

Chapter 2 sets out TfL's expectations of how London will grow and the implications for the demand for travel, looking at the characteristics of that growth and exploring the drivers of travel demand.

Most Londoners are not sufficiently active for their health. Chapter 3 presents the health challenge and describes the Healthy Streets approach.

Chapter 4 describes the challenges and opportunities in delivering Healthy Streets and healthy people, including the need to increase active travel, deliver an improved street environment, tackle road danger and reduce dependence on the car.

Chapter 5 describes the environmental challenges – in terms of air quality, tackling climate change and adapting to its impacts, and tackling noise disturbance. It also describes the challenges for London's natural and urban environment.

Chapter 6 presents the challenges faced in delivering a good public transport experience for all, looking at bus and rail services in turn. It explores the challenge of delivering affordable, accessible and safe services.

Chapter 7 outlines the role of transport in unlocking new homes and jobs, and explores the relationship between a range of factors and sustainable travel choices in order to identify the characteristics of 'good growth' that can benefit everyone.

2 Travel patterns, trends and forecasts

This section describes how the population and economy of London has changed in the past and presents the forecasts of what is expected to happen in future. The section also describes the likely impact of population and employment growth on travel demand – the amount of travel people do and the characteristics of that travel – in London over the next 25 years to 2041.

Travel patterns, trends and forecasts: key findings

- The primary drivers of travel demand at the aggregate level are population growth and employment growth. London's population is forecast to grow 22 per cent by 2041, and the level of employment in London is forecast to increase by 20 per cent. This growth in population and employment means that travel demand will increase substantially to 2041.
- At a more detailed level, the growth in travel demand on different modes and in different locations will be influenced by changes in London's demographics and economic structure. Factors such as the changing age profile of Londoners – including a forecast increase in the number of residents aged over 65 – will influence where and when travel demand occurs. Similarly, the spatial distribution of new homes and jobs will determine where increases in additional demand will occur. With central London employment forecast to continue to grow, much of the increase in travel demand will be experienced on peak-time radial rail modes.
- The net effect of the various influences on travel demand is forecast to lead to an increase in the total number of trips made daily from 26.7 million to 32 million. There is forecast to be some growth in car travel, mainly in Outer London, as well as a rise in the amount of van traffic. However, the vast majority of the increase in travel is instead accounted for by growth in public transport and cycling trips.

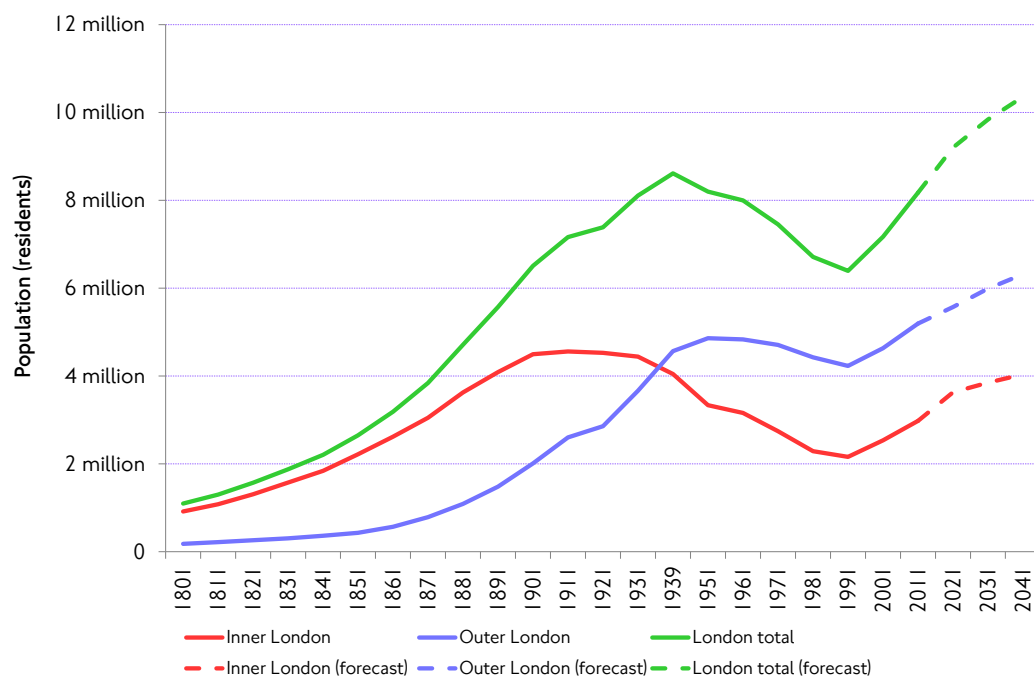
2.1 Population

Growth to 2041

London is expecting to see rapid growth in population over the coming decades. In 2015, London's population topped 8.6 million, the highest it's ever been. The GLA's latest forecast (released in July 2016) is that London's population is expected to reach 9.9 million by 2031 and 10.5 million by 2041. This is 22 per cent higher than today, 28 per cent higher than at the last census in 2011, and is equivalent to adding the combined populations of Birmingham and Glasgow.

Figure 1 shows how the population of London has grown since 1801, and how it is expected to grow in future. London has changed radically over the past two decades. Following a long period of population decline, population growth returned to London in the 1990s. At the last peak, in the 1930s, the populations of inner and outer London were broadly equivalent. Today, the shape of the capital is different with a more dispersed population. Outer London's suburban lifestyles were facilitated first by the expansion of local rail and Tube networks and later by the car. They were accompanied by a huge rise in car ownership and use, with both also strongly associated with rising incomes.

Figure 1 Historical and Forecast Population in London, 1801 to 2041

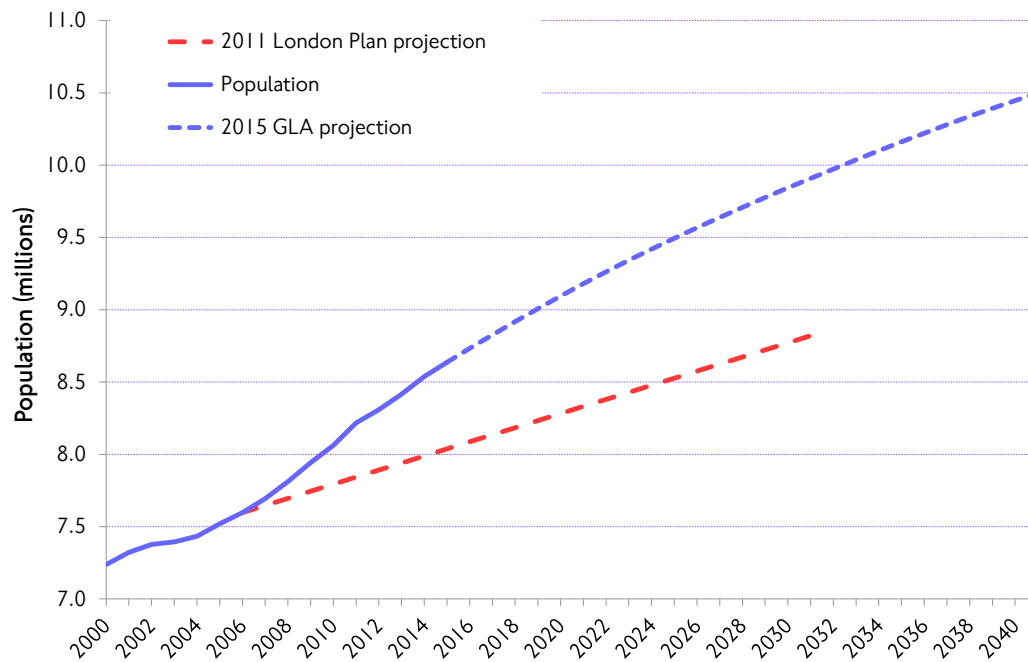


Source: City Planning

London's Changing Demography

Over the past five years, London's growth has outstripped expectations, with the population in 2015 already far higher than forecast in the 2011 London Plan, as shown in Figure 2.

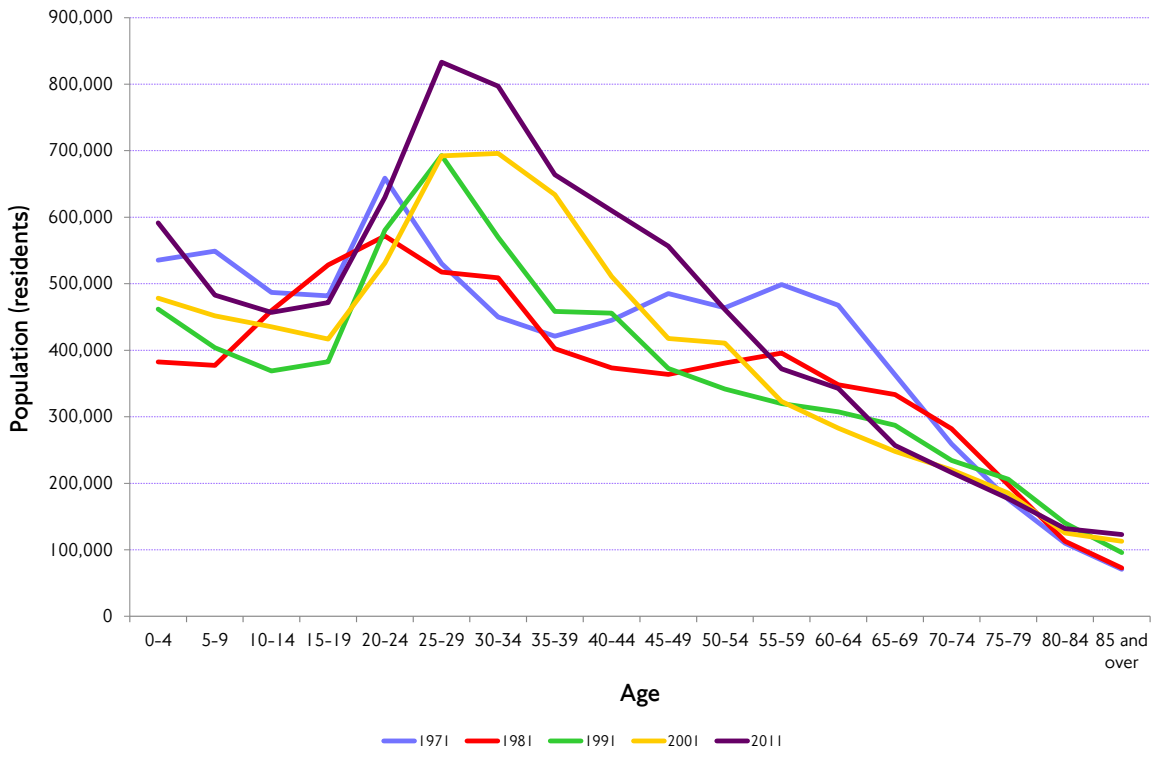
Figure 2 Comparison of forecast and actual population growth in London to 2015 and of 2011 and 2015 forecasts



Source: City Planning

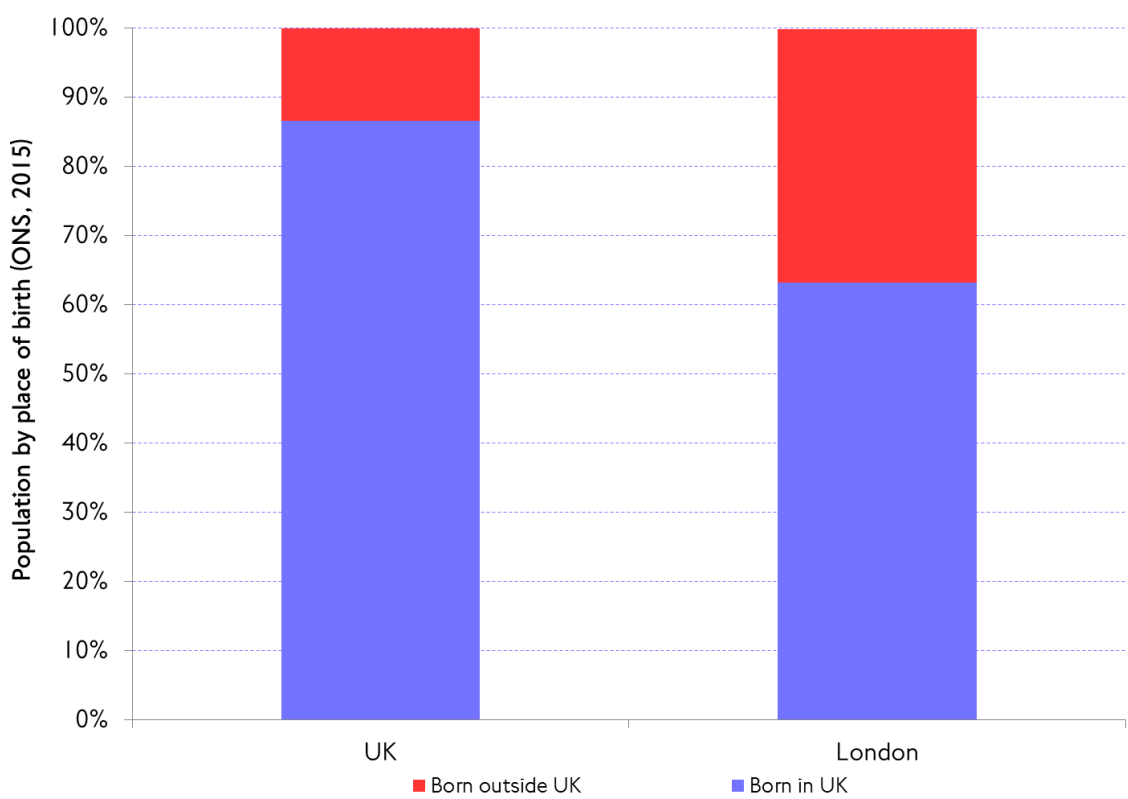
Over the past decade, population growth has been driven by two factors: strong growth in the number of births in London (21 per cent increase since 2002) and high levels of net international migration. This has been partly balanced by large numbers of people leaving London for the rest of the UK. High growth has been seen in the number of younger people of working age, with very low growth in the population aged 65 and over. Figure 3 shows that in 1971 there was a fairly similar number of people in each five year age group between ages 30 and 64, whereas by 2011 the population aged 25 to 35 was far higher than that aged 50 plus. This is in marked contrast to the rest of the UK where the proportion of the population aged 60 and over has increased from 19 per cent to 27 per cent since 1971. London residents are also far more likely to have been born outside the UK than residents of the country as a whole, as shown in Figure 4.

Figure 3 London's Population by Age, 1971 to 2011



Source: City Planning

Figure 4 Population by place of birth, London and UK, 2015



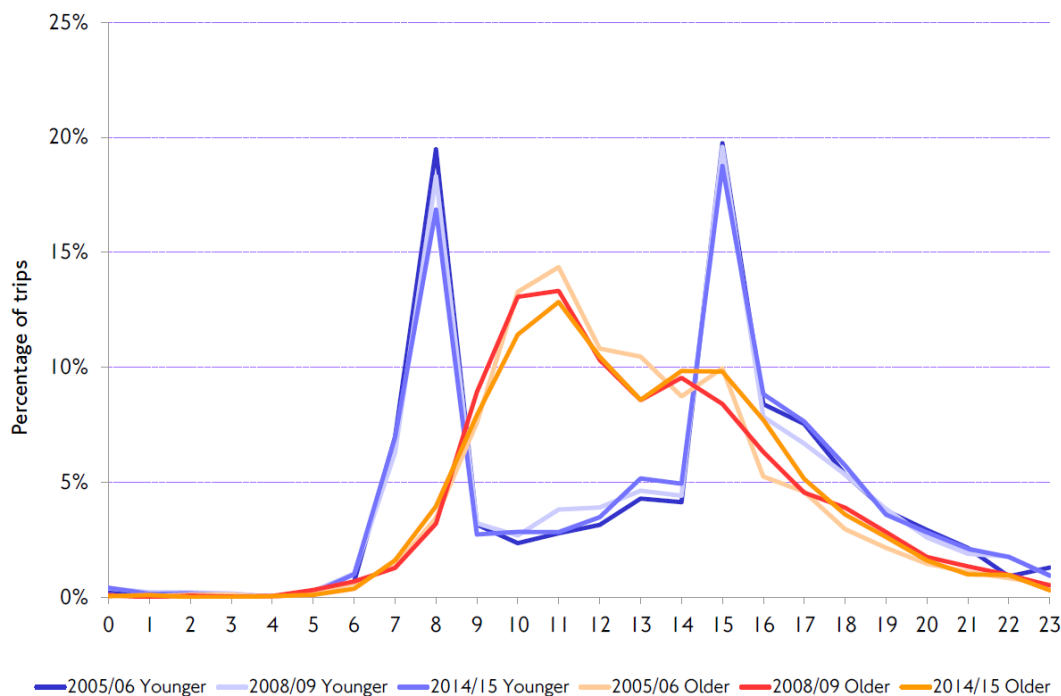
Source: City Planning

In comparison, the characteristics of the growing population are expected to be different in the future:

- The number of births, which has grown in recent years, is expected to remain stable at around 130,000 per year, with net natural change (i.e. births minus deaths) at around 80,000 per year.
- Consequently, growth is expected to be stronger amongst those aged 65 and over, particularly from 2020 onwards. The number of London residents aged 70 and over is expected to be 85 per cent higher in 2041 than in 2014.
- Net international migration to London is expected to fall slightly, to around 80,000 per year. This will be matched by a net increase in domestic migration out of London. From 2025, it is expected that over 100,000 London residents will move to other parts of the UK each year.

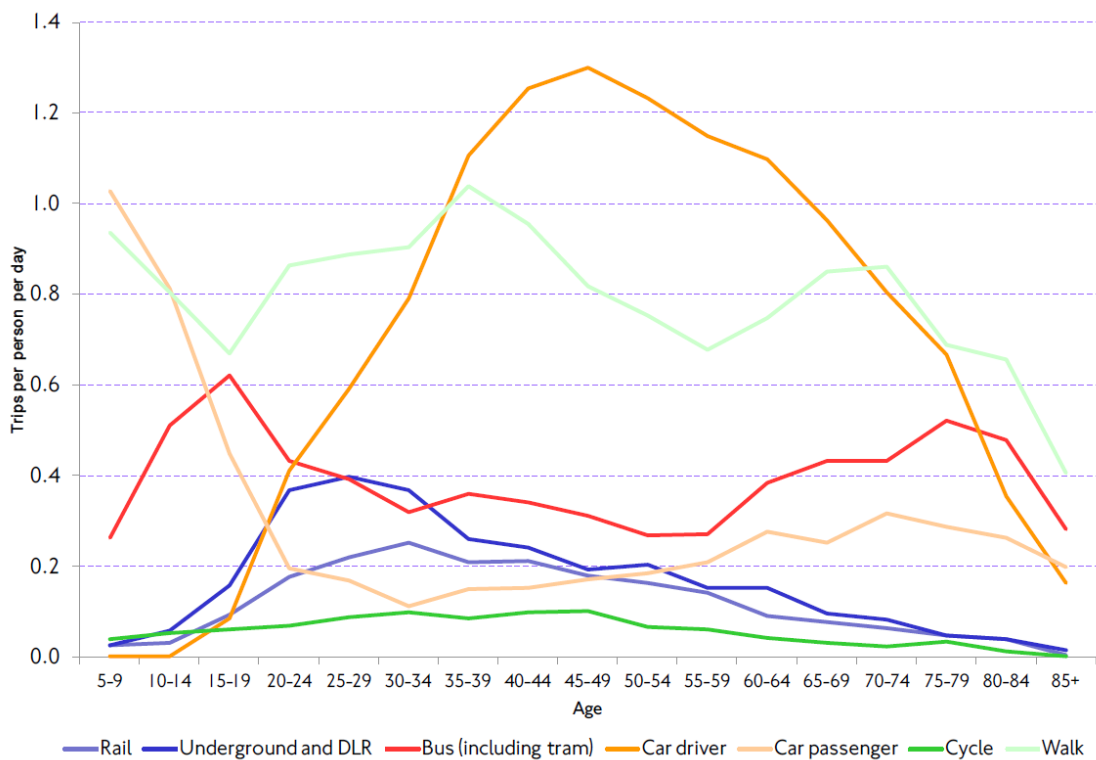
This means that, in future, it is expected that more people will leave London than arrive but that this will be offset by a growing number of older people living in the city. Travel patterns vary between different groups and between residents of different parts of London. Therefore, the impact of population growth on travel will be different depending on where it occurs and the characteristics of the emerging population, as shown in Figures 5 and 6. A larger population of older people will mean increased demand for travel outside peak periods and on road-based modes, and will also create a greater need for accessible services. Conversely, if the pattern of population growth continues to follow the trends seen over the past 15 years, this would place even more pressure on peak hour services than described in this report.

Figure 5 Age profile of weekday trips by start hour, London residents, 2005/06, 2008/09 and 2014/15



Source: City Planning

Figure 6 Trip rates by mode and age, London residents, 2014/15



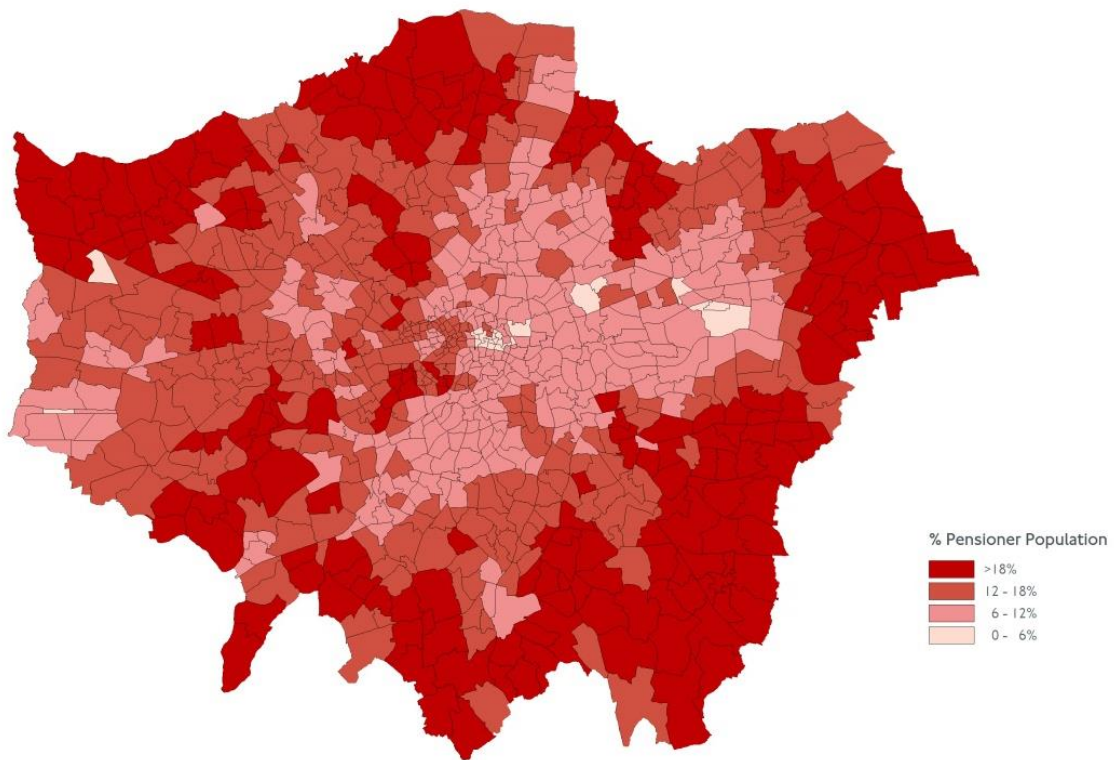
Source: City Planning

Spatial Distribution of Population Growth

Where population growth happens will determine where travel demand pressures will become particularly intense, and will also affect the character of that demand. Inner London residents tend to travel more, compared to Outer London residents, and are more likely to use public transport. Outer London residents tend to use cars more, and so growth here may lead to a particular increase in car travel. Older adults tend to live in the least connected parts of Outer London and this is forecast to continue, as shown below in Figure 7. This will continue to present challenges for transport provision as these areas are harder to serve by public transport and have more car orientated travel patterns.

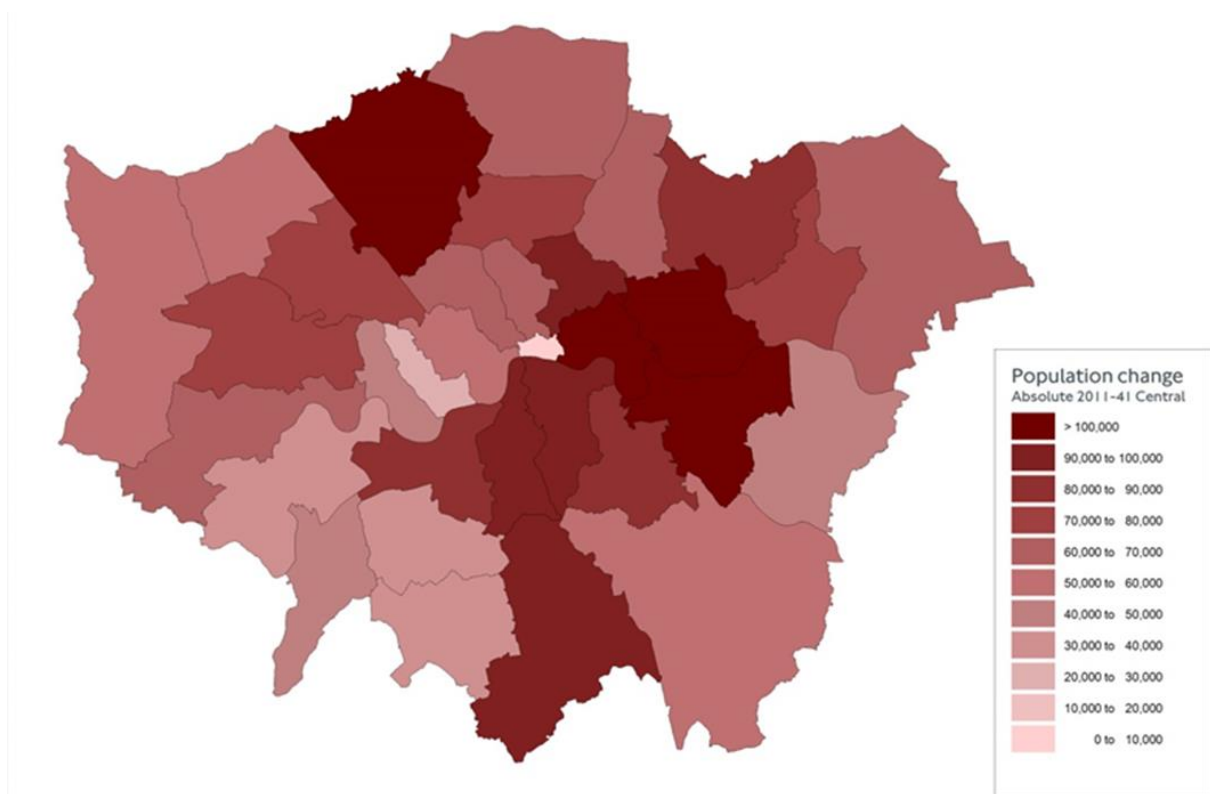
Over the last decade, growth has been highest in the east of London and this is expected to continue. Figure 8 shows the expected distribution of growth across London, with high concentrations in east London, south London at Croydon, and northwest London at Brent Cross and Old Oak Common.

Figure 7 Forecast distribution of residents aged 67 and over by 2041



Source: City Planning

Figure 8 Spatial distribution of population growth in London, 2011 to 2041



Source: City Planning

2.2 Employment

Growth to 2041

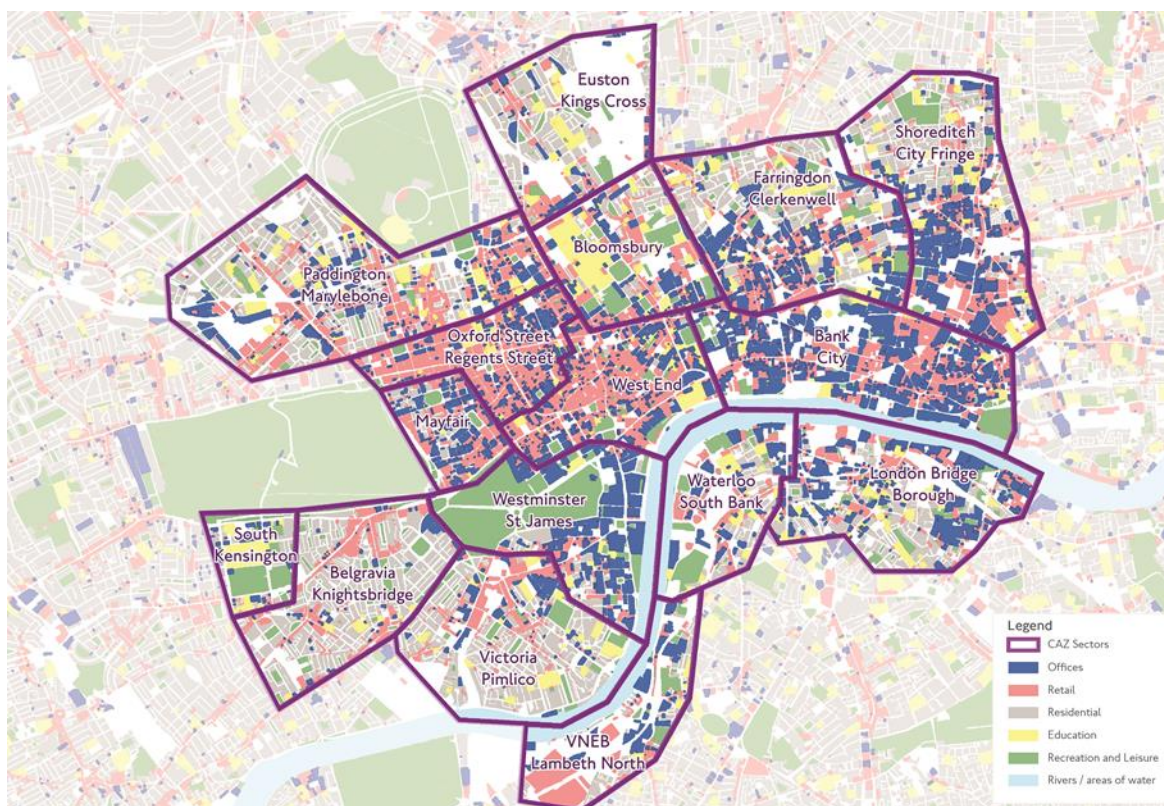
Employment in London has also grown rapidly, from 4.6 million jobs in 2000 to 5.7 million jobs in 2016 and is projected to grow to 6.25 million by 2031 and 6.75 million by 2041.

London's employment offer not only provides opportunities for London's residents but attracts people from across the country and the 'commuter belt' extends into the Home Counties. At present, approaching 800,000 people commute into London and the GLA estimates that this will grow to more than a million by 2041. It is anticipated that around 350,000 London residents will commute to jobs outside London by 2041.

Focus on the Central Activities Zone (CAZ)

The Central Activities Zone (CAZ) extends from Chelsea and Kensington through Westminster to the City and reaches north into Camden and south into Southwark and Lambeth, as shown in Figure 9. Together with the North Isle of Dogs, it covers London's geographic, economic and administrative core. It brings together the largest concentration of London's financial and globally-oriented business services. Almost a third of all London jobs are based there and, together with North Isle of Dogs, it has historically experienced the highest rate of growth in London and the UK.

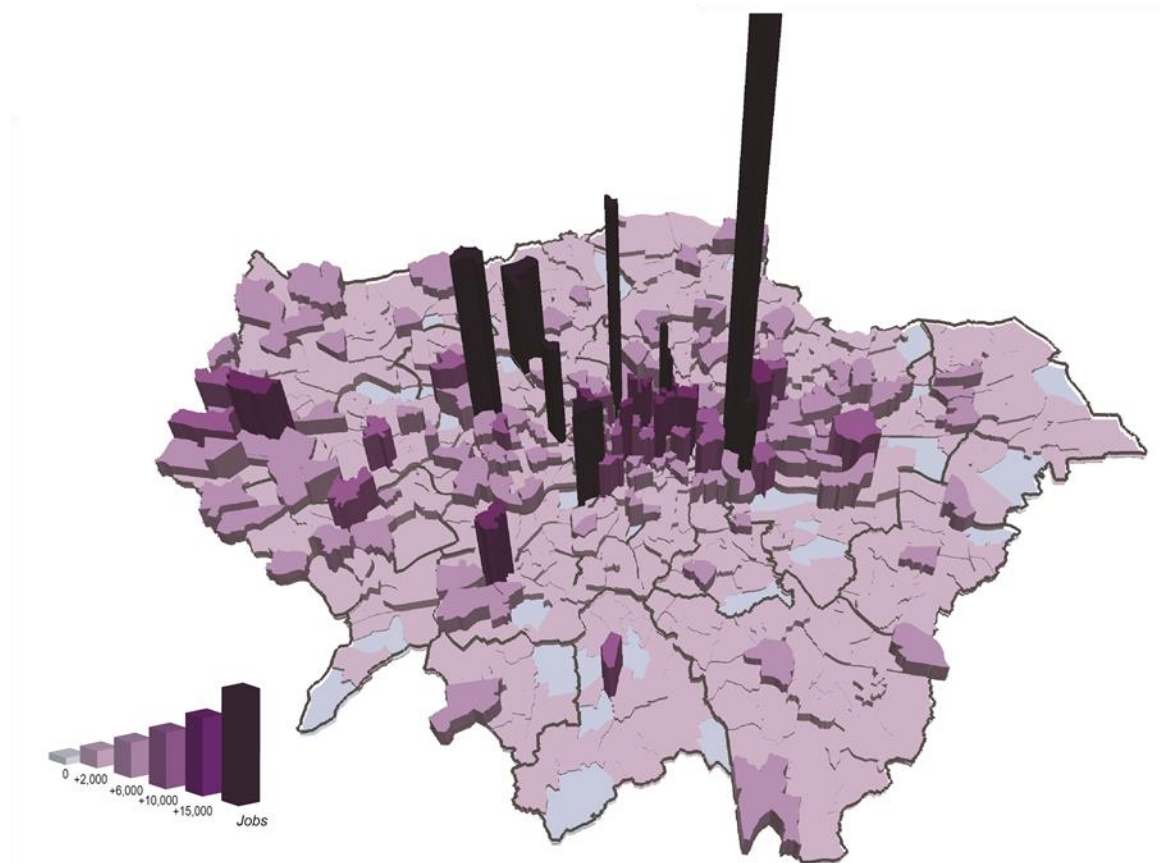
Figure 9 Map of the Central Activities Zone



Source: City Planning

Figure 10 shows the distribution of employment growth expected between 2011 and 2041. In future, agglomeration will see employment growth concentrated in the central area. 1.4 million jobs are expected in the City of London and Westminster alone. Tower Hamlets – containing Canary Wharf and the Isle of Dogs – will contain 450,000 jobs. Stratford and Old Oak also have the potential to become major hubs. This growth is expected to be driven by expansion of the office-based business services sector, as well as more jobs in retail and leisure services.

Figure 10 Spatial distribution of employment growth in London to 2041



Source: City Planning

The capital's excellent radial connectivity allows a very large number of firms and workers to be located in a small geographic area in central London. The proximity of all of these firms and workers has the effect of increasing the productivity of each through the phenomenon of economies of agglomeration. Continued employment growth will, however, place significant strain on the public transport network and in particular on rail modes.

Profile of Employment in London

London's employment profile has changed over the past 15 years. Manufacturing has been declining and jobs in professional services, health and education have been increasing. Overall there has been a loss of comparatively lower density employment and an increase in comparatively higher density employment uses. These sectoral trends are predicted to continue with manufacturing and wholesale predicted to decline by 80 per cent and 40 per cent respectively by 2041 (compared to 2011) while professional services are predicted to increase by almost 80 per cent, followed by over a 50 per cent increase of jobs in administrative/support services, information/communication and accommodation and food respectively. These jobs are more likely to be located in Central London and town centres, with workers commuting by public transport rather than by car. This is expected to have an impact on travel demand, with public transport mode shares expected to increase and the car mode share to reduce for travel to work.

Strategic Industrial Locations (SIL) are London's main reservoir of industrial land, comprising about 50 per cent of London's total supply. Demand for SIL is projected to change – 744 hectares of industrial land is projected to be released between 2011 and 2031, while demand for warehousing is projected to increase by 329 hectares.

Release of industrial land and associated intensification of employment uses may result in a change in travel patterns, with a reduction or change in commuting trips where employment land has been released or transformed into office based employment; and an increase in freight related traffic where land is converted to warehousing. Where industrial land is transformed into office based employment, a mode shift can be encouraged if the right public transport infrastructure is in place. These structural changes to industrial land are particularly expected in east and west London.

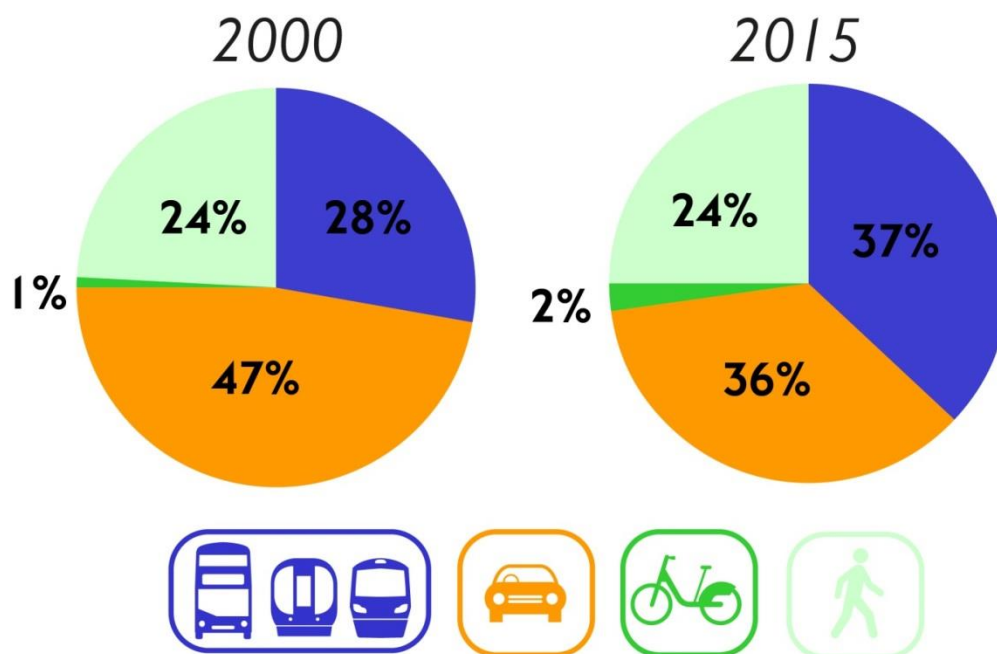
2.3 Current Travel Patterns and Trends

Trends to Date

In 2015, there were 26.7 million daily trips on London's transport network, an 18 per cent increase from 2000. Of these around 36 per cent - 9.6 million trips - were made by car, with the remainder by public transport and/or walking and cycling.

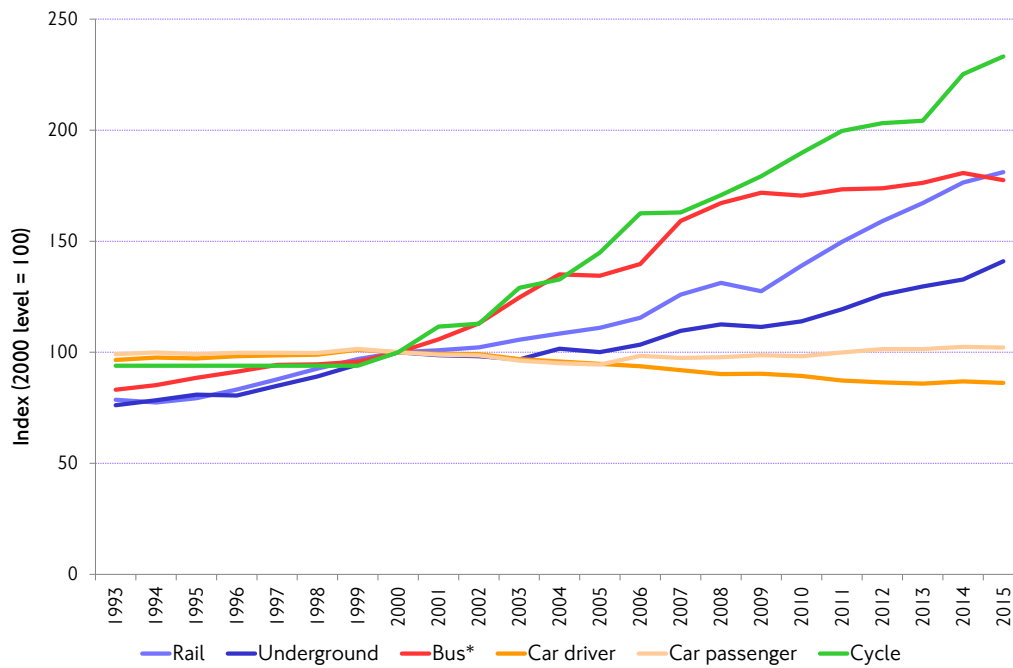
Trip rates in London have remained broadly stable for decades and so the total volume of travel has reflected the number of people living and working in the city. Notably, however, in the 1990s, population growth was not accompanied by equivalent growth in car travel, and from 2000 onwards demand for car travel began to fall. Between 2000 and 2015, the car mode share fell by 10.4 percentage points from 47 to 36 per cent, shown in Figure 11. Over the same period, particularly strong rises were seen in the use of bus, cycle and rail, as shown in Figure 12.

Figure 11 Mode share of trips in London, 2000 and 2015



Source: City Planning

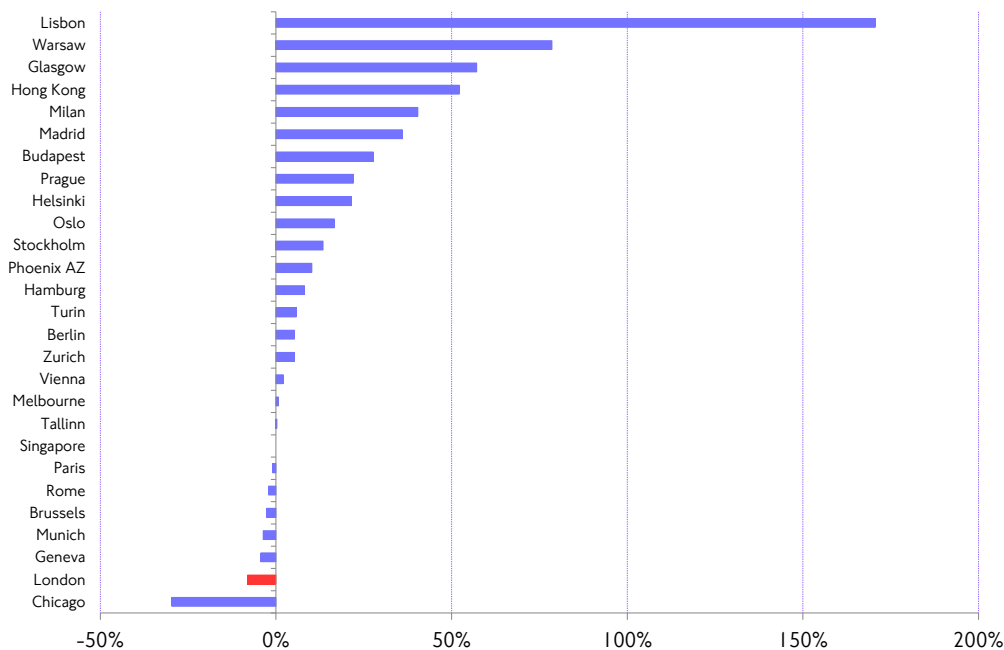
Figure 12 Trends in journey stages by mode, 1993 to 2015



Source: City Planning

Over this period, London has become one of the most sustainable major cities in terms of mode share. Whilst many other world cities have increased car use, motorisation, defined as cars per thousand inhabitants, fell in London from 334 in 1995 to 307 in 2012. Figure 13 provides a global comparison. Of the cities that participate in the UITP comparison study, London is now the least motorised developed city other than Hong Kong and Singapore.

Figure 13 Change in level of motorisation by city, 1995 to 2012



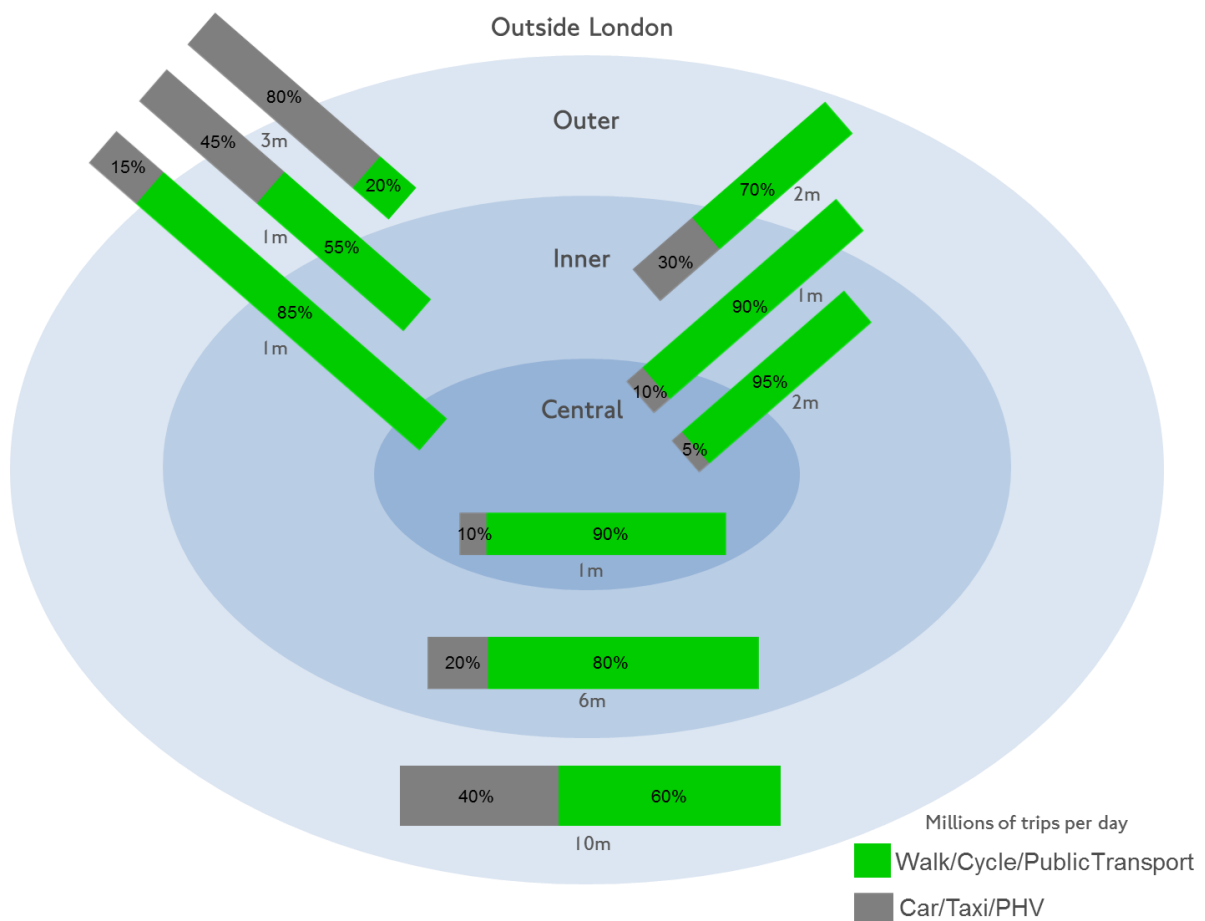
Source: City Planning

The different demographic and structural factors influencing travel choices mean that mode share varies across London. There has been a marked shift away from car travel in Inner London – down from 27 per cent in 2005/06 to 20 per cent in 2014/15. Most of this shift has been towards active travel (up five percentage points) alongside public transport (up two percentage points).

In Outer London a more complicated picture emerges. The car mode share fell by four percentage points, with a six percentage point increase in public transport mode share, a one percentage point increase in cycle mode share, but a four percentage point reduction in walk mode share.

Figure 14 shows the share of journeys by origin and destination of the trip between different regions of London. This clearly demonstrates the continuing dominance of the car for travel within outer London and between inner and outer London.

Figure 14 Mode share of trips by origin and destination, 2015



Source: City Planning

2.4 Understanding the Drivers of Demand

TfL has sought to understand why the mode shift from car to more sustainable modes has happened. Travel demand is a complicated function of many factors including: population, demographics, economy, incomes, supply of public and private transport, public and private transport network 'quality', and costs of travel in terms of both money and time. TfL's 'Drivers of Demand' study identified three categories of factors determining travel demand: supply side factors, underlying demand and structural change.

Supply Factors

The supply changes that have influenced travel trends are perhaps the best understood. The investment that has been made in the public transport network, improving both capacity and quality, has led to an increase in demand on these modes. In contrast, capacity for general traffic on London's road network has declined over the long term, making car travel less appealing again relative to public transport in terms of journey time. In addition, changes to parking policy and regulation introduced in the mid-1990s have continued to have an effect on the total quantity of parking spaces available and restrictions on their use.

The cost of travelling by both car and public transport has risen, but the increase in public transport connectivity and the quality of the journey experience by public transport meant that this has not suppressed demand for travel by bus and rail.

Underlying Demand Factors

Underlying demand factors such as London's economic output, as measured by GVA (Gross Value Added) and household incomes have also influenced travel. Income is an important factor, not only because people with higher incomes make more trips, but also because income influences individuals' choices about which modes of transport they use. The long term trend for rising incomes was disrupted by the recession, and per capita incomes in London have fallen in real terms in recent years. The influence that income may have had on the observed trends appears stronger again when Inner London and Outer London residents' incomes are disaggregated. Inner London saw real incomes increase by 18 per cent from 2003 to their peak in 2009, while in Outer London there has been no increase 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.

Structural Changes

In addition to the supply and demand influences that have been in effect, it appears there have been some structural changes in the drivers of travel demand in recent years. Changes in attitudes toward car ownership and use - perhaps partly a result of improved public transport services and the increased cost of taking up motoring - mean that London's youngest residents are now much less likely to hold a driving licence than previous generations.

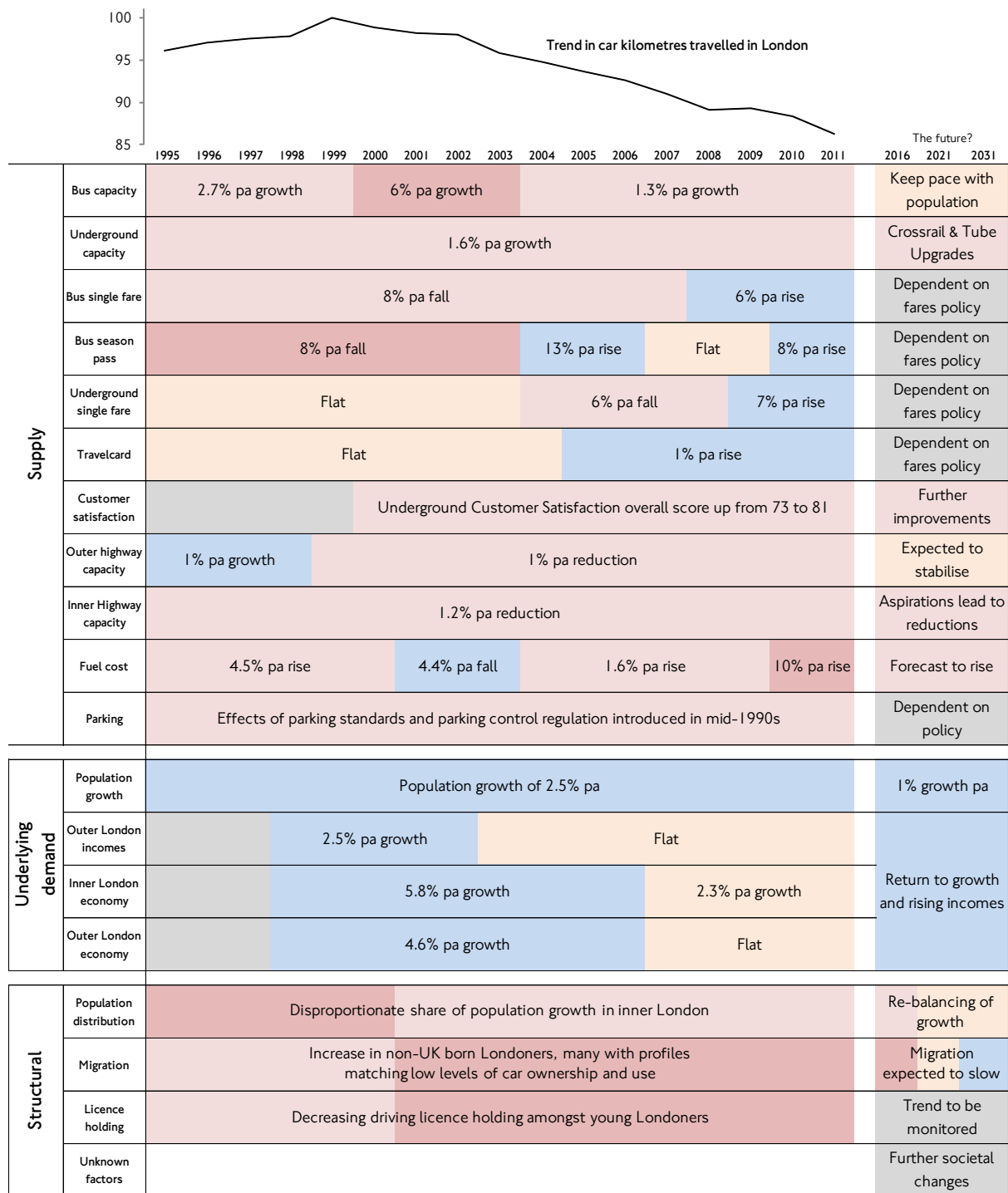
Another area of significant change has been in the types and locations of employment that take place in London, with the distinction between blue and white collar workers that was once linked to travel characteristics no longer appearing relevant. Working arrangements have also evolved, with a higher proportion of the population now working part-time – a characteristic often associated with higher rates of travel.

London has also seen continued in-migration, including from 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 increasing population without increasing car use.

A further influence on London-wide travel also relates to the Inner and Outer London distinction. Over the past 20 years, Inner and Outer London have seen roughly equal growth in population, despite the fact that Outer London is approximately four times the area of Inner London. With Inner London residents making only half the number of car trips of their Outer London counterparts – a pattern that is constant across the spectrum of income bands – the accelerating densification of Inner London relative to Outer London has also contributed to sustained mode shift toward walking, cycling and public transport.

Crucially, the Drivers of Demand study found that almost every area had seen significant changes that supported modal shift away from car travel to public transport, walking and cycling, with very few factors pushing in the opposite direction. A change or reversal in any of these factors could make continued mode shift more challenging in future. Figure 15 summarises the findings and challenge ahead.

Figure 15 Drivers of Demand



Legend				
Unknown or data break	Contributor to more car travel	Broadly neutral effect	Contributor to less car travel	Stronger trend away from car

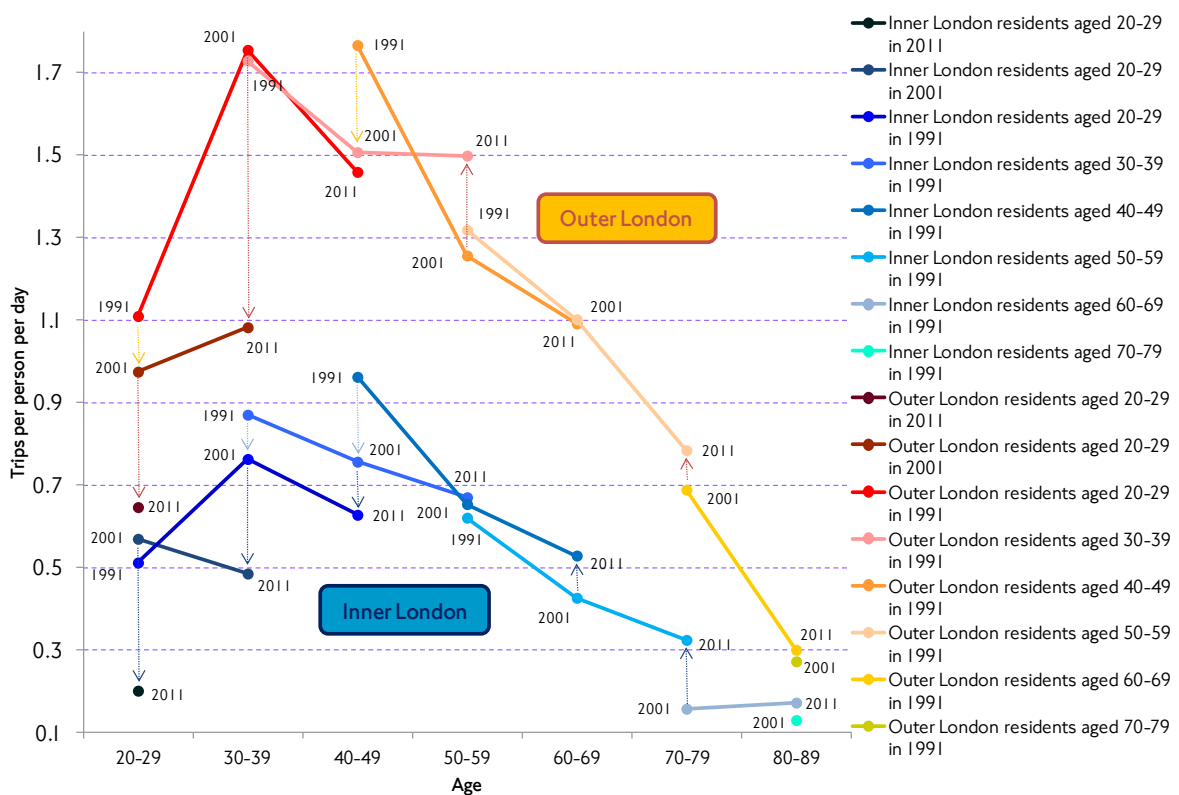
Source: City Planning

Change in travel patterns between the generations

There is evidence that younger generations are travelling differently to the generations that came before them and in particular that they are less likely to drive. While all age groups had lower car driver trips rates in 2014/15 than in 2005/06, the reductions were larger among younger age groups. Over the last 10 years car driver trip rates fell by around 25 per cent among Londoners in their 20s, with sequentially smaller reductions among each age band up to those in their 60s and 70s, who each had around a 10 per cent lower car driver trip rate in 2014/15 than in 2005/06.

Analysis of three large-scale surveys of personal travel in London, spanning the period 1991-2011, shows both the way that travel patterns change over the life cycle, and clear evidence of a ‘cohort effect’ such that as each generation moves through their lives, their car use rises, but each generation is driving less than their predecessors – shown in Figure 16. Young people in their late teens and 20s are less likely to hold a driving licence and be the main user of a car than their predecessors. Behaviour in relation to car ownership illustrates similar generational lag effects, with people currently in older age groups tending to maintain travel patterns established in their earlier working age years, while contemporary young people have by comparison a much reduced propensity to obtain the means to drive. What these (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.

Figure 16 Car driver trip rates by age and region, 1991, 2001 and 2011



Source: City Planning

2.5 Future Travel Patterns

The Mayor's Transport Strategy relies upon an understanding of what could happen in the future *without* the measures proposed in the draft strategy. TfL maintains a suite of transport demand models that predict future travel patterns. Using these models, a Reference Case has been produced to build on our understanding of current travel patterns and present possible future travel volumes, distribution and mode share. The Reference Case for 2041 represents a future demand scenario if no further action was taken beyond schemes already funded. This has formed the basis of much of the analysis identifying the challenges and opportunities facing London and its transport network over the period to 2041.

The Reference Case is based upon GLA population and employment projections, shown in Figure 17.

Figure 17 Population and employment assumptions, Reference Case

	Population (millions)		Employment (millions)	
	2015	2041	2015	2041
Central London	0.2	0.3	1.9	2.3
Inner London	3.2	3.9	1.5	1.9
Outer London	5.2	6.2	2.2	2.5
Greater London	8.7	10.5	5.6	6.8

Source: City Planning

The Reference Case assumes the delivery of a funded programme of investment from TfL and other transport providers. The major schemes included in the funded programme are:

- The opening of the Elizabeth line from 2019
- Northern line extension to Battersea and Nine Elms and upgrades of the Jubilee, Victoria, Northern and sub-surface lines
- Capacity and frequency enhancements, and electrification of the Gospel Oak to Barking line on London Overground
- Capacity and frequency enhancements on the DLR
- Delivery of HS2, the HLOS and Thameslink upgrade schemes on national rail

The modelling also includes some key assumptions determining future travel patterns. These have been derived from DfT guidance and TfL analysis of trends.

Key assumptions include:

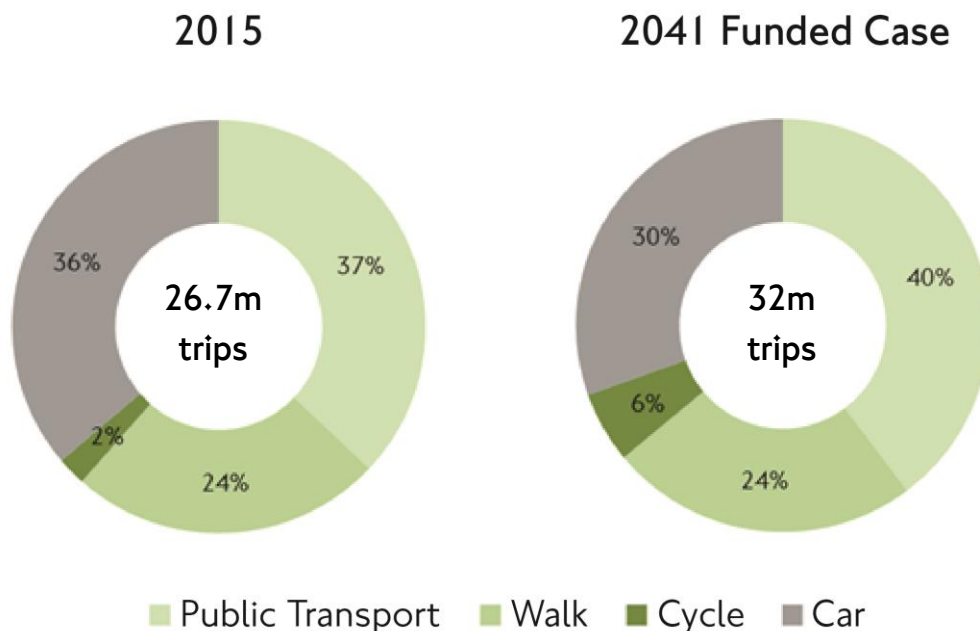
- The economy is expected to grow, so that values of time increase.
- The number of cars owned per person is expected to fall, but the population increase is so high that the total number of cars rises.
- Highway capacity for general traffic is expected to reduce in the early years due to measures to promote cycling amongst other things.
- The cost of car use is expected to fall over time, as technology improves vehicle efficiency, but parking costs are expected to increase

In the Reference Case, travel demand is expected to increase to around 32 million trips on an average day in 2041, 5 million more than today. Analysis based upon current trends and the funded programme (so, without the interventions proposed in the draft Mayor’s Transport Strategy) suggests that most of the additional travel demand will be more public transport, walking and cycling. Figure 18 shows the current trip-based mode share and the expected mode share for 2041 without the Mayor’s Transport Strategy.

Among public transport modes, rail and Underground will see the largest growth, with daytime passenger kilometres increasing by more than 50 per cent between 2015 and 2041. Bus passenger kilometres are forecast to increase by around 18 per cent.

Despite a falling car mode share, car kilometres will rise by around 8 per cent. This reflects the distribution of trips, with more car travel in outer London where trips are longer. This, coupled with a large rise in van traffic of 26 per cent, will lead to an overall rise in traffic on the network if left unchecked.

Figure 18 Trip volumes and mode shares, 2015 and 2041, Reference Case



Source: City Planning

2.6 Summary: travel patterns, trends and forecasts

London's transport network has been transformed since 2000, delivering a better experience for customers.

Since TfL was formed in 2000 and the first Mayor of London was elected, London has experienced unprecedented population growth, supported by an expanding and improving transport network. All public transport modes have seen significant increases in capacity and service quality; with innovations on the street network such as congestion charging, cycle hire and superhighways, and technological innovation from Oyster to apps.

Since 2000, there has been substantial mode shift away from the car, bucking national trends for many years.

London has grown rapidly leading to increased demand on the transport system: an average of 26.7 million trips per day were made in London in 2015, 18 per cent more than in 2000. In the period since TfL was formed in 2000, London has achieved an unprecedented shift in travel patterns, with the proportion of trips made by car falling from 47 per cent to 36 per cent and a real terms fall in car travel despite rising numbers of people travelling in the capital. London has become one of the most sustainable major cities in terms of mode share and whilst many other world cities have seen increased car use, we have achieved the reverse.

This shows that change is possible, but the recent rise in car traffic is an urgent reminder that much more needs to be done to deliver mode shift from the car.

This achievement reflected a massive commitment to improving the public transport network, delivering better connectivity, more capacity and a transformed customer experience on London's rail and bus services. Investment in cycle infrastructure has also paid off, with cycling now the fastest growing mode of travel in London. At the same time, it became less appealing to travel by car as fuel prices and insurance costs rose, congestion increased and parking became more constrained. In central London, the introduction of the Congestion Charge in 2003 reduced traffic by 15 per cent overnight.

Wider societal factors, not all of them positive or desirable, had the effect of making it more likely people would travel by sustainable modes. A disproportionate amount of the population growth took place in denser inner London, and amongst younger working-age adults, particularly non-UK born Londoners, who are less likely to use the car. Amongst the youngest group, license holding fell considerably so that today's young adults drive less than their predecessors. And although at an aggregate level the London economy was growing, incomes in outer London, where most of the car travel happens, remained stagnant from the early 2000s. In total, nearly all of the factors that influence the patterns of travel demand contributed to the rise of sustainable travel; in future, changes in any of these trends could make it more difficult to continue to reduce car use and help Londoners travel sustainably.

In future, travel patterns will be influenced by what we do, but also by factors outside our control. There is emerging evidence that car traffic is increasing, suggesting the balance of factors influencing demand may be changing.

London is bigger than it has ever been and growing rapidly with the population expected to reach 10.5m by 2041, accompanied by 6.8 million jobs.

This is equivalent to adding two double decker buses full of new residents every day. The shape of the capital is changing, with more older people - the population over 70 is growing between two and three times as fast as average - and 1.8 million people with accessibility needs will be living in London by 2041. Employment is also expected to grow, with more than a million additional jobs by 2041, concentrated in central London.

Inevitably, growth on this scale will place significant pressure on the transport network. Total travel will increase by 23 per cent, with 5 million more trips per day by 2041 than today. Analysis has been undertaken to understand how people might travel in future, based upon current trends and the existing investment programme, which includes the opening of Crossrail 1 – the Elizabeth line – and the funded London Underground upgrade programme, as well as HS2 and the delivery of the HLOS and Thameslink upgrade programmes on national rail, but excludes unfunded major projects such as Crossrail 2. This analysis suggests that mode shift from the car will continue, albeit more slowly, with the car mode share falling from 36 per cent to 30 per cent by 2041 based on the current programme. Despite the falling car mode share, traffic will continue to rise if left unchecked.

3 The health challenge

Transport plays a vital role in improving health, and particularly in helping people to be physically active – most Londoners do not do enough activity to be healthy and travelling actively is the best way to achieve this. Streets make up 80 per cent of London’s public space so improving the street environment can dramatically improve quality of life in the city. This section describes the health challenge facing London and introduces the Healthy Streets approach.

The health challenge: key findings

- The life expectancy of Londoners has been increasing but adults are living more of their lives in poor health. Adults need at least 150 minutes and children 420 minutes of physical activity a week to stay healthy and reduce their risk of common, preventable diseases.
- At present, most Londoners do not do enough activity to be healthy and travelling actively is the best way to achieve this.
- Currently, a third of Londoners achieve their recommended level of physical activity from active travel alone. This has remained stable for the past seven years.
- If all Londoners walked or cycled for 20 minutes a day, this would save £1.7bn in NHS treatment costs over 25 years.
- Healthy Streets are safe, inclusive and encourage activity but London’s streets fall short of expectations. TfL and the GLA have identified ten Healthy Streets Indicators necessary to create a safe, inclusive space where people will choose to walk and cycle.
- Currently, London’s streets fall short of the expectations of those using them and this could worsen as the city gets busier.

3.1 The health challenge

Transport plays a vital role in improving health, and particularly in helping people to be physically active. A variety of factors mean that London's population is gradually becoming or likely to become older, fatter, sicker and less mobile. The life expectancy of Londoners has been increasing but adults are living more of their lives in poor health. Six in ten adults and four in ten children (measured at age 11) are overweight or obese.

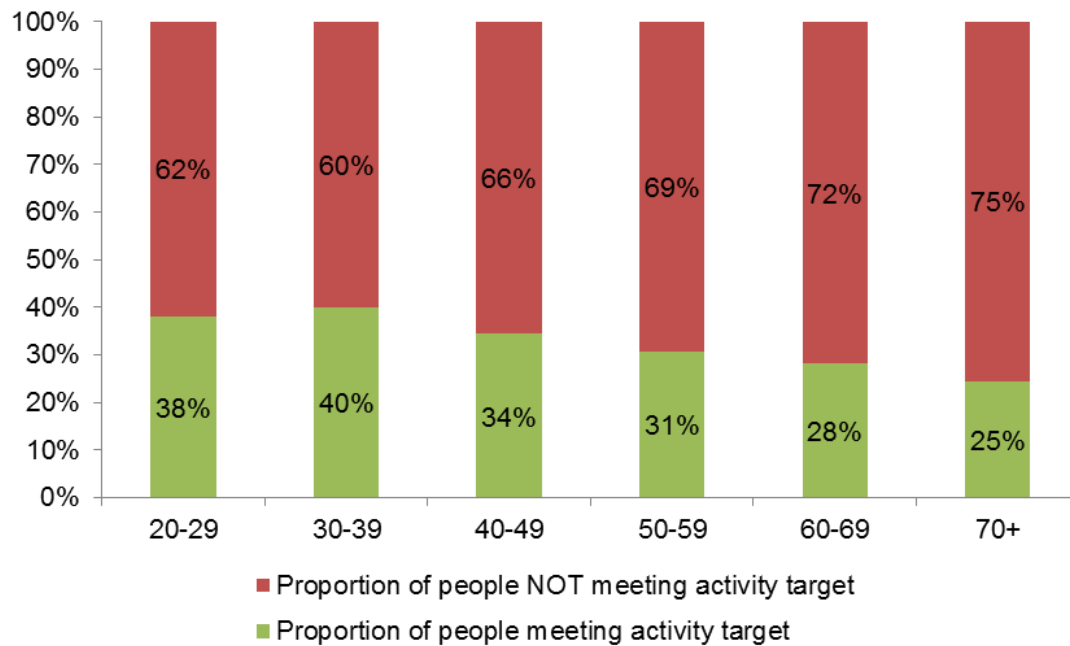
Under the GLA Act 2000, TfL has a responsibility to consider the impact of its policies on health and health inequalities and a new EU directive provides an additional requirement for TfL to specifically assess impacts on population and human health. In 2012, the Health and Social Care Act transferred responsibility for public health from the NHS to local government meaning that local authorities now have a statutory responsibility to use their powers and resources across all sectors to improve the health of their population. TfL has a significant role in supporting and enabling London boroughs to meet their statutory public health responsibilities.

The challenges that the Healthy Streets approach addresses are set out in the TfL report 'Improving the health of Londoners - Transport Action Plan'.

Adults need at least 150 minutes and children 420 minutes of physical activity a week to stay healthy and reduce their risk of common, preventable diseases. Walking or cycling is one of the best ways to stay active and healthy as it provides regular physical activity integrated into people's daily routines, particularly for groups who may struggle with more vigorous activity, but can manage to walk a journey.

At present, a third of Londoners achieve their recommended level of physical activity through active travel alone (as shown in Figure 19), with younger adults and non-car owners more likely to do so than older adults. If someone reports that they did two periods of ten minutes of active travel on the previous day through the London Travel Demand Survey we can be confident that they are sufficiently active. Currently, 34 per cent of Londoners report having done two periods of ten minutes of active travel on the previous day. This has remained constant over the last seven years.

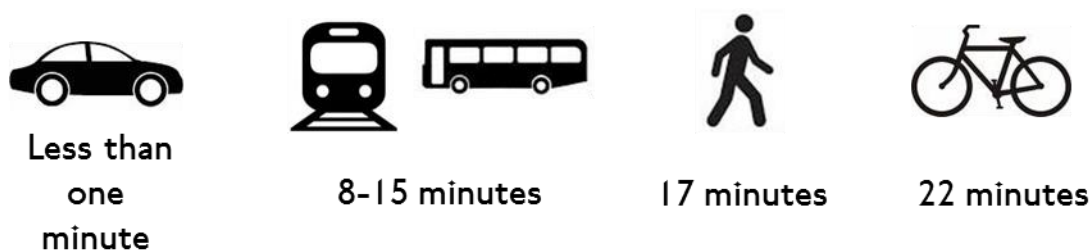
Figure 19 Proportion of adults doing 2 x 10 minute periods of walking or cycling per day by age, London residents 2014/15



Source: London Travel Demand Survey 2014/15 (TfL)

As well as making end-to-end journeys on foot or by bike, London residents can be more active by using public transport instead of the car. Travelling by public transport typically involves significantly more physical activity than travelling by car, due to the need to walk to and from the station or stop – most public transport trips include two or more walk ‘stages’ to complete the journey. As a result, recent research found that walk, cycle and public transport commuters had a lower BMI than those who commuted by car. Figure 20 shows the amount of time spent active as part of an average journey by mode.

Figure 20 Amount of time spent active on an average journey by mode



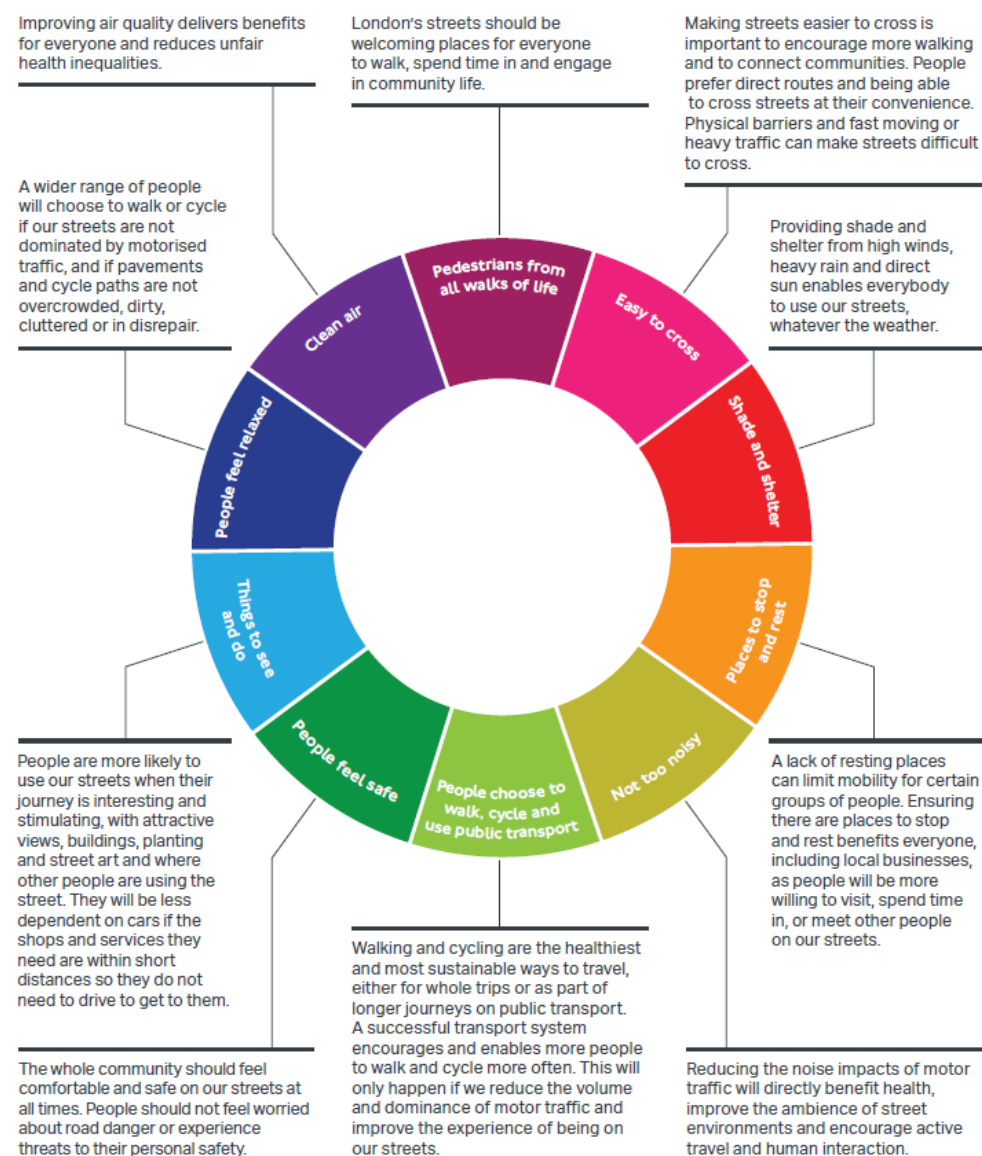
Source: London Travel Demand Survey 2012/13 – 2013/14 (TfL)

If all Londoners walked or cycled for 20 minutes a day, this would save £1.75bn in NHS treatment costs over 25 years. In total, over two million more adults in London need to travel actively than do so today in order to deliver these health benefits. 60 per cent of those who need to be more active are under 50 years old.

3.2 Healthy Streets

The biggest benefits of transport on health in London are enabling people to interact with other people and be physically active as part of their daily routine. The biggest health harms of transport in London are road danger, noise and air pollution. The ten Healthy Streets Indicators are the essential ingredients required to address these health priorities, shown in Figure 21. Street environments which are safe and inclusive spaces in which everyone chooses to walk, cycle, access public transport and spend time improve health, reduce inequalities and make the city a better place to live, work and visit. Figure 22 outlines how the ten Healthy Streets indicators influence wellbeing, health inequalities and active travel.

Figure 21 Ten Healthy Street Indicators



Source: Lucy Saunders

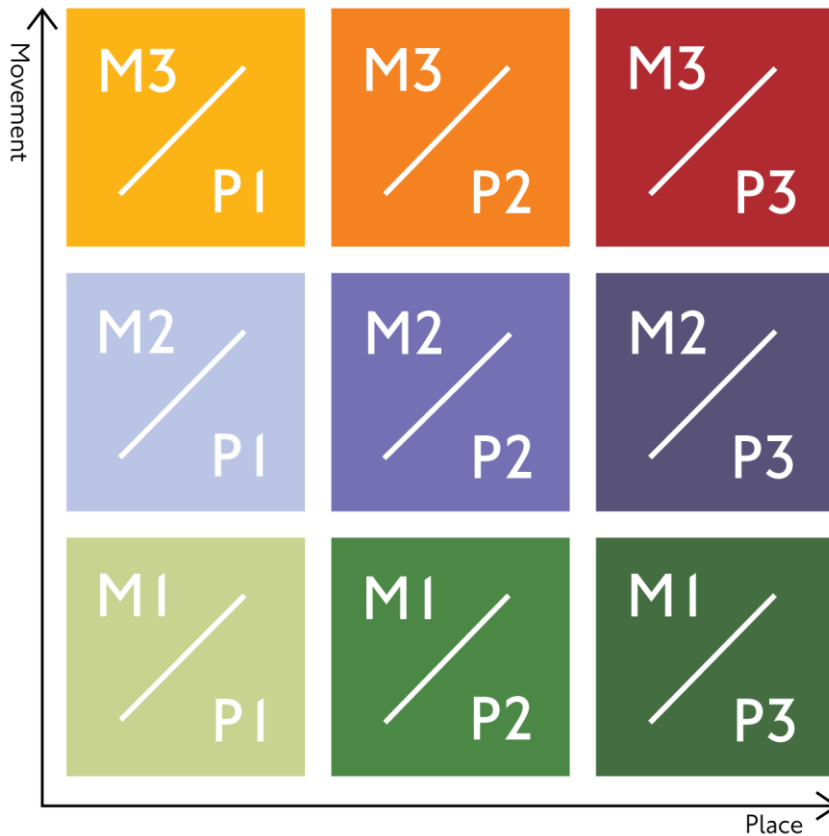
Source: Mayor's Transport Strategy – Draft for Consultation (2017)

Figure 22 Influence of the 10 Healthy Streets Indicators on health, health inequalities and active travel

Indicator	Influence on health and wellbeing	Influence on health inequalities	Influence on active travel
People choose to walk, cycle and use public transport	Active travel enables Londoners to achieve the recommended physical activity levels to stay healthy.	Car owners, older people and children are less likely to travel actively enough to get the activity they need to stay healthy.	Active travel is cheap, accessible and sustainable. People are more likely to walk and cycle when they see others doing so.
Pedestrians from all walks of life	Walking can provide opportunities for social interaction. People with weak social and community ties have worse health outcomes.	Environments that aren't inclusive to all create inequalities in activity levels and social interaction.	Environments that are safe and inviting for journeys made on foot or by bike will encourage people to be active.
Easy to cross	Physical barriers or heavy traffic can make streets difficult to cross. This can disrupt social networks and lead to social isolation.	Severance is more likely to affect people living in deprived areas, disabled people and their carers, children and older people.	People prefer direct routes. Streets with fewer crossings and more, faster traffic are associated with less active travel.
Not too noisy	Noise pollution influences sleep, stress, anxiety, blood pressure and mental health and affects memory and concentration.	Socially disadvantaged people are more likely to live in noisy environments near busy roads.	It is more pleasant to walk or cycle where noise levels are low. People avoid noisy streets for walking or social use.
Clean air	Exposure to small particles causes cancers, cardiovascular and respiratory disease and contributes to premature deaths.	Most affects those who live, learn or work near busy roads; or are more vulnerable because of their age or existing medical conditions.	People with respiratory conditions must stay indoors and limit activity when pollution is high.
Shade and shelter	Shade helps to protect people from sun damage. Heat can trigger exhaustion, confusion and heart attacks.	Older people are particularly vulnerable to excess heat, as are people with heart, respiratory and other serious health problems.	Temperature and rain influence active travel rates therefore shade and shelter can encourage active travel.
People feel safe	Fear of injury and antisocial behaviour can be stressful and prevent people from walking and cycling.	Women, older people, and residents of deprived areas are more likely to feel unsafe.	Cyclist and pedestrians make up over half of all casualties on London's streets. Safety concerns limit active travel.
Things to see and do	People are more likely to travel actively when there are things to do locally. Long distances to everyday services increases isolation.	People who live in low density, car oriented environments travel less actively and tend to spend more on travel.	People prefer to be physically active in places they find appealing, with local destinations to go to and things to do.
People feel relaxed	The physical environment, noise and air pollution, and safety concerns all contribute to stress.	Busy roads are intimidating and stressful to pedestrians, particularly children, disabled and older people.	People are more likely to walk or cycle in areas where they feel relaxed and which have pleasant and scenic elements.
Places to stop and rest	Lack of resting places can influence and limit mobility for certain groups of people, leading to loneliness and social isolation.	Older people, people with injuries and mobility impairments and those accompanying young children, all rely on places to stop and rest.	People are more willing to visit, spend time in, or meet other people in areas where there are places to stop and rest.

Of course, not all streets are the same. Streets have different layouts and vary in terms of the type and volume of traffic they carry and why people go there. The challenge is to balance the many different demands of London's streets, reflecting both their movement and place functions. Based on the idea that streets serve movement and place functions to differing degrees, nine 'street types' have been identified, shown in Figure 23 below.

Figure 23 Classification of streets by function



Source: The Vision for London's Streets and Roads (Roads Task Force, 2013)

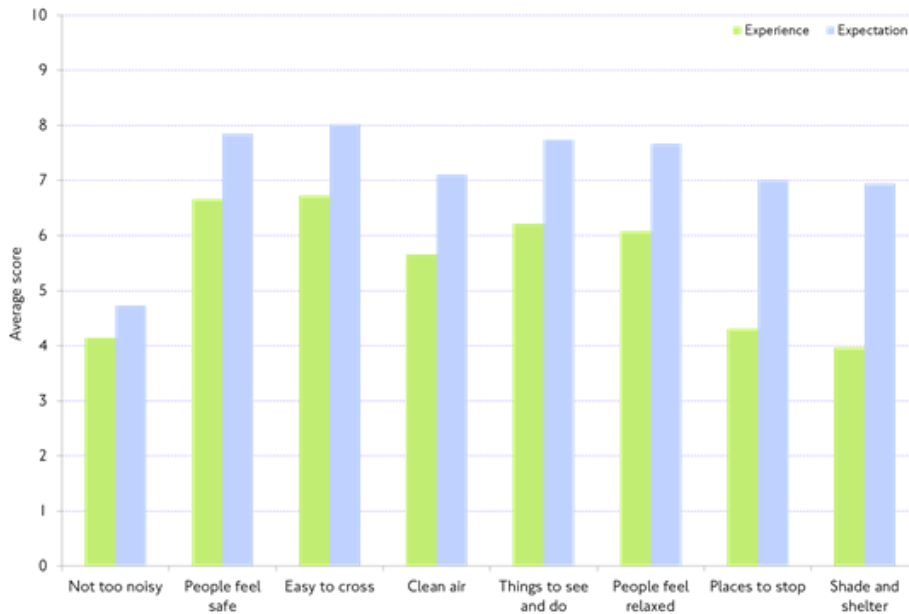
Research has explored how the different street types were performing from the perspective of people walking - do people's perceptions of the street environment change depending on what type of street they are on? How do their expectations compare with their experience? This research found that London's streets consistently perform below expectations across all measures, as shown in Figure 24. The survey was conducted on 80 streets in central, inner and outer London, representing all of the Street Types as defined by Street Types for London.

Respondents were asked to score 8 of the 10 Healthy Streets Indicators from 0 to 10 (10 is best) in terms of their expectation and experience. The two top level Indicators (Pedestrians from all walk of life & People choose to walk and cycle) cannot be assessed by this methodology and so the assessment was based on pedestrian counts and mode share data.

The research found significant differences between expectations and experiences for all streets. On average, pedestrians expected a better environment on streets that were considered to have a high 'place' function and lower 'movement' function

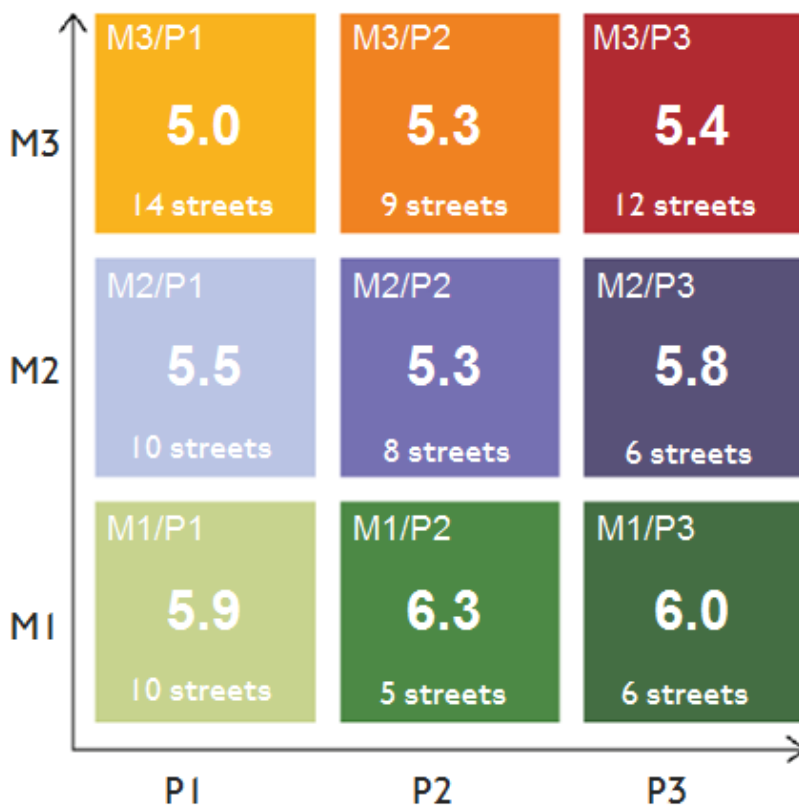
(respondents were not told the TfL categorisation of the street), suggesting that people adapt their expectations to the situation and that the street types have real world relevance to Londoners. The results by street type are shown in Figure 25.

Figure 24 Performance of streets against the Healthy Streets Indicators



Source: Travel in London report 7 (TfL 2014)

Figure 25 Average Healthy Streets Scores and Street Types



Source: City Planning

3.3 Summary: the health challenge

The life expectancy of Londoners has been increasing but adults are living more of their lives in poor health. Most Londoners do not do enough activity to be healthy and travelling actively is the best way to achieve this.

Transport plays a vital role in improving health, and particularly in helping people to be physically active – adults need at least 150 minutes and children 420 minutes of physical activity a week to stay healthy and reduce their risk of common, preventable diseases.

Walking or cycling is one of the best ways to stay active and healthy as it provides regular physical activity integrated into people's daily routines, particularly for groups who may struggle with more vigorous activity, but can manage to walk a journey. Currently, a third of Londoners achieve their recommended level of physical activity from active travel alone. If everyone in London walked or cycled for 20 minutes each day - including travel to and from public transport stations and stops - this could save £1.7bn in NHS treatment costs over 25 years.

Healthy Streets are safe, inclusive and encourage activity but London's streets fall short of expectations.

Streets make up 80 per cent of London's public space so improving the street environment can dramatically improve quality of life in the city. TfL and the GLA have identified ten indicators of a Healthy Street necessary to create a safe, inclusive space where people will choose to walk and cycle and spend time. Research shows that London's streets fall short of the expectations of those using them. As the city gets busier, the street experience could worsen.

4 Healthy Streets and healthy people

In response to the call to action presented by the health challenge, this section describes the wide ranging challenges in delivering Healthy Streets and healthy people, including improving the street environment and helping people travel more actively, reducing road danger, tackling traffic and congestion and, at the heart of delivering each of these challenges, achieving mode shift from the car to more sustainable modes of transport.

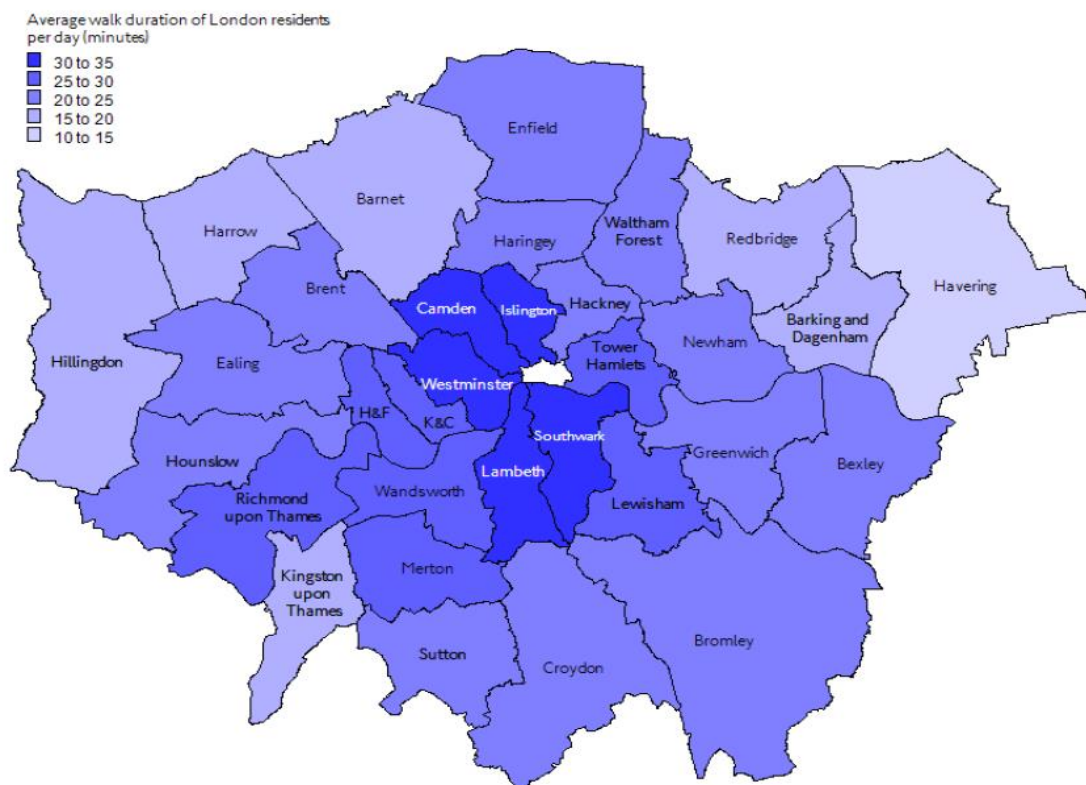
Healthy Streets and healthy people: key findings

- Walking accounts for 30 per cent of all trips made by Londoners. As mode shift continues from car to public transport, more walk travel will be generated, with 38 million walk journey stages on an average day by 2041. There is considerable potential for people to walk more, with 3.6 million journeys made by motorised modes every day that could be walked all or part of the way. Over 60 per cent of these are in outer London.
- Cycling is now a major transport mode in London, with 670 thousand cycle journeys made each day. There is enormous potential to grow cycling further - 8.2 million trips are currently made by a motorised mode that could feasibly be cycled, with a further 1.6 million that could be cycled part of the way. Realising this potential means convincing non-cyclists that cycling is a safe and convenient option and investing in infrastructure to support this.
- The number of people killed or seriously injured on London's roads in 2016 was the lowest on record. However, the proportion of KSIs made up of vulnerable road users has risen and more than 2,000 people were killed or seriously injured on London's roads in 2015.
- Reducing transport crime and further improving confidence to travel will be challenging in the context of global insecurity, the threat of terrorist attacks on the road and transport system, financial constraints, a growing population and the impact of overcrowding on passenger behaviour, along with the changing risk and nature of crime.
- Congestion causes stress and frustration, delays bus passengers and imposes costs on businesses. As traffic volumes rise - particularly due to increasing van travel - and network capacity falls, congestion is expected to rise so that by 2041 the average Londoner will lose two and half days a year in traffic. In central London, congestion has returned to levels not seen since the introduction of the Congestion Charge in 2003.
- Freight activity in London has been increasing, with a 20 per cent increase in LGV vehicle kilometres by 2014, compared with 1994-1999. This growth is expected to continue, especially considering trends in ecommerce, an increase in just-in-time deliveries, and lengthening supply chains.
- Car ownership is linked to inactivity – 70 per cent of people without a car do some active travel in a day, compared to 40-50 per cent with a car. There is potential to deliver substantial mode shift from the car across London, but this would require changing the relative appeal of the car compared to other modes in terms of cost, convenience and attractiveness

4.1 Walking

Walking is a near universal mode of transport, with very few Londoners saying that they never walk to make a trip. Younger people are more likely to walk than middle aged and older people, and the average distance walked per journey reduces with age. Women walk more than men, and inner London residents walk more than outer Londoners (shown in Figure 26), with residents of central London boroughs walking the most of all. Walking is the most commonly used mode of travel for trips to the shops, and for trips to and from school.

Figure 26 Amount of time spent walking on an average day, by borough of residence, London residents 2013/14



Source: Travel in London report 7 (TfL 2014)

Walking accounts for 30 per cent of all trips made by Londoners and two thirds of trips under a mile. Furthermore, people walk as part of trips made by other modes. There are more than four times as many walk stages as walk trips made by Londoners every day – 30 million walk stages, including 13 million longer than five minutes. People walk further to access rail modes than to catch a bus, whilst most car trips involve very little walking at all.

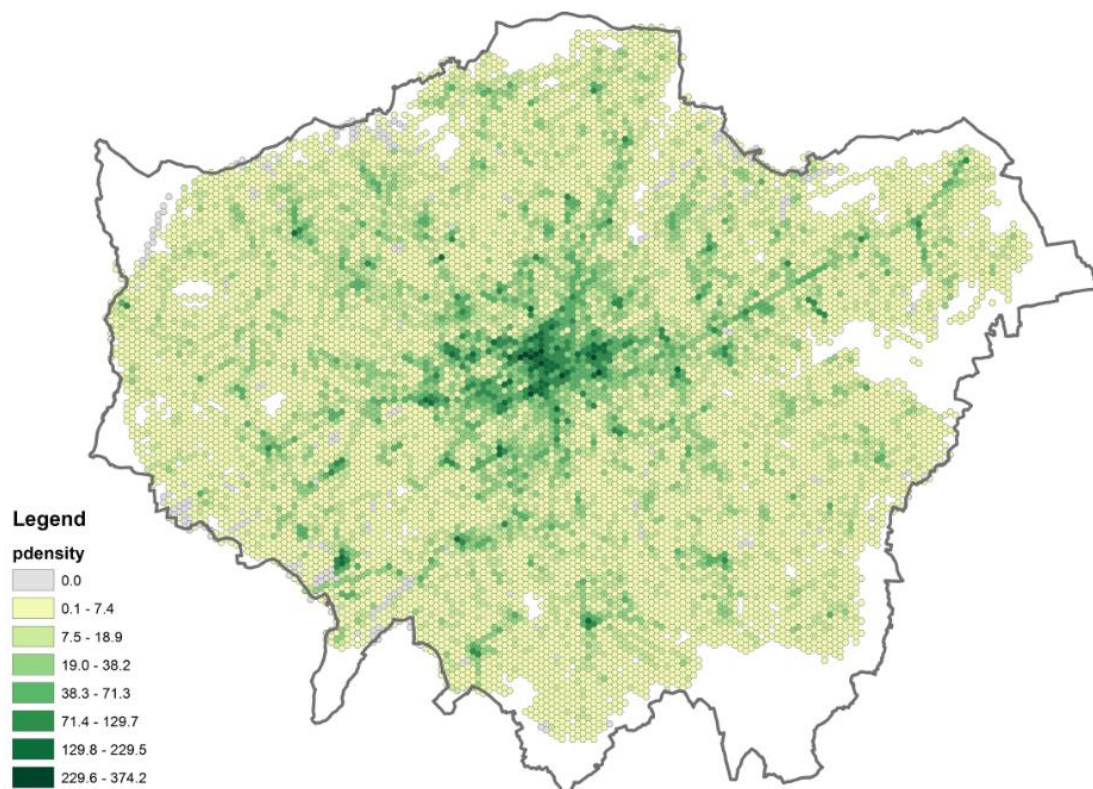
Over the past decade, the proportion of trips made on foot has stayed the same but walking as part of a trip by another mode has increased at a faster rate, reflecting mode shift from car to public transport. This trend is likely to continue in future. The reference case forecast, if no further action is taken, is that eight million walk-all-the-way trips and 38 million walk journey ‘stages’ will be made on average day in 2041.

The experience of walking in London

Most Londoners are highly positive about walking, considering it enjoyable, interesting and a good way to get fit (around 90 per cent of respondents to TfL's Attitudes to Walking survey agreed with each statement in 2016). Three quarters believe that London is "a city for walking". But Londoners also tell us that traffic fumes and heavy traffic make people dislike walking in London (66 and 57 per cent respectively).

The demand for high quality streets and public spaces that support physical, social and economic activity will increase as London's population grows and changes. However, at the same time, the competition for time and space, including space to 'dwell', will intensify as the population and economy grow. Many streets in Central and Inner London already suffer from pedestrian overcrowding and low levels of pedestrian comfort. Particular challenges arise at major rail termini and on busy high streets on the strategic road network, where the needs of pedestrians conflict with the movement requirements of other modes. Figure 27 shows where pedestrian activity is most dense – with high pedestrian densities found in central London and town centres across the city.

Figure 27 Density of pedestrian activity in London



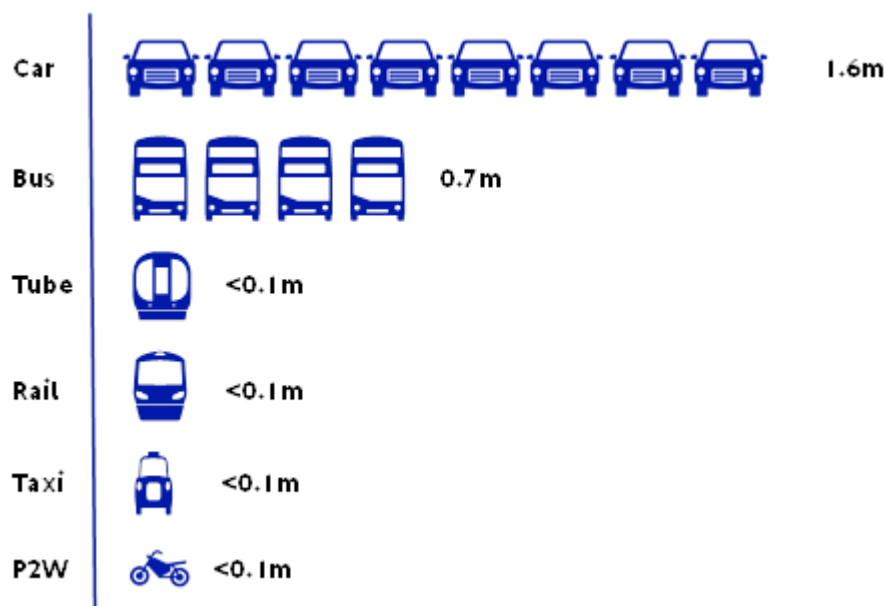
Source: City Planning

The potential for people to walk more

In total, there are 3.6 million journeys made every day by a motorised mode that could be walked all or part of the way. These trips are mostly made by car or bus, and most take place in outer London (62 per cent). Figure 28 shows trips that could feasibly be walked, by the current mode of travel used. Characteristics of potentially walkable trips are:

- More than half of all potentially walkable trips are for shopping and leisure purposes.
- There are nearly a million journeys that would take less than 10 minutes for most people to walk – most of which are made by car.
- There is potential for more walking at all times of day, with the greatest number of potentially walkable trips occurring between 8am and 9am and 3pm and 4pm (in line with the profile of existing walk trips)
- The potential for walking is greater among women. Around 1.4 million potentially walkable trips (58 per cent) are currently made by women, compared to just over one million walkable trips for men. This difference is most pronounced for those aged 25-54. By mode, potentially walkable trips made by men are slightly more likely to be car driver trips, with women more likely to be travelling by bus or as a car passenger
- All groups could be walking more. The profile of both potentially walkable trips and overall Londoners' travel is broadly similar with regard to ethnicity, age, household income and disability

Figure 28 Trips that could feasibly be walked all the way, by current mode of travel, London residents 2012/13 – 2014/15















Source: Analysis of Walking Potential (TfL 2017)

In contrast, journeys where part (but not all) of the trip could be walked are more likely to be in central or inner London (61 per cent) and more likely to be made by public transport. Figure 29 shows trips that could feasibly be walked part of the way, by the mode currently being used instead and by the main mode of the trip.

A comparison of the demographic profile of potentially walkable trips and potentially walkable stages shows notable differences:

- Trips that could potentially be walked part of the way are more geographically concentrated, with 67 per cent to or from one of London’s town centres, compared to just 30 per cent of trips that could be walked all the way.
- While trips that could be walked all the way are more likely to be made by women, trips that could be walked part of the way are more likely to be made by men.
- People aged 17-44 are more likely to be making trips that could be walked part of the way – around 65 per cent of the total, compared to only 40 per cent of walkable trips.
- People in higher income households are more likely to make trips that could be walked part of the way.
- Trips that could be walked part of the way are more prevalent at peak times (8-9am and 4-7pm).

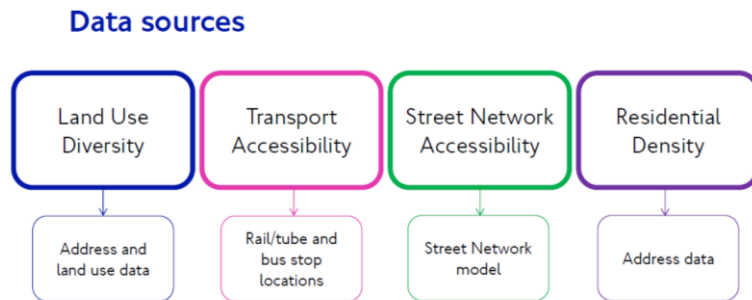
Figure 29 Journeys that could feasibly be walked part of the way, by current mode of travel used for walkable journey stage and main mode of the trip, London residents 2012/13 – 2014/15

Mode of walkable stage	Main mode of trip	Number of walkable stages
		330,000
		250,000
		230,000
		160,000
		100,000
		40,000

Source: Analysis of Walking Potential (TfL 2017)

Analysis was conducted by Dr Ashley Dhanani at University College London of London’s street network to assess how walkable the network is. Walkability is a technical measure that takes into account the availability of the network and the density of origins and destinations – the measures included are shown in Figure 30. It does not tell us how much walking is currently taking place in that location, or how pleasant it is to walk there.

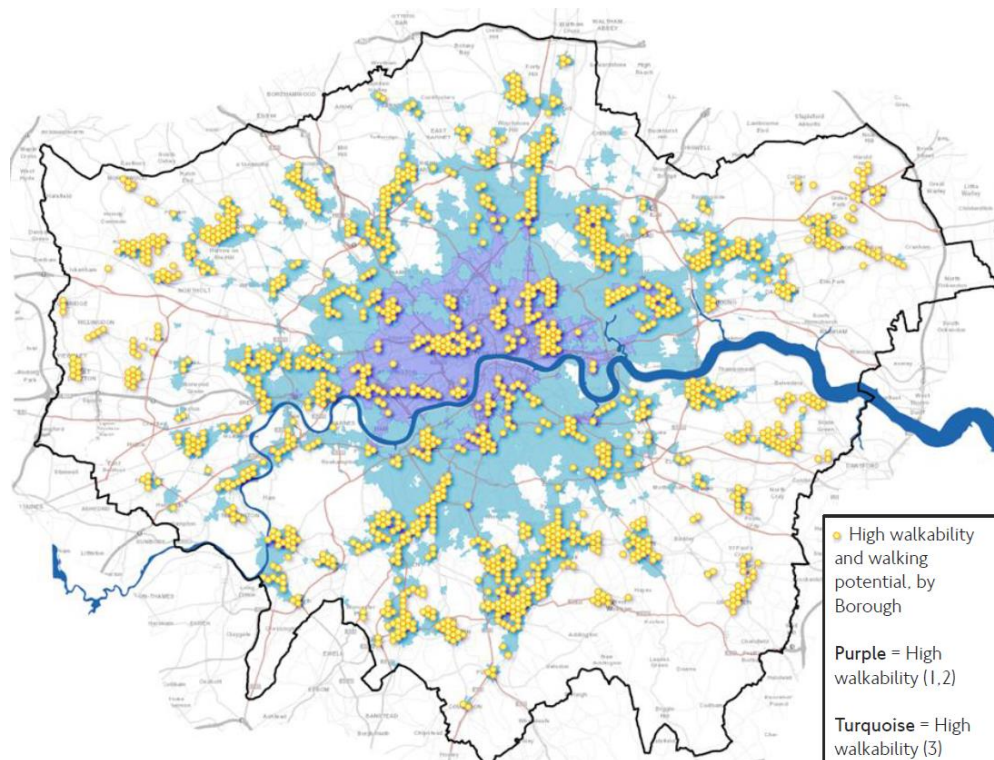
Figure 30 Measures of walkability



Source: TfL Walking team and Dr Ashley Dhanani

Combining walkability data with trips that could potentially be walked identifies suitable locations to focus the effort to increase walking, shown in yellow in Figure 31. These are the quick wins – places where the improvements required will be at the street rather than the network level, and are often in town centres. One of the challenges is that growing walking will require structural changes too – delivered through planning, regeneration and expansion of the public transport network

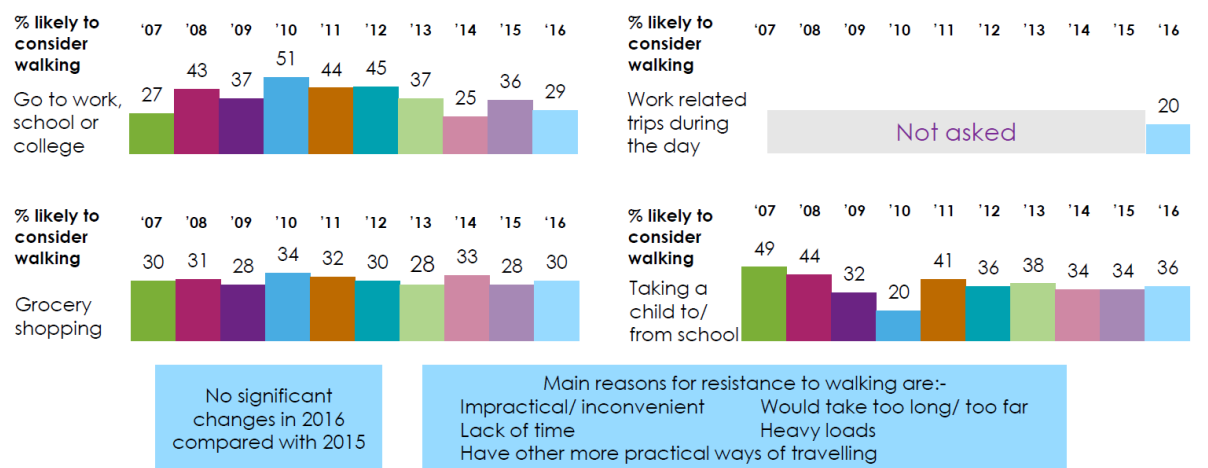
Figure 31 Walkability of London’s street network combined with trips that could potentially be walked but aren’t at present, by origin



Source: TfL Analysis of Walking Potential (2017)

TfL's Attitudes to Walking Survey revealed that many Londoners are open to changing their travel behaviour. A third of those who don't currently walk short distance would consider walking the school run or when grocery shopping (see Figure 32).

Figure 32 Proportion of Londoners who would be likely to consider walking, by type of journey, 2007 - 2016



* Caution: small bases (under 50) for taking a child to/ from school

Source: Attitudes to Walking Survey (TfL 2016)

However, we know that whilst over time around a third of London residents have consistently said that they would be willing to consider walking more, the share of trips made on foot has remained highly stable over a very long period of time. This is partly because of the natural 'churn' in travel behaviour – so that a stable headline figure can be made up of masses of people changing their behaviour, with some walking more and others walking less. But it is also because it is difficult to translate good intentions into sustained change and some Londoners, particularly regular car drivers are resistant to walking – three in ten say they do not see why they should consider walking journeys that take more than 15 minutes on foot. Two thirds of trips that could feasibly be walked but aren't at present are made by people less likely than average to increase their walk travel. London residents tell us that the main barriers to walking are convenience, time, distance, the need to carry things, and having other, more practical ways of travelling.

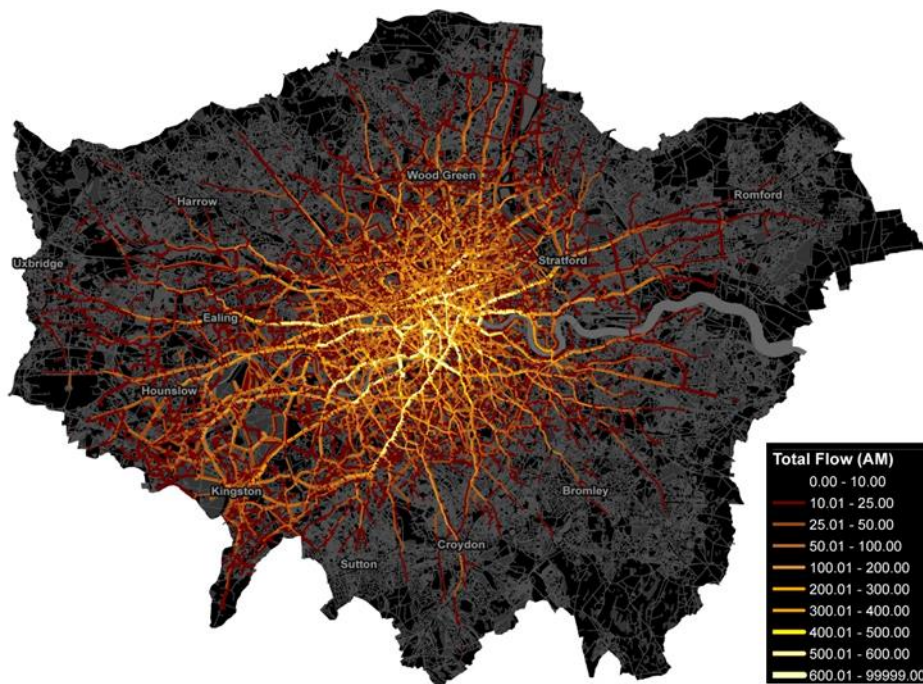
Together, these findings suggest that people could be encouraged to walk more by an improved walking environment, and by better information about walking routes, distances and times. People are often unaware of the route or likely time it would take to walk a familiar journey they make by another mode. When people choose how to travel, they take into account the relative cost, time and convenience of the alternatives available to them. Improving the appeal of walking, by providing a safer and more pleasant environment will encourage people to walk. Nevertheless, they will continue to be deterred from walking if the alternatives are (or are perceived to be) more convenient, cheap and quick. Every day, many journeys are driven that could easily be walked. Whilst the car remains a cheap and convenient mode of travel, we can expect this to continue: encouraging people to be more active means discouraging them to travel by car.

4.2 Cycling

Cycling is now a major mode of transport in London, with 670,000 journeys made each day by bike in 2015 equating to 10 per cent of bus passenger journeys, almost a fifth of Tube passenger journeys or 100 per cent of all journeys on the District Line. This is the result of sustained investment by TfL working jointly with the London boroughs to create cycle route networks, improve access to cycles, and provide cycle parking facilities and training for cyclists, as well as a wide range of initiatives to make cycling safer.

In particular, there has been substantial growth in the number of people choosing to cycle in order to access Central London, with flows across the cordon surrounding central London increasing by more than 200 per cent since 2001. Cycle trips made by London residents in inner London have risen by 133 per cent since 2005/06 (based on trip origin). Cycling has grown the least in outer London, but the region has the most potential for growth in terms of trip volumes - only 6 per cent of trips that could be cycled are currently cycled. Figure 33 shows current cycle flows by route in the morning peak hour, showing the extent to which cycling is concentrated in central and inner London and in the south west of London.

Figure 33 Cycle flows, morning peak hour, 2014

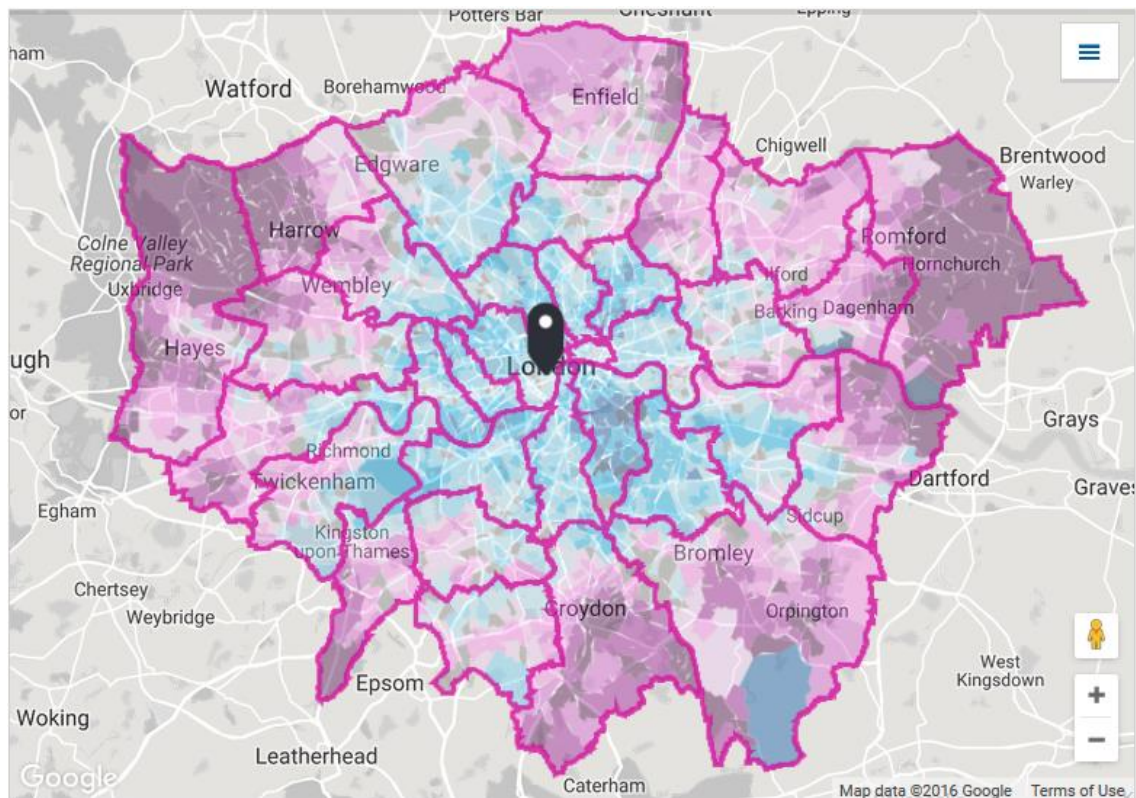


Source: City Planning

The experience of cycling in London

Cycling is an efficient way to travel in London. Figure 34 compares the travel time by cycle and public transport to central London. This shows that more than half the working age population in London would find it quicker to cycle than travel by public transport. This is recognised by Londoners – 83 per cent say that cycling is a convenient way to get around.

Figure 34 Comparison of journey times by cycle and public transport



Source: City Planning

People enjoy cycling and cite multiple benefits of cycling. 77 per cent of Londoners believe that cycling is enjoyable and people continue to cycle in London because it is fun, quick, convenient, cheap and a good way to keep fit.

However, London cyclists often feel that the experience of cycling could and should be better. Just 54 per cent of people who cycle regularly said they were satisfied with their journey experience on London's streets in 2016. These people were particularly concerned about the impact of heavy traffic and congestion on their journey, and by the lack of consideration shown to them by other road users. In particular, TfL's Attitudes to Cycling Survey in Autumn 2016 found that 15 per cent of people who cycle regularly in London feel unsafe cycling on quiet roads and 62 per cent feel unsafe cycling on busy roads – rising to 82 per cent of those who only cycle occasionally. One in six cyclists did not feel safe from crime and antisocial behaviour whilst cycling in London in the daytime, rising to 45 per cent at night. More than one in ten had experienced bike theft in the past two years.

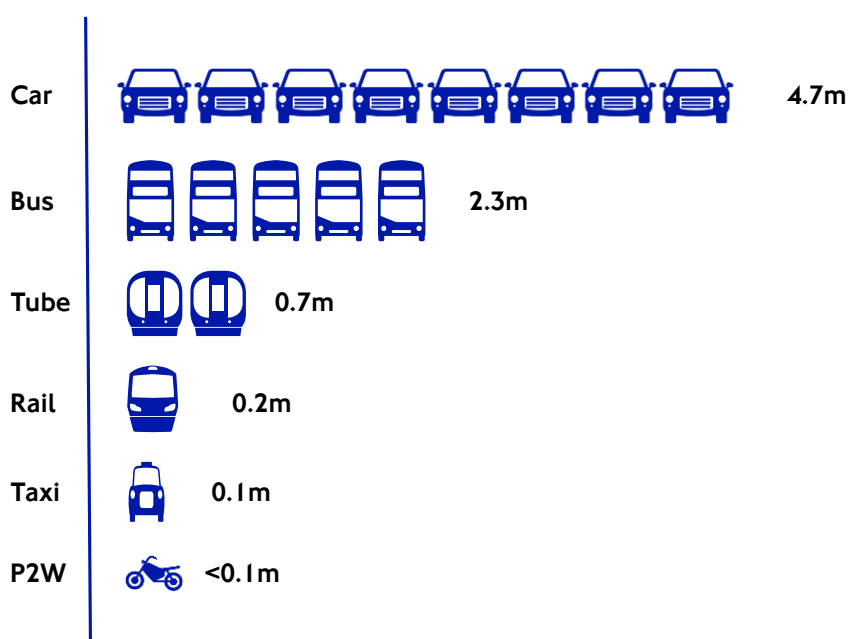
The potential for people to cycle more

There remains enormous potential to grow cycling further to 2041. New analysis suggests that 8.2 million trips currently made by a motorised mode could feasibly be cycled all the way, and a further 1.6 million trips could be cycled part of the way. More than half of trips that could be cycled all the way are currently made by car (shown in Figure 35) whilst the parts of journeys that could feasibly be cycled are mostly made by public transport (shown in Figure 36). Characteristics of trips that could potentially be cycled are:

- Almost half of all potentially cyclable trips are made for shopping and leisure purposes, one in six made for each of commuting and education.
- 6.5 million trips currently made by a motorised mode would take less than 20 minutes for most people to cycle.
- There is considerable overlap between trips that could feasibly be walked or cycled: 2.4 million trips could feasibly be made by either mode.
- The potential for cycling is greater among women. Just over 4.5 million potentially cyclable trips (55 per cent) are made by women, compared to just over 3.6 million cyclable trips for men. This difference is most pronounced among those aged 25-54.













There is the potential to grow cycling across London. Just over one in ten potentially cyclable trips was made within or to/from central London. Around a quarter of the potential is within inner London, 64 per cent within outer London or travelling between inner and outer London. Town centres offer a particular opportunity for growth, with 33 per cent of potentially cyclable trips involving travel to or from one of London's town centres.

Figure 35 Trips that could feasibly be cycled all the way, by current mode of travel, London residents 2012/13 – 2014/15



Source: Analysis of Cycling Potential (TfL 2017)

Figure 36 Journeys that could feasibly be cycled part of the way, by current mode of travel used for cyclable journey stage and main mode of the trip, London residents 2012/13 – 2014/15

Mode of cyclable stage	Main mode of trip	Number of cyclable stages
		330,000
		250,000
		230,000
		160,000
		100,000
		40,000

Source: Analysis of Cycling Potential (TfL 2017)

TfL’s Transport Classification of Londoners classifies London households into nine segments based on their characteristics, preferences and travel habits. Figure 37 describes these segments and shows how their propensity to cycle varies considerably. It also shows the number of trips currently made by another mode that could feasibly be cycled made by each group. This highlights both the opportunity and the challenge: 43 per cent of potentially cyclable trips are made by the four segments with the greatest propensity to increase cycling, 20 per cent by the two groups with around average propensity to increase cycling, and 37 per cent by those in segments much less likely than average to choose to cycle. The groups who will be the most difficult to persuade to take up cycling typically live in outer London and use the car as their main mode of travel.

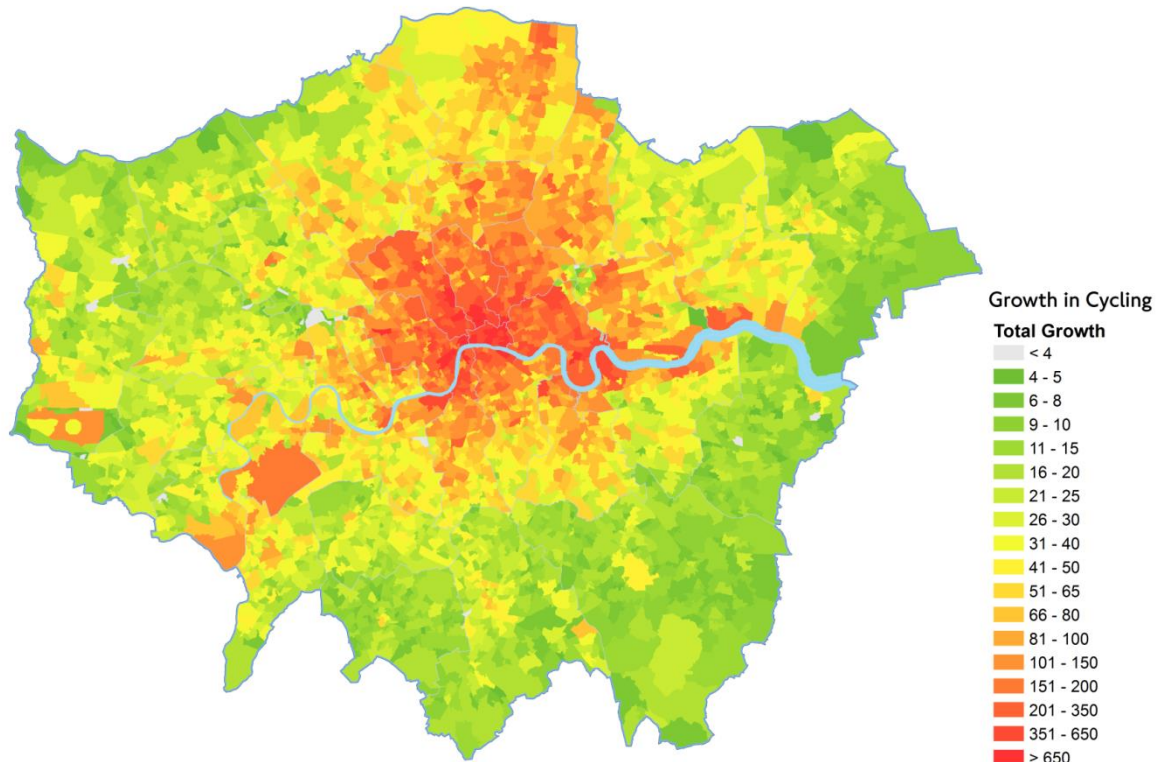
Figure 37 Segmentation of Londoners by propensity to cycle and cycling potential

Segment	Description	Propensity to increase cycling (100=average)	Potentially cyclable trips	
			Number	Percentage
Affordable transitions	Often experiencing life transitions such as starting a first job or a new family and consequently exhibit the most change. Low car use, high PT use, average amount of walking and more likely than average to cycle.	164	458,600	6%
Urban mobility	Typically young working adults with no children and good incomes living in inner London. Low car use and high levels of cycle use. High bus use, average amount of walking and Underground use.	142	879,900	11%
Suburban moderation	Living in outer London with at least one child at home. Car use is high, with use of public transport and active modes below average but with a higher than average tendency to change.	138	1,689,500	21%
Educational advantage	Mainly living in central London, highly educated with above average incomes and without children. Rely on public transport and walking.	113	422,700	5%
Students & graduates	Based mainly in inner London, students and recent graduates on average incomes. Car use low so rely on public transport and active modes for travel, particularly bus and walk.	106	1,026,400	13%
City living	Mainly living in central London. Rely on the tube and active modes, and are no more than averagely likely to change.	102	585,000	7%
Detached retirement	Typically retired or "empty nesters" living in the greener suburbs on the fringes of London, their lives are 'settled' and they don't make many changes. Travel is dominated by the car.	55	1,833,100	22%
Family challenge	Typically young families; finances are tough for this segment and they are less likely than average to make changes. Use of car and active modes is around average, while bus use is well above average.	55	545,500	6%
Settled suburbia	Living across outer London with at least one child at home and on lower incomes. Car use is high and use of active modes and public transport particularly low. Low likelihood of change.	42	725,000	9%

Source: City Planning

TfL’s Cynemon tool estimates the demand for cycling at a strategic level across London. It draws together all the analysis described above into a single estimation tool, derived from the analysis of potentially cyclable trips, propensity to cycle based on the Transport Classification of London segmentation, and current cycle journey patterns. Figure 38 shows the estimate distribution of cycle trips in 2026 as suggested by the model. It shows that the most intense increase will be in the centre of London, but with significant growth in the east of London as well.

Figure 38 Estimate of future cycle trips by location, 2026



Source: City Planning

Challenges in encouraging people to cycle more

Most Londoners can ride a bike (80 per cent), although some may not have done so since they were a child, and more than half have access to a bike they can use. However, 44 per cent say that cycling is “not for people like me”. Many recognise the benefits of cycling, but are put off by concerns about safety, traffic and lack of confidence – perception of safety is the number one deterrent for 75 per cent of those thinking about taking up cycling. Children are often enthusiastic about cycling and are keen to cycle to school and at the weekends, whereas their parents may be more cautious, citing concerns about safety as well as issues around practicality such as trips being too far. Realising the potential for growth in cycle travel will require a range of barriers particular to each region of London to be overcome, as shown in Figure 39.

Figure 39 Barriers to cycling

Barrier	Description
Fear and vulnerability	Concerns about safety from collisions and the volume of traffic, as well as concerns about personal safety whilst cycling or the risk of bike theft.
Lack of infrastructure	Lack of dedicated cycle routes and wayfinding, or inadequate routes, the poor condition of roads and the lack of cycle facilities particularly secure cycle parking at origins and destinations (including at home).
Whether they identify with cycling and how attractive it is to them	Lack of identification with stereotypes about 'who cycles', and not knowing anyone who cycles in their social network or local community. May not consider cycling an attractive option.
How cycling compares to the alternatives	Cycling is not always seen as compatible with busy lifestyles or with the need to look smart. Bad weather and fears of bike breakdowns put people off cycling, and other modes may simply be considered more convenient.
Lack of confidence	Lacking confidence in ability to ride a bike, knowing the rules or etiquette of cycling, not knowing what equipment is needed or what route to take.
The physical effort of cycling	Concern that you need to be fitter to cycle, compounded by a lack of awareness of how long it will take to cycle a journey and lack of awareness of different bike and route options.
Access to a cycle	The cost or availability of a cycle is a barrier to cycling.

Source: TfL Surface Transport

Many people use cycles as mobility aids, and many people with mobility impairments would consider cycling if street environments allowed them to do so in safety and comfort. Providing appropriate cycle infrastructure, or improving streets in general by allowing for all types of cycle to be used with comfort, can therefore play an important role in ensuring that TfL meets the commitments set out in its Single Equality Scheme through taking a Healthy Streets approach.

There is considerable potential to grow cycling – many journeys could be cycled in under 20 minutes, and for many journeys cycling would be quicker than the current mode of travel used. Cycling is cheap, efficient and reliable, and most people agree that cycling can be a pleasant way to get about. People that don't currently cycle in London can be concerned about safety and worried that cycling may not be a convenient option for them – to help them start cycling means overcoming the practical and attitudinal barriers. More high quality, safe and pleasant routes, supported by plentiful and secure parking, will be required to change people's minds.

4.3 Reducing road danger

While London has a long and successful history in reducing casualties, adopting Vision Zero for London would represent a step change in the approach to reducing road casualties. Adopting Vision Zero for London would mean a long term vision to reduce road danger so that no deaths or serious injuries occur on London's roads.

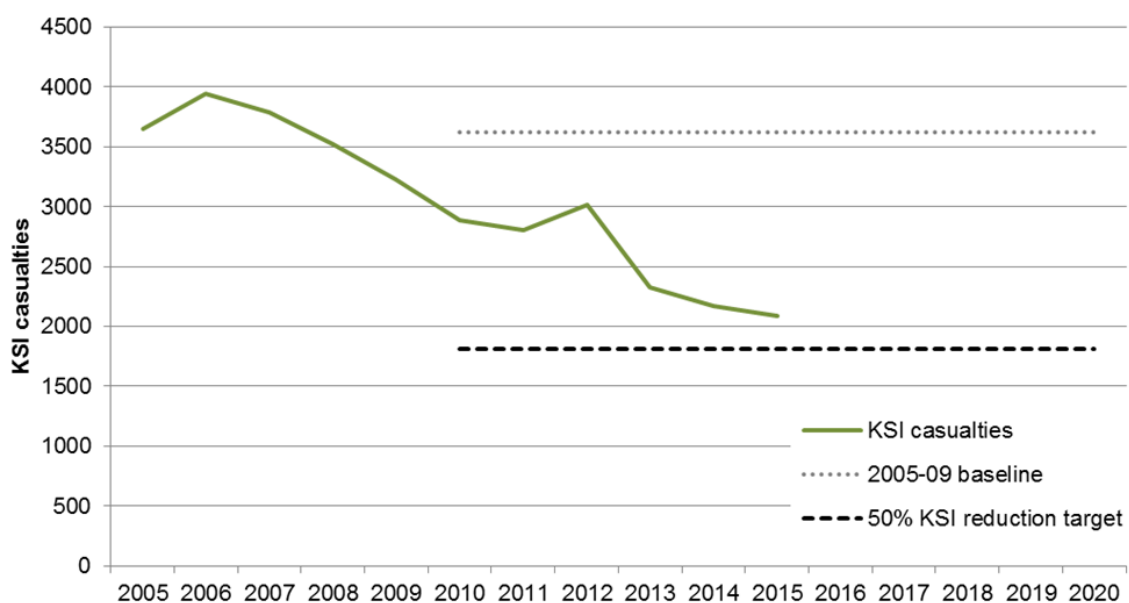
The reduction of road danger is also essential to delivering mode shift from the car, as people will only choose to walk or cycle if they feel safe doing so. The fear of cycling is a barrier for many non-cyclists to start cycling and a safer network will encourage more cycling.

Reducing the dominance of motor vehicles is key to this approach, specifically on routes and locations where the numbers of vulnerable road users are greatest and continue to grow. The general characteristic of the road network makes this a highly complex task due to the widely open nature of the system, with interactions between all travel modes, and many instances of conflict.

The number of people killed or seriously injured (KSI) on London's roads is the lowest on record but still stands at more than 2,000 per year. In 2015, 2,092 people were injured in KSI collisions on London's roads. This is 42 per cent below the 2005-09 baseline. The previous road safety target was met six years early and London is on track to achieve the target established in 2015 of a 50 per cent reduction in KSIs by 2020 (shown in Figure 40).

Current forecasts show that if progress continued at a similar rate, KSIs would continue to fall to around 1,000 by 2040.

Figure 40 Progress towards reducing the numbers of people killed or seriously injured by 2020

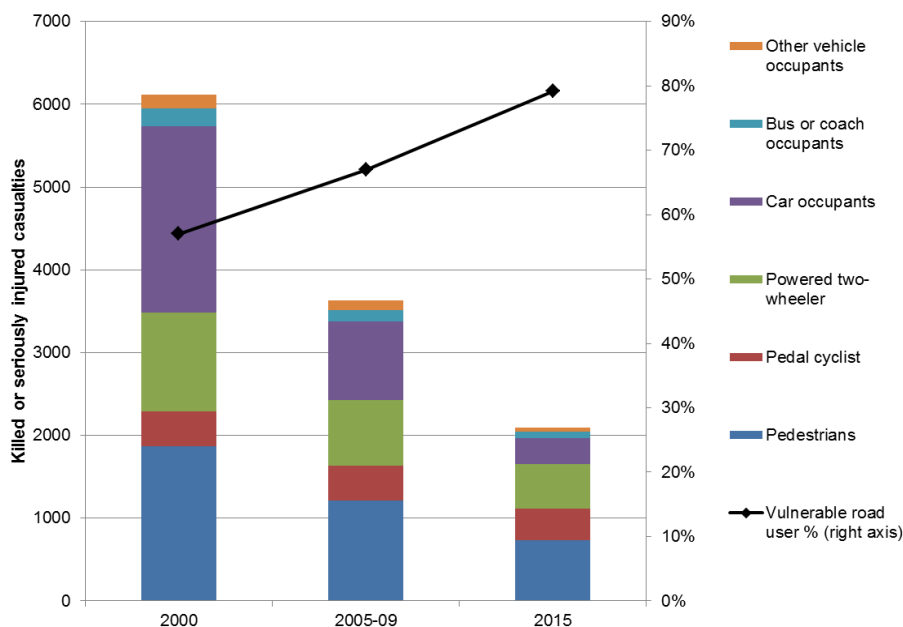


Source: TfL Road Safety team

Pedestrians, cyclists and motorcyclists are most at risk of being involved in a collision. In recent years, the greatest reductions in KSIs have been amongst car occupants. As a result, the proportion of KSIs made up of vulnerable road users has risen as overall KSIs have fallen. Figure 41 below illustrates.

Some groups are more vulnerable to road danger than others. Londoners from Black, Asian and Minority Ethnic groups suffer a disproportionately high number of road casualties. Pedestrians in the most deprived areas are more than twice as likely to be injured as those in the least deprived areas. Between 2005 - 2009 and 2015, there were 55 per cent fewer children killed or seriously injured. Over this period child pedestrian KSIs reduced by 52 per cent and child car occupants by 72 per cent showing that more needs to be done to increase child pedestrian safety.

Figure 41 Number of people killed and seriously injured by road user type, 2000 to 2015



Source: TfL Road Safety team

Buses are an efficient way of travelling – they take up 11 per cent of road space but make up almost 60 per cent of distance travelled by people on central London roads. However, in the last three years there were on average 200 people killed or seriously injured in collisions involving buses or coaches. Furthermore, buses and coaches are disproportionately involved in collisions with pedestrians and cyclists, relative to their traffic mode share. For example a pedestrian is seven times more likely to be killed in a collision with a bus and five times more likely to be seriously injured in a collision with a bus than would be expected, given buses' share of traffic

Recent trials of Intelligent Speed Assistance on buses, additional segregated cycle routes, average speed cameras, engineering schemes, educational initiatives and 20mph limits have all reduced danger and increased safety. There are now 20mph speed limits and zones on 28 per cent of London's roads. Overall, including slight casualties, there were 30,182 injuries from road collisions in 2015 showing the scale of the challenge of reducing road danger in London and improving safety.

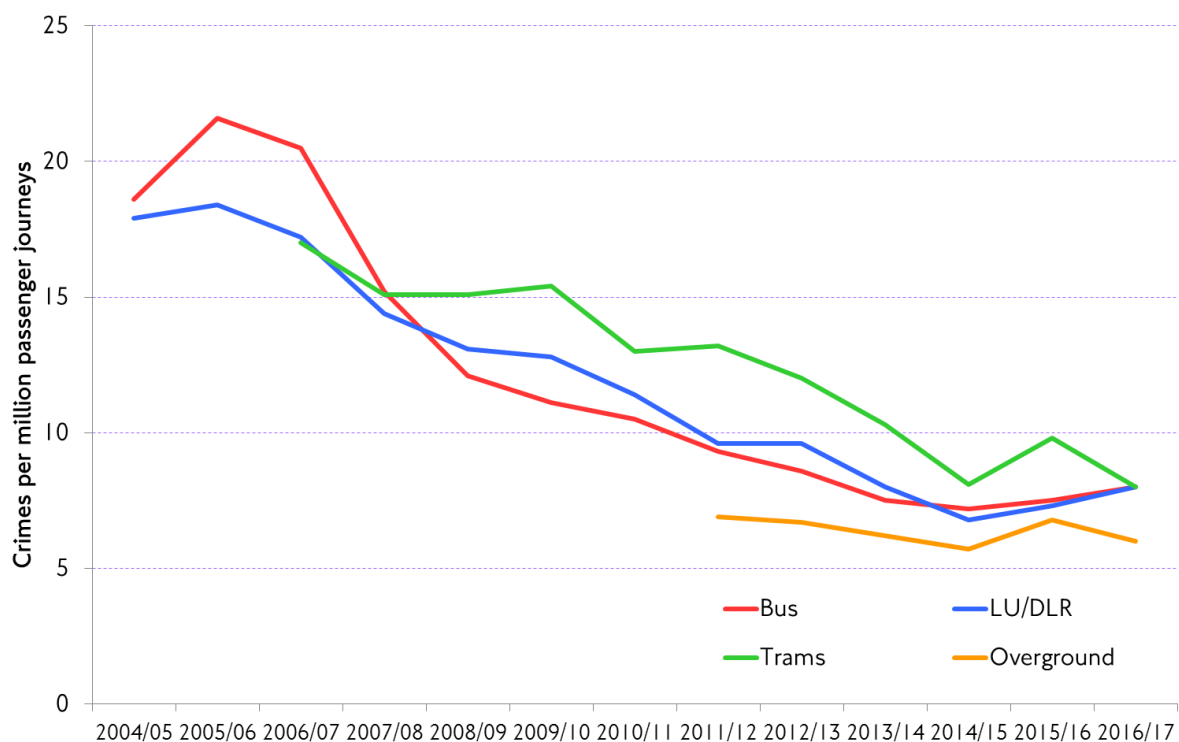
4.4 Personal safety and security

The safety and security of transport and travelling in London remains a priority for the Mayor. The recent terror attacks in London and Manchester have highlighted the importance of ongoing efforts to reduce the likelihood and impact of these terrible incidents on London's roads and public transport networks and to improve safety and security of transport and travelling.

Reducing transport crime and further improving confidence to travel will be challenging in the context of global insecurity and the growth in hatred and intolerance and extremism; the threat of terrorist attacks on the road and transport system; financial constraints; a growing population and the impact of overcrowding on passenger behaviour; along with the changing risk and nature of crime. These challenges are increasing demands for policing and enforcement resources, as well as other important crime reduction and operational security measures.

In terms of crime levels on TfL's public transport network, crime fell by over 50 per cent between 2005/6 and 2016/17 – equivalent to almost 30,000 offences. While over the long term, crime has been falling on the public transport network, levels of crime on the system have seen small increases since 2014/15. The rate of crime in 2016/17 was 7.5 crimes per million passenger journeys, up from 7.0 in 2014/15 (which was the lowest rate on record). The increases in crime have largely been driven by an anticipated increase in reported sexual offences and an increase in low-level violence and public order offences. Trends in crime rates on the transport network are presented in Figure 42.

Figure 42 Reported crime on the public transport network, 2004/05 to 2016/17



Source: TfL Surface Transport

Concerns about the risk of crime and disorder can act as a barrier to travel. Research commissioned by TfL shows that the majority of Londoners feel safe whilst using public transport. The 2016 annual report showed that 11 per cent of Londoners were very or quite worried about their personal security when using public transport in London and 18 per cent had recalled an incident in the last three months which made them feel worried about their personal safety. Women, black and minority ethnic and disabled Londoners are significantly more likely to be generally worried (very or quite) and have experienced a specific incident of worry in the last three months.

Maintaining the downward trend in crime levels and further improving confidence to travel will be challenging while dealing with financial constraint, a growing population, increasing demands for policing and enforcement resources, as well as changes in the nature of crime and antisocial behaviour affecting transport and travelling in London.

4.5 Traffic and congestion

Impact of congestion

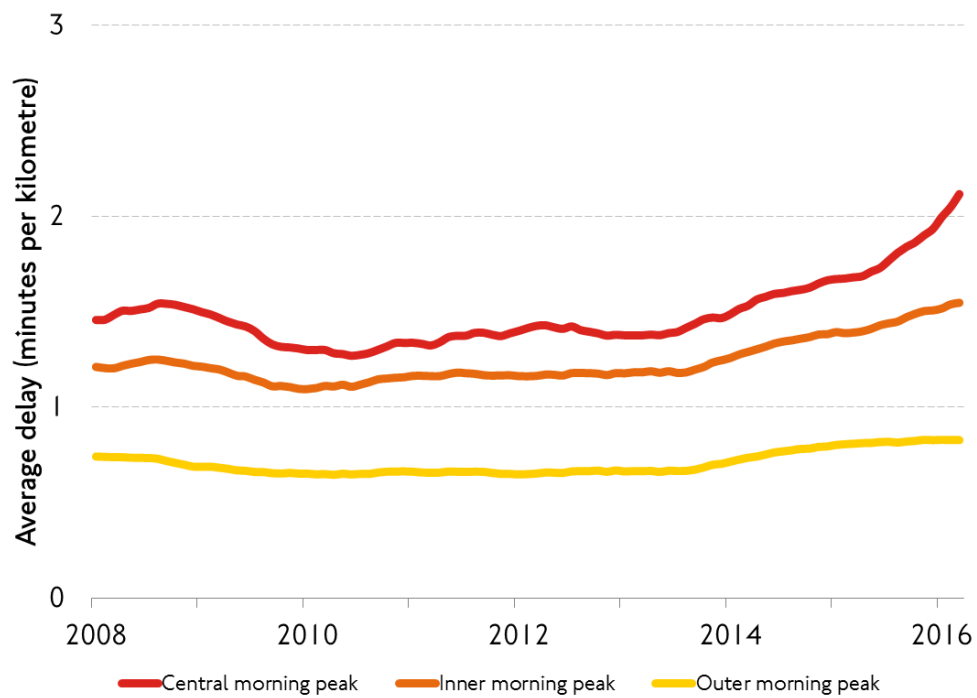
15 per cent of the UK's road congestion is concentrated in the Capital and the average Londoner loses two days a year to congestion. Congestion causes stress and frustration, and limits the amount people can travel because journeys are slow and unpredictable. For businesses, congestion costs businesses money as workers spend time queuing in traffic, it is difficult to make deliveries on time, and an unreliable road network harms the reputation of London as a good place to do business for investors. Bus users are also affected by congestion, as their journeys become slower and more unreliable. A recent study by INRIX and the Centre for Economics and Business Research suggested that London could incur costs of £9.3 billion from traffic congestion by 2030, an increase of 70 percent from today, costing each car commuting household more than £4,000 a year.

That being said, arguably, congestion is an inevitable by-product of a vibrant, successful city. Put simply, a network with no congestion is a network with no traffic – congestion exists because lots of people want to be in the same place at the same time, and the benefits they gain from this make it worthwhile for them to endure the conditions. The high levels of congestion experienced in central London reflect its status as the centre of the UK economy. Nevertheless, we need to find a way of delivering a functioning, reliable road network that has less of an impact of people's quality of life, without limiting the amount of activity that can take place.

Current conditions on the road network

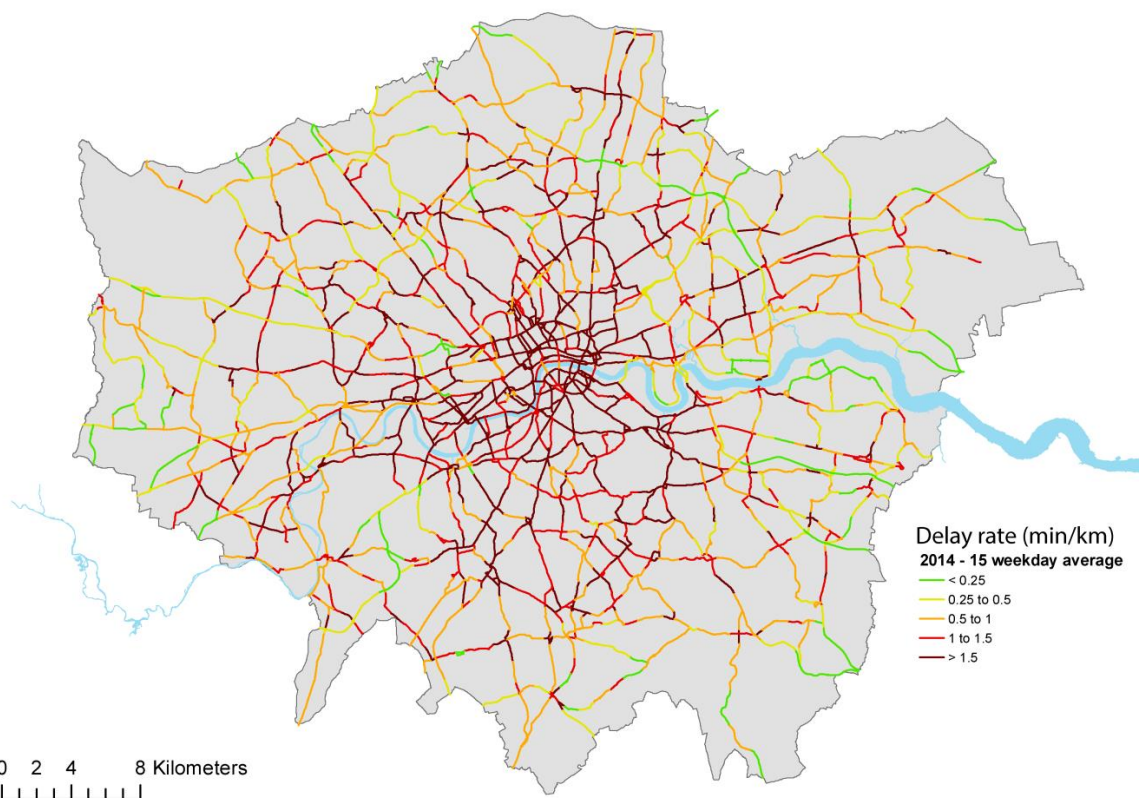
Congestion remained relatively stable for a period, but started to rise from 2014, with a particularly sharp rise seen in central London, already the region with the highest rate of congestion, as shown in Figure 43. For much of this period, traffic was stable or falling but in the most recent period, traffic has started to rise again, perhaps explaining the sharp spike in congestion. Figure 44 shows how this level of congestion manifests itself on the network – across the day, large parts of the strategic road network suffer delays of more than one minute per kilometre.

Figure 43 Congestion by London region, morning peak, 2008 to 2016



Source: TfL Surface Transport

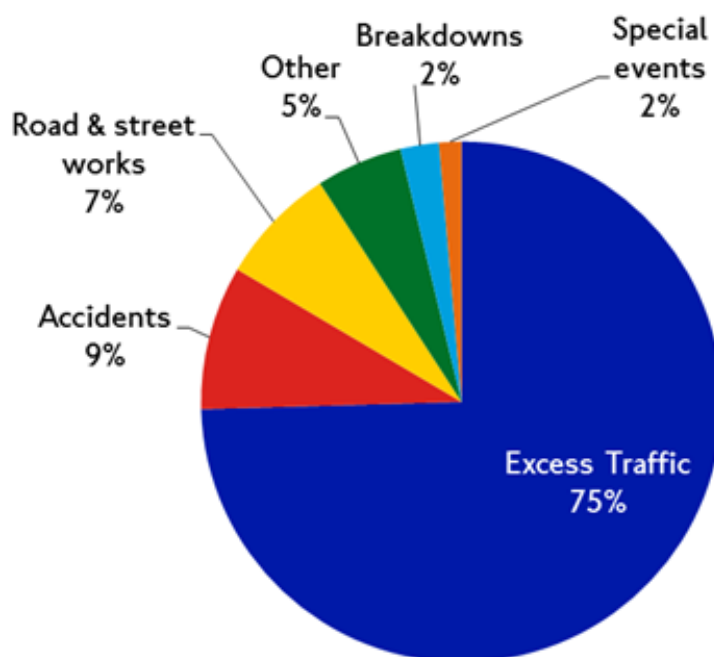
Figure 44 Congestion (minutes per kilometre of delay), weekday average, 2014/15



Source: TfL Surface Transport

Around a quarter of the congestion experienced in London is caused by temporary incidents – accidents, roadworks, special events and so on (shown in Figure 45). Road network management strategies, technology and customer information can all be employed to minimise the impact of such incidents on road users. However, analysis has suggested that around three quarters of congestion in London is simply caused by there being more traffic than the network can handle, by demand exceeding supply in other words. Beyond the immediate stress and frustration, congestion is primarily experienced as something which limits the ability to travel and thus reduces the connectedness of the city. Given these two factors – that congestion is caused by excess demand, and that congestion limits effective connectivity – the best solution to the problem of congestion is to improve connectivity by other modes and reduce the demand on the road network.

Figure 45 Estimated causes of congestion



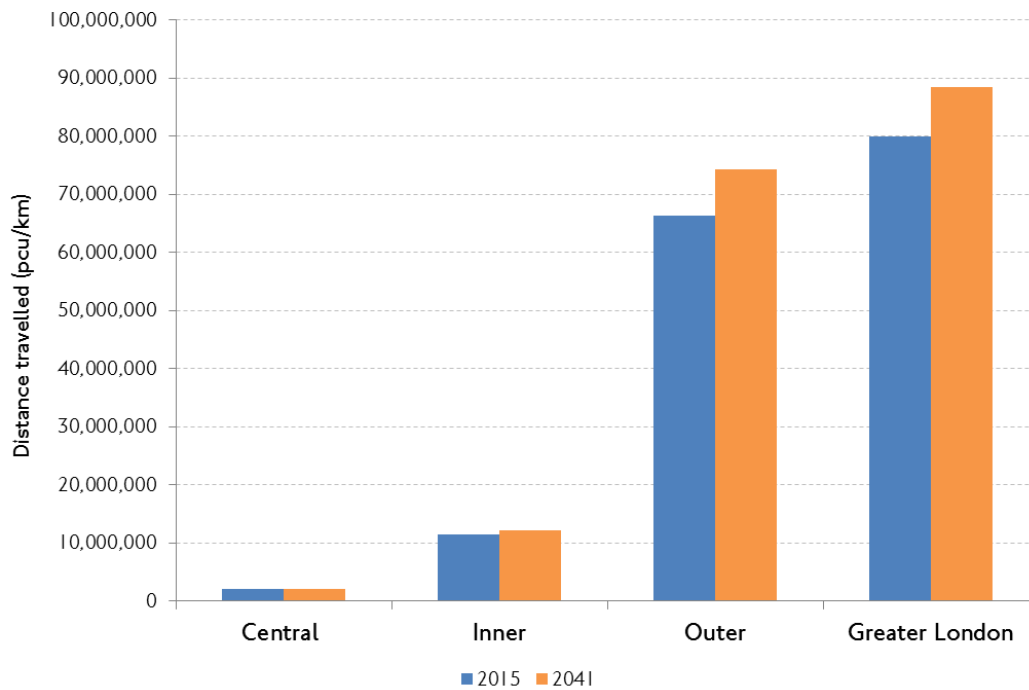
Source: TfL Surface Transport

Future conditions on the road network

Despite a falling car mode share, without further action traffic is expected to rise across much of London, with the exception of central London (see Figure 46), with 8.6 million more kilometres travelled by road on an average day in 2041 compared to 2015.

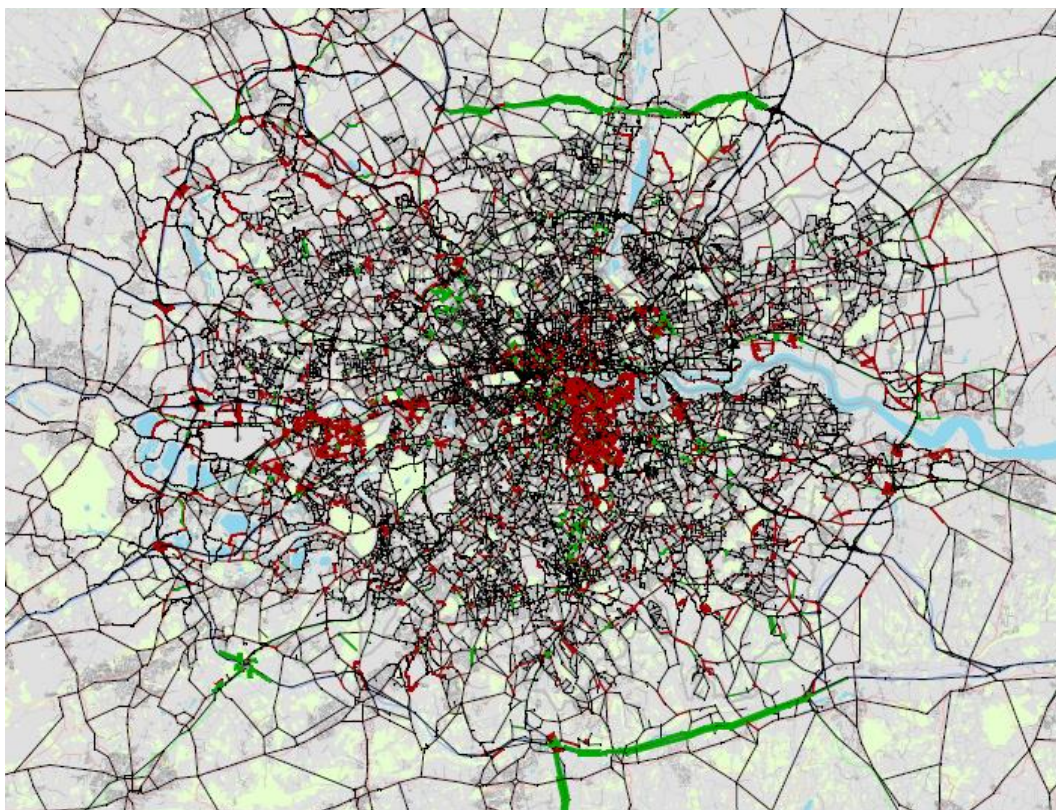
Over the same period, the amount of space available for use by general road traffic is expected to reduce by 3 per cent, as shown in Figure 47. This reduction is particularly pronounced in central London.

Figure 46 Change in traffic volumes by region, baseline without interventions proposed in MTS, 2015 to 2041



Source: City Planning

Figure 47 Forecast changes in road network capacity, baseline without interventions proposed in MTS, 2015 to 2041

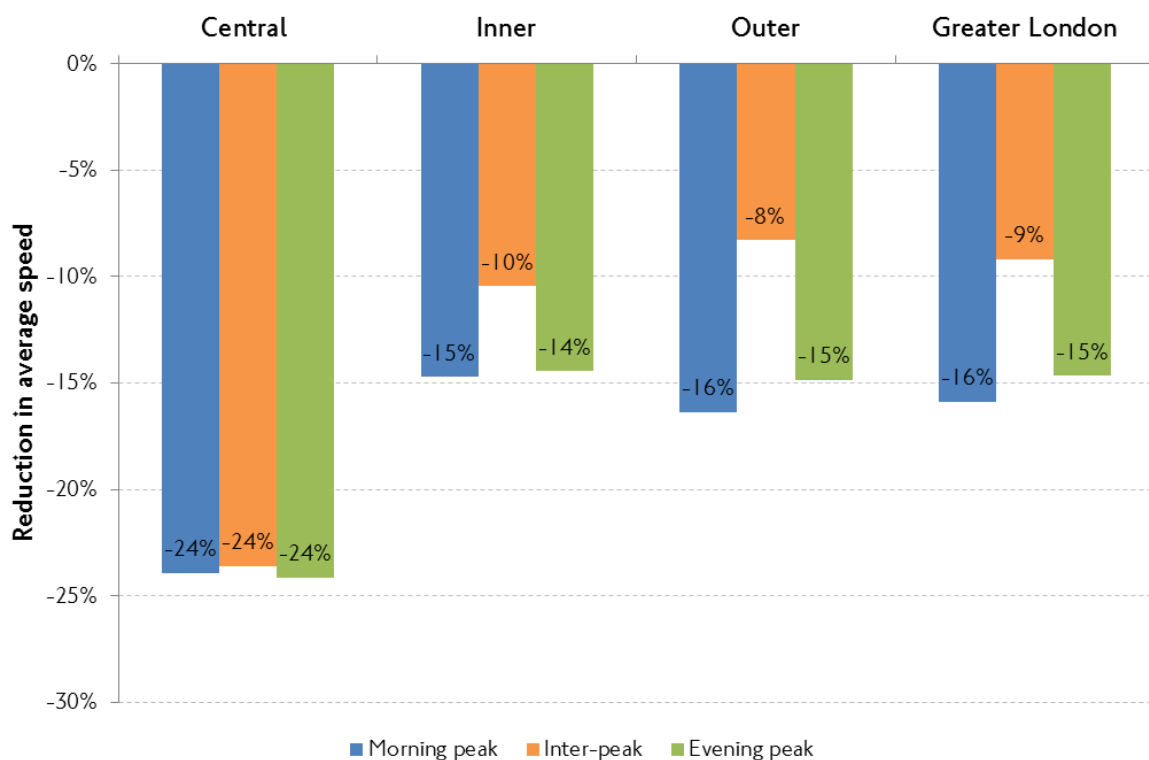


Source: City Planning

Notes: Red indicates reduced capacity, green increased capacity

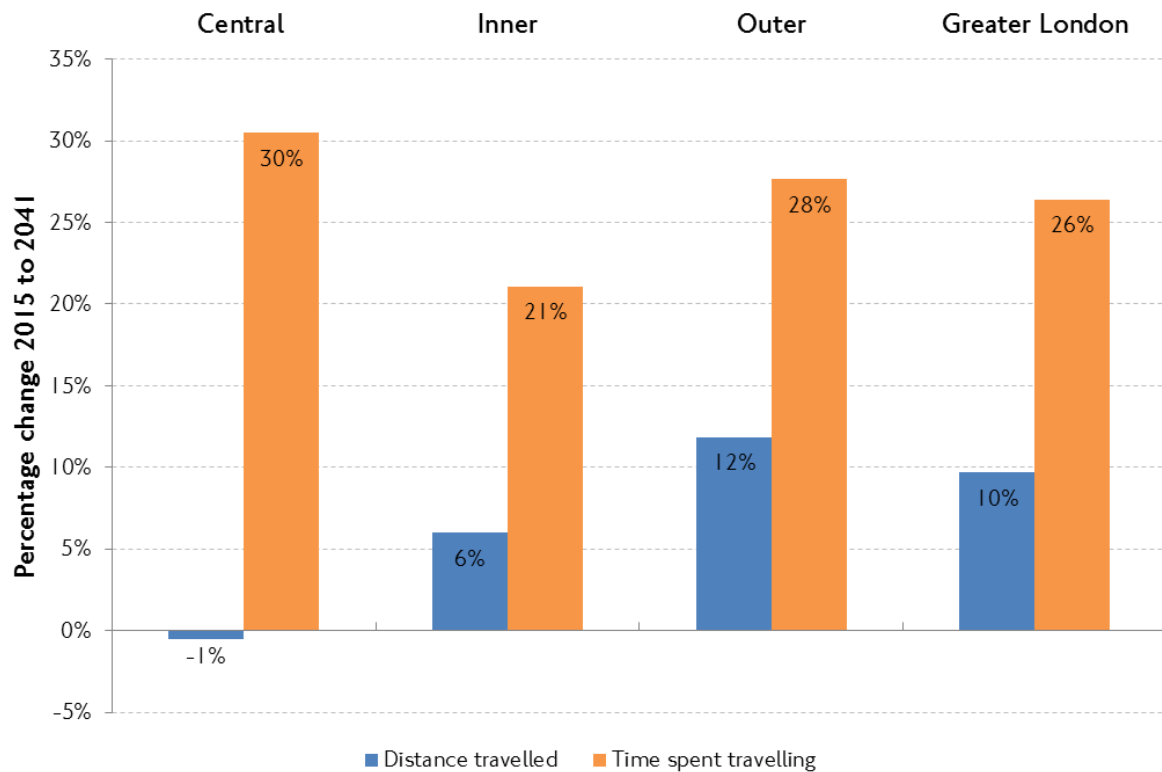
The cumulative impact of more traffic in a reduced network is that congestion is expected to rise steeply over the period to 2041, leading to slower traffic speeds and more time spent travelling, as shown in Figures 48 and 49. In total, speeds will fall by a quarter in central London throughout the day and by around a sixth across the rest of London in peak periods, with speeds in central London remaining at below 10km per hour all day. The effect of this is that by 2041, it will take more than an hour (64 minutes) to travel 10km by road in central London, 15 minutes longer than today. In inner London, the same journey would take 35 minutes, 4 minutes longer than today, and in outer London 21 minutes, 3 minutes longer than today. By 2041, the average Londoner will lose two and a half days to congestion per year.

Figure 48 Forecast changes in traffic speeds by region, baseline without interventions proposed in MTS, 2015 to 2041



Source: City Planning

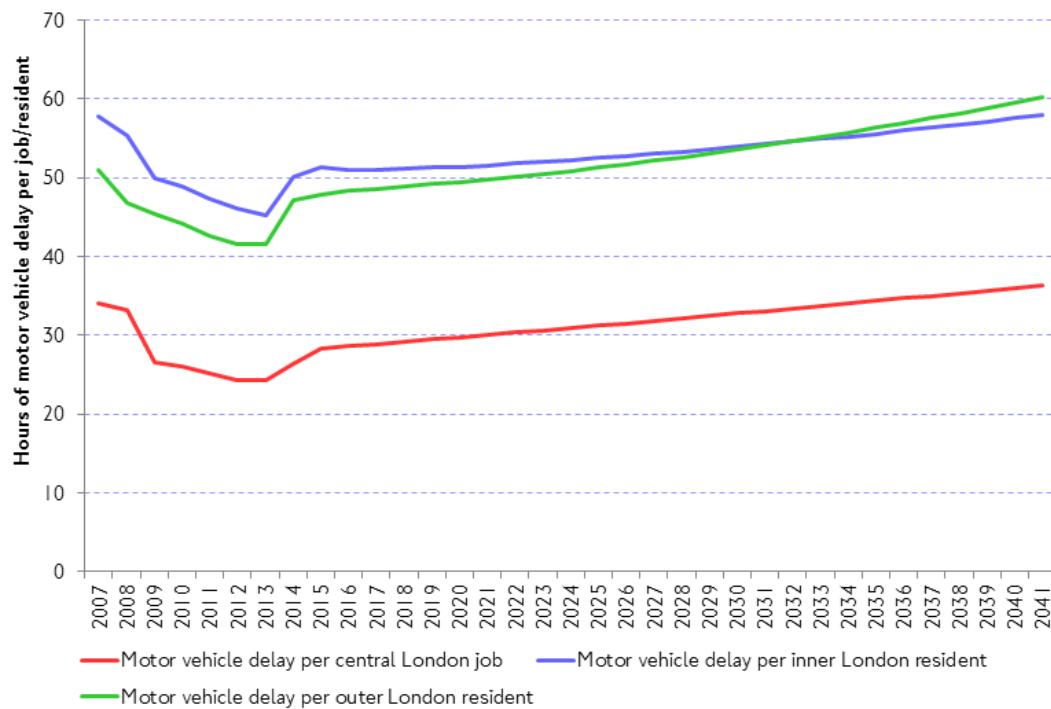
Figure 49 Forecast changes in distance travelled and time spent travelling by road, baseline without interventions proposed in MTS, 2015 to 2041



Source: City Planning

Congestion is most damaging where it affects journey times in places and for people and groups who are highly dependent on highway connectivity. Whilst congestion in terms of the rate of delay per kilometre travelled is worst in central London: 68 per cent of time lost to congestion occurs in outer London, 23 per cent in inner London and just 9 per cent in central London. This reflects the size of outer London but also its dependency on car as the main mode of travel. The amount of congestion experienced per capita has been calculated as a way of evaluating the possible impact of congestion. In central London, congestion has been calculated per job for the same purpose. These calculations show that, per resident, outer Londoners experience 48 hours of congestion per year, and this is expected to rise to 60 hours per person per year by 2041, a greater increase than is expected anywhere else in London, as shown in Figure 50. The greater dependency of outer London’s population and businesses on the road network may mean that congestion in outer London has a more significant economic impact than elsewhere, despite being ‘less congested’ on a minutes per kilometre basis.

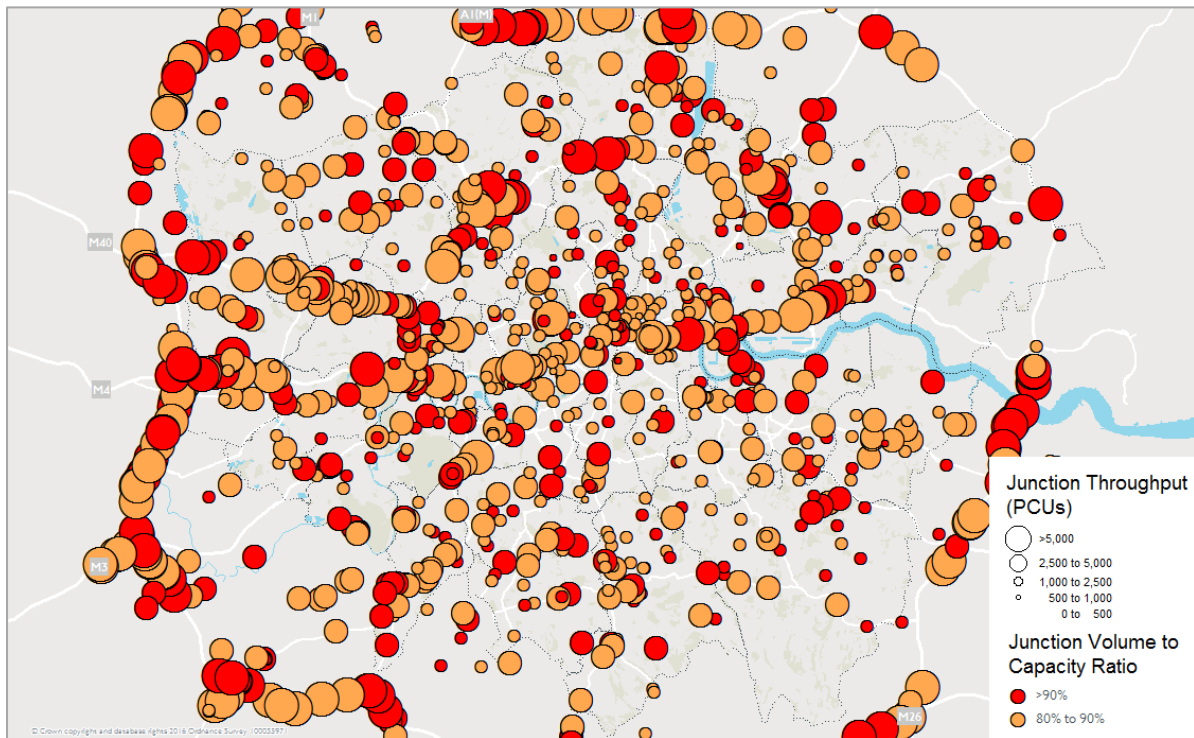
Figure 50 Delay experienced per job in central London and per resident in inner and outer London, actual and baseline forecast without interventions proposed in MTS, 2007 to 2041



Source: City Planning

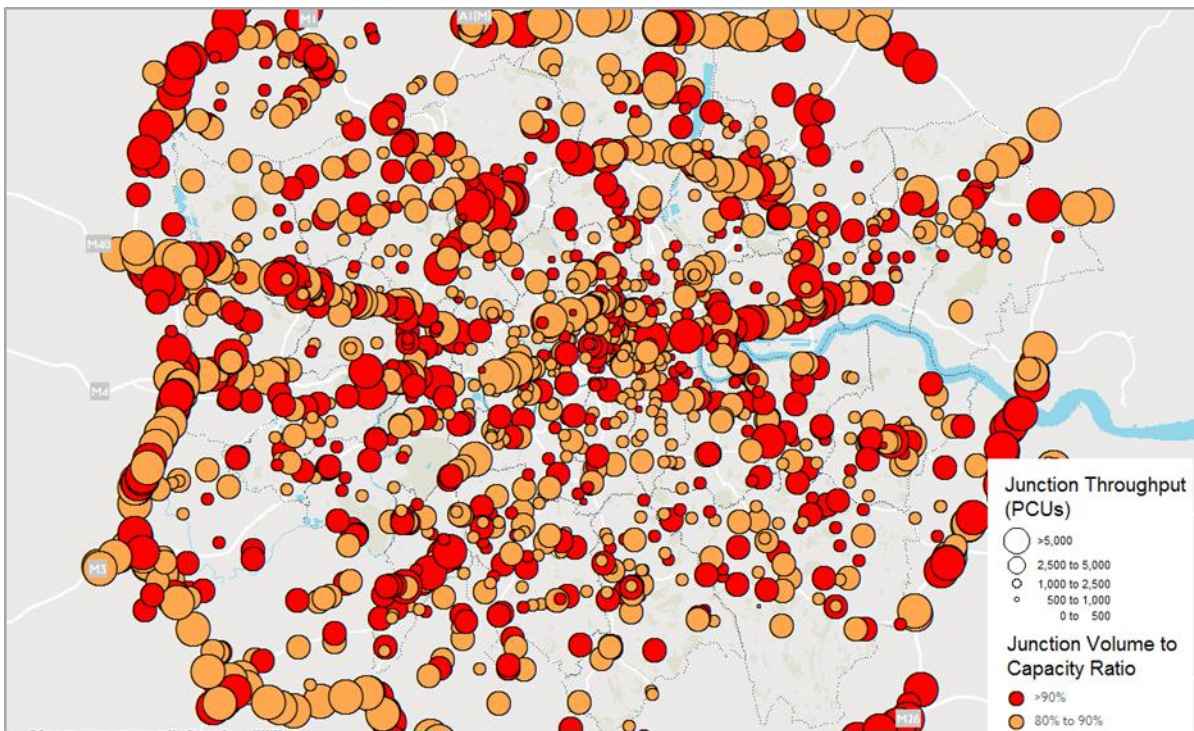
Figures 51 and 52 show junctions operating at between 80 to 90 per cent capacity (marked in orange) and at over 90 per cent of capacity (marked in red). Junctions operating so close to capacity lack resilience and cause congestion. By 2041, the number of junctions operating at this level increases dramatically, from 750 in 2015 to 1150 in 2041 and traffic flows through those junctions also increase. By 2041, the junctions marked in Figure 52 are expected to account for 38 per cent of congestion, unless further action is taken.

Figure 51 Junctions operating at over 80 per cent capacity, flow weighted, 2015



Source: City Planning

Figure 52 Junctions operating at over 80 per cent of capacity, weighted by flow, baseline forecast without MTS interventions, 2041

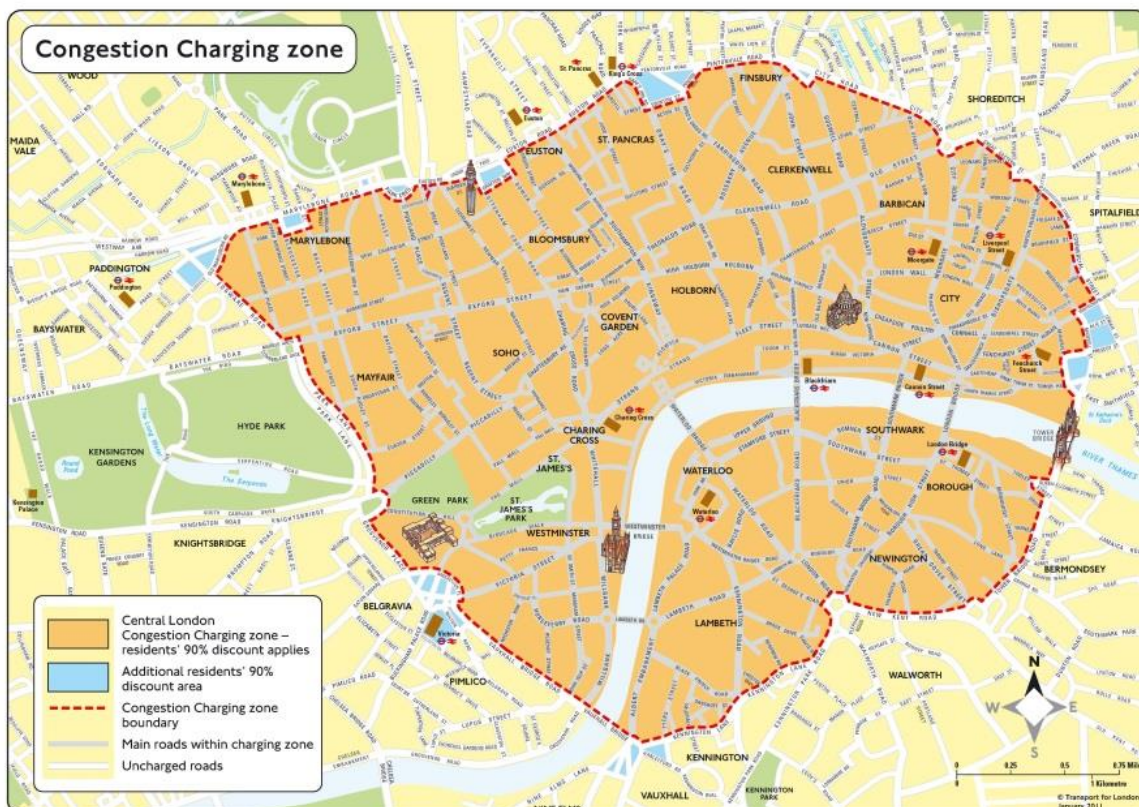


Source: City Planning

Focus on congestion in central London

Central London is a special case on London's road network, because it is subject to the Congestion Charging Scheme, which operates between 7am and 6pm, with drivers required to pay a charge of £11.50 per day to travel in the zone. The area covered by the Congestion Charge is shown in Figure 53.

Figure 53 Central London Congestion Charging Zone



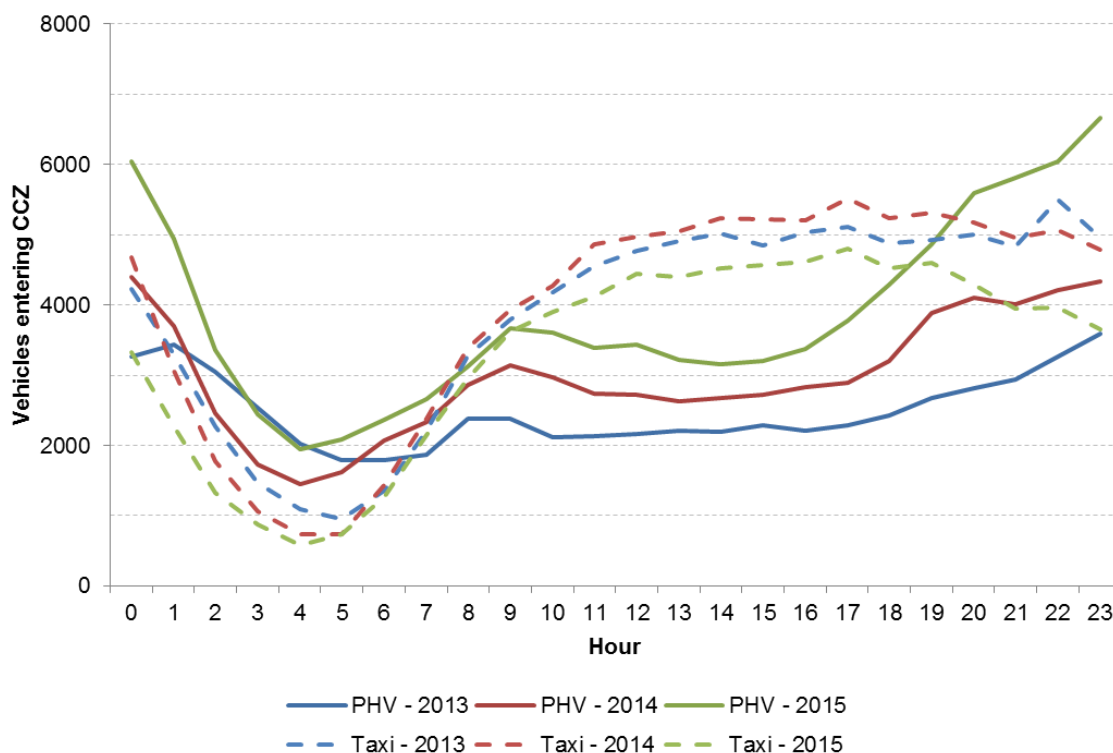
Source: TfL Congestion Charging

A range of discounts and exemptions apply, most notably: blue badge holders, motorcycles, Ultra Low Emission vehicles (that qualify for the ULED discount) and vehicles with 9 or more seats are not required to pay the charge. Taxis and private hire vehicles are exempt from paying the Congestion Charge when actively licensed with London Taxi and Private Hire (TPH). The exemption for private hire vehicles only applies when undertaking private hire bookings. Residents of the zone are entitled to a 90 per cent discount on the charge.

The immediate impacts of the introduction of the Congestion Charging Scheme in 2004 were a 15 per cent reduction in circulating traffic and a 30 per cent reduction in congestion. However, a steady programme of improvements to conditions for buses, pedestrians and cyclists means that the capacity available for general traffic is now considerably lower than in 2004, and as a result, whilst traffic levels remain lower than in the pre-charging period, congestion is now reaching pre-charging levels. This reduction in speeds has been matched by deteriorating bus speeds, so that buses in central London now travel more slowly than in the pre-charging era. This decline in speeds is affecting passenger demand for bus services.

Half of the vehicles in the zone during charging hours are subject to the full charge, four per cent to the residents discount and 46 per cent are exempt or entitled to an 100 per cent discount. Taxis and private hire vehicles are the largest group of discounted or exempt vehicles, accounting for 25 per cent of all unique vehicles seen in the zone. Taxis and private hire vehicles account for a higher proportion of traffic, with taxis accounting for 20 per cent of traffic and private hire vehicles for 13 per cent. There is evidence that the volume of private hire vehicles is rising fast throughout the day and week, with a rise of 54 per cent between 2013 and 2015 (shown in Figure 54), although the busiest periods for private hire vehicles remain late evenings/nights and the volume of taxis remains considerably higher during the daytime.

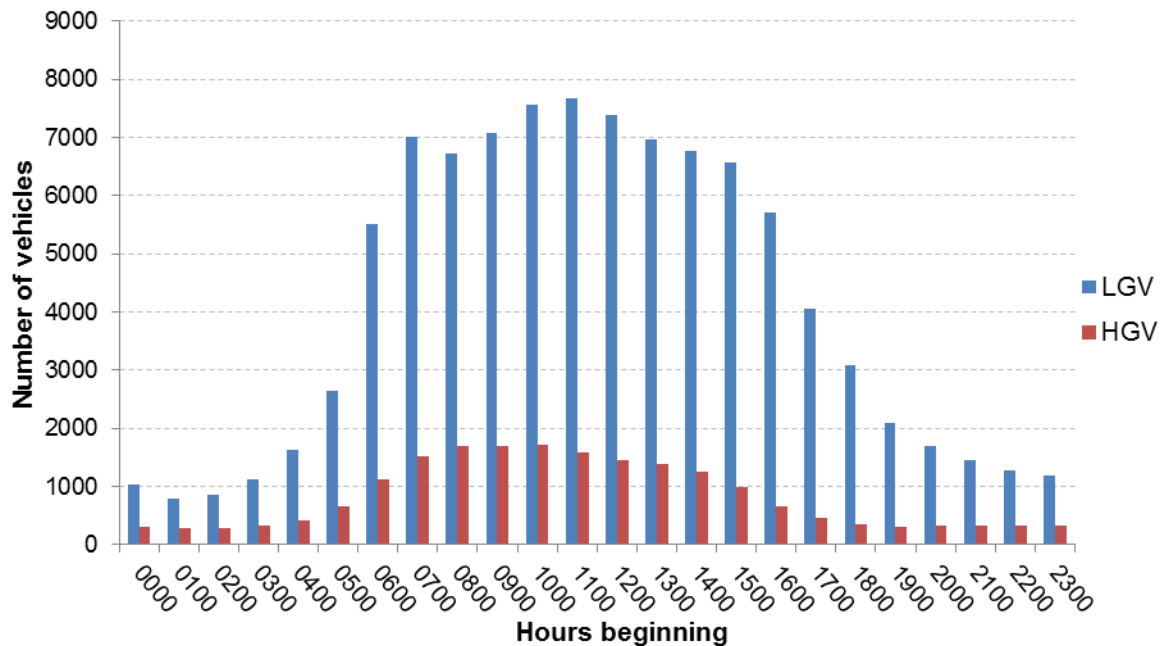
Figure 54 Taxi and private hire vehicle entries to the Congestion Charging Zone on an average Friday, 2013 to 2015



Source: TfL Surface Transport

Freight accounts for 19 per cent of traffic in the charging zone (15 per cent light goods vehicles, 4 per cent heavy goods vehicles) but due to the size of the vehicles takes up a disproportionate amount of road space. Van traffic has been rising and this is expected to continue – freight trends are described in more detail in the section below. The volume of vans rises sharply from 6am, and then remains relatively flat between 7am and 3pm (shown in Figure 55). Heavy goods vehicle flows are highest through the morning, falling off from lunchtime. There is relatively little freight activity outside of charging hours. In particular, almost 30 per cent of all morning peak movements are freight, but only 17 per cent across the whole day. Only 15 per cent of freight trips are overnight.

Figure 55 Light and Heavy Goods Vehicle movements in the Congestion Charging Zone, 2015

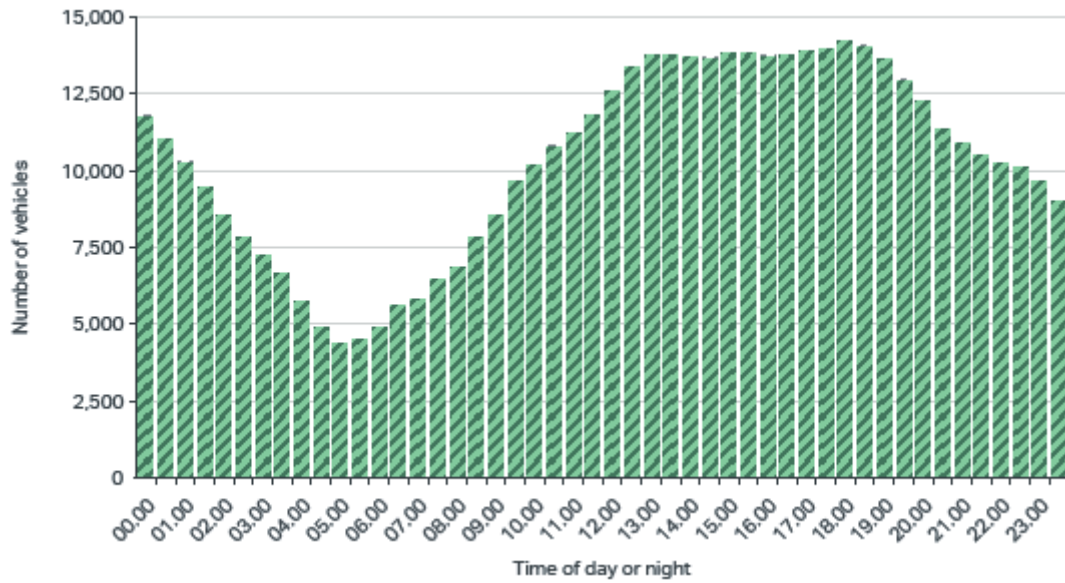


Source: City Planning

Outside of charging hours, traffic levels and congestion have risen such that traffic speeds at the busiest times on Saturdays and Sundays are barely higher than in the weekday morning peak: in 2014/15, average speeds were 8mph in the weekday morning peak, 8.4mph in the Saturday evening peak, and 8.9mph in the Sunday evening peak. At the weekend, the profile of traffic throughout the day looks very different, with low levels in the mornings and then rising steadily to peak at around 6pm. At the busiest times, traffic levels are similar to those seen on weekdays (see Figure 56). At the weekend, cars make up a much higher proportion of vehicles at around 70 per cent of all vehicles, with fewer freight vehicles in particular.

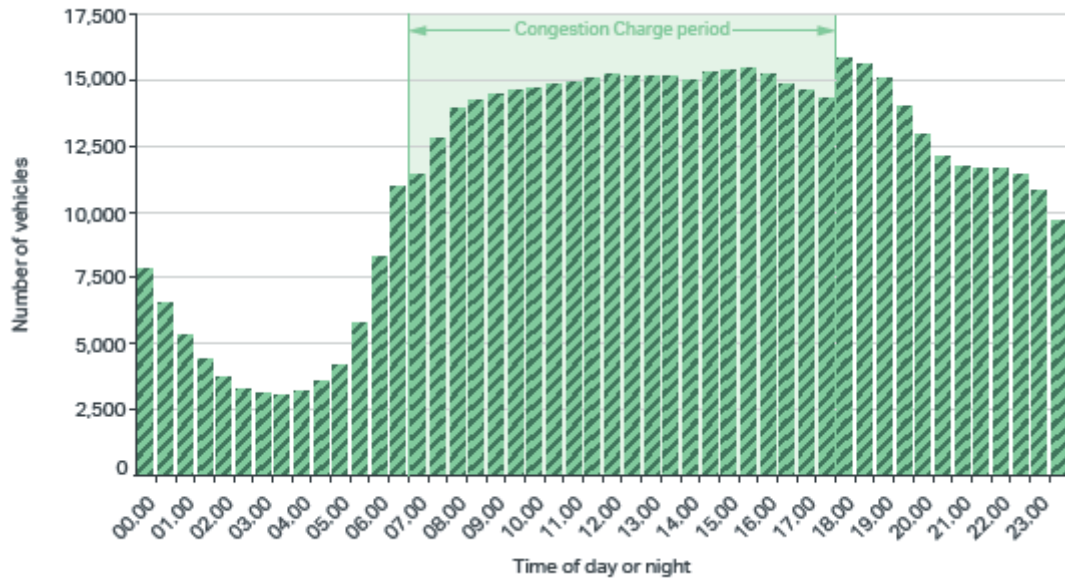
Furthermore, traffic levels on weekdays outside of charging hours have risen so that the busiest time of day is now the period immediately after charging finishes in the evening peak, as shown in Figure 57. 56 per cent of these vehicles are travelling in the evening period only, and have not been subject to the Congestion Charge.

Figure 56 Average weekend traffic, 2015



Source: City Planning

Figure 57 Average weekday traffic, 2015



Source: City Planning

Congestion during charging hours is already at pre-charging levels and is forecast to rise significantly in future. In particular, the volume of private hire vehicles (not subject to the Congestion Charge) and vans is rising, and this is expected to continue. Only half of all vehicles in the Congestion Charging Zone are required to pay the full charge, and this proportion may fall given current trends. Outside of charging hours, traffic and congestion in the evenings and at weekends are as bad or worse than during charging hours, affecting central London’s appeal as a shopping, leisure and entertainment destination.

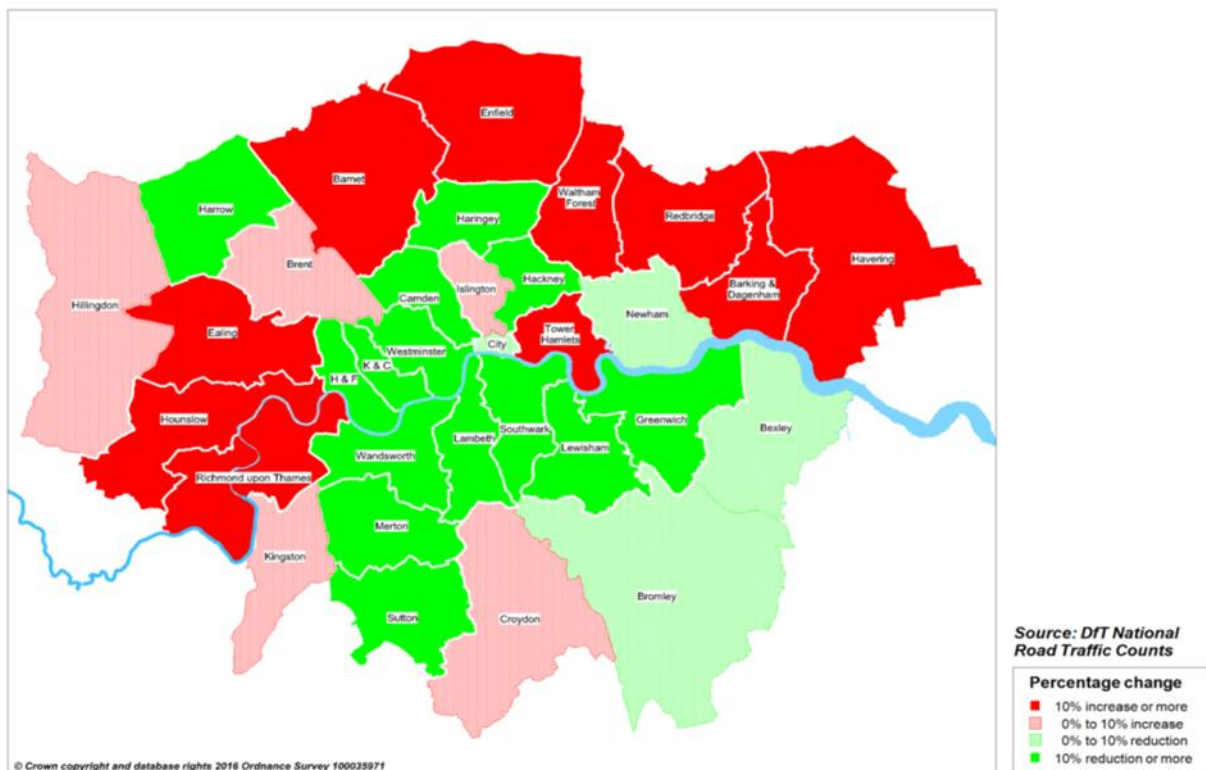
4.6 Freight

London's continued success critically relies on safe, reliable, sustainable and efficient goods delivery and servicing. Every Londoner, business or visitor is dependent on the goods and services that are delivered by road, rail, water and air transportation. As London grows, the demand for freight activity will grow accordingly but, as with all travel, we must ensure that this need is met in a way that minimises its negative impact on the rest of the city.

In 2010, 132 million tonnes of road freight were lifted (having an origin or destination within) in London, and 90 per cent of all freight is lifted by road. In 2013, Light Goods Vehicles (LGVs) accounted for 14 per cent and Heavy Goods Vehicles (HGVs) for 5 per cent of motorised vehicle kilometres in London. Not all travel using a freight vehicle is for business purposes – LGVs in particular are also used for personal travel and commuting and conversely, some freight activity is conducted in private cars – there is anecdotal evidence that this is becoming more common.

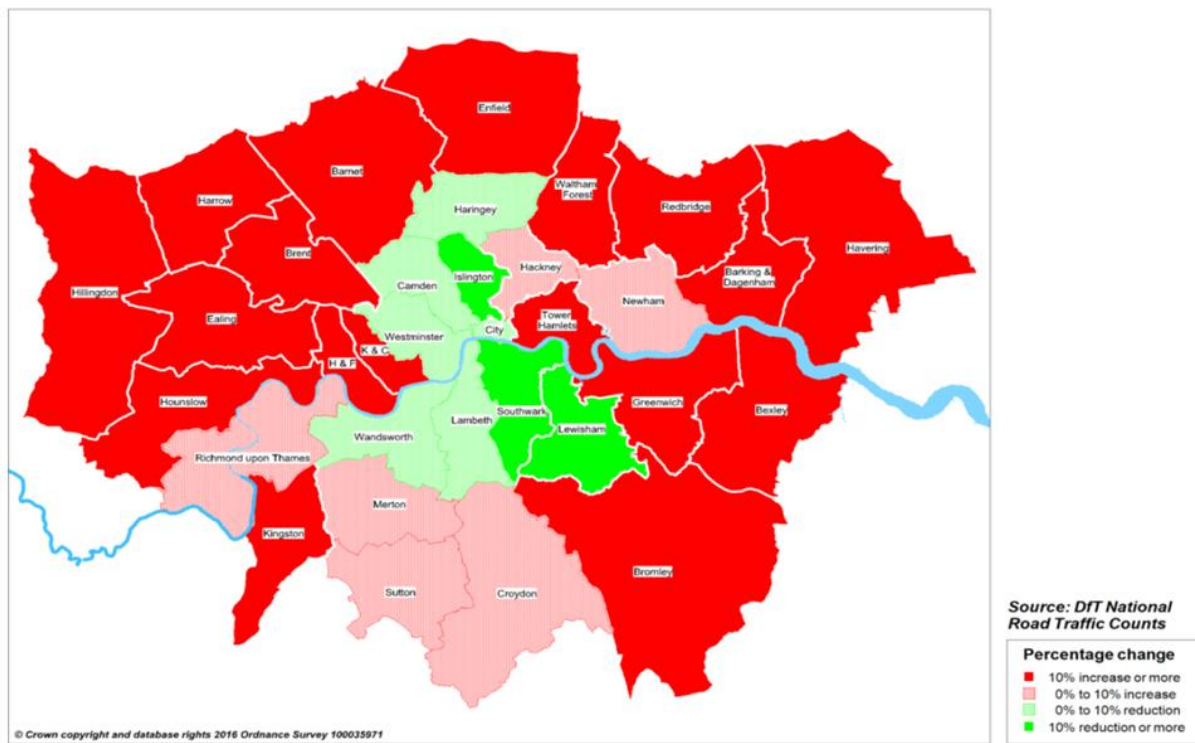
Freight activity has been increasing. By 2015, LGV vehicle kilometres were 20 per cent higher and HGV vehicle kilometres 4 per cent higher than the average for 1994-1999 (see Figures 58 and 59). This is expected to continue, with van traffic expected to grow by 26 per cent by 2041, whilst HGV traffic is likely to remain fairly stable.

Figure 58 HGV traffic, percentage change, 1994-99 - 2015



Source: TfL Surface Transport

Figure 59 LGV traffic, percentage change, 1994-99 - 2015



Source: TfL Surface Transport

The growth in freight traffic has been driven by population and employment growth, but also by trends, most of which are expected to continue, such as:

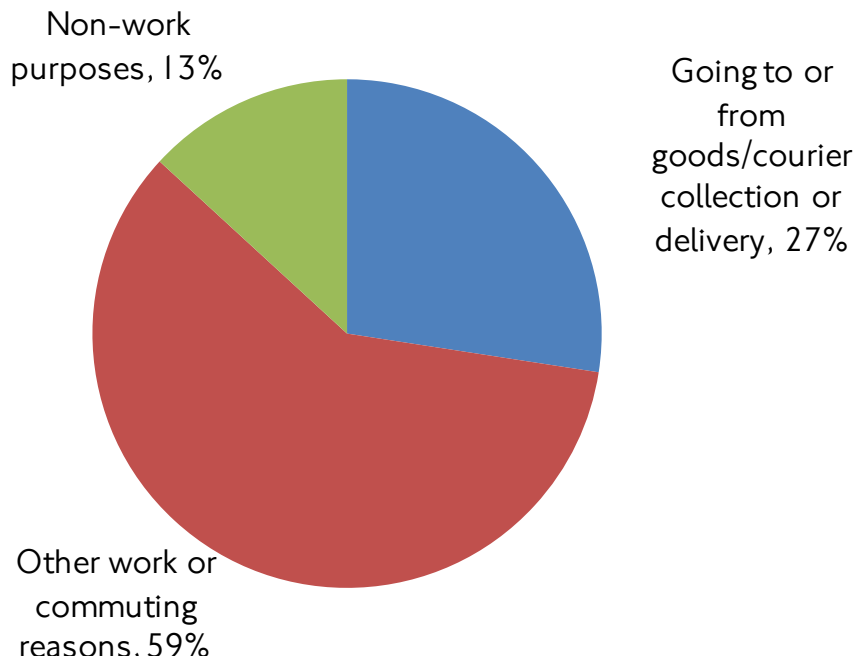
- An increase in ecommerce, placing pressure on employment zones as people increasingly order personal goods for delivery to their workplaces.
- An increase in just-in-time delivery and roads becoming on-the-move warehouses.
- Freight/logistics pushed to peripheral out-of-town areas.
- Freight/logistics pulled to areas with good highway accessibility.
- Globalisation of supply, lengthening supply chains and the distance travelled.

It is estimated that freight adds around £7.5 billion to the GVA of London. 230,000 people were directly employed in the logistics sector in London in 2012, 5 per cent of the workforce, and many more jobs rely on freight movement. Nevertheless, whilst freight is an essential part of economic activity, not all freight movements are efficient or essential in the place and time that they are taking place. For example, AECOM's report for the RAC Foundation found that 66 per cent of vans are less than half full.

HGV activity primarily supports construction – almost half of all HGV trips in the peak are for construction purposes, with municipal vehicles and food and drink the next largest categories. Vans serve a wider range of purposes, lifting goods but also being used for servicing. Figure 60 below shows that around one in eight vans is being

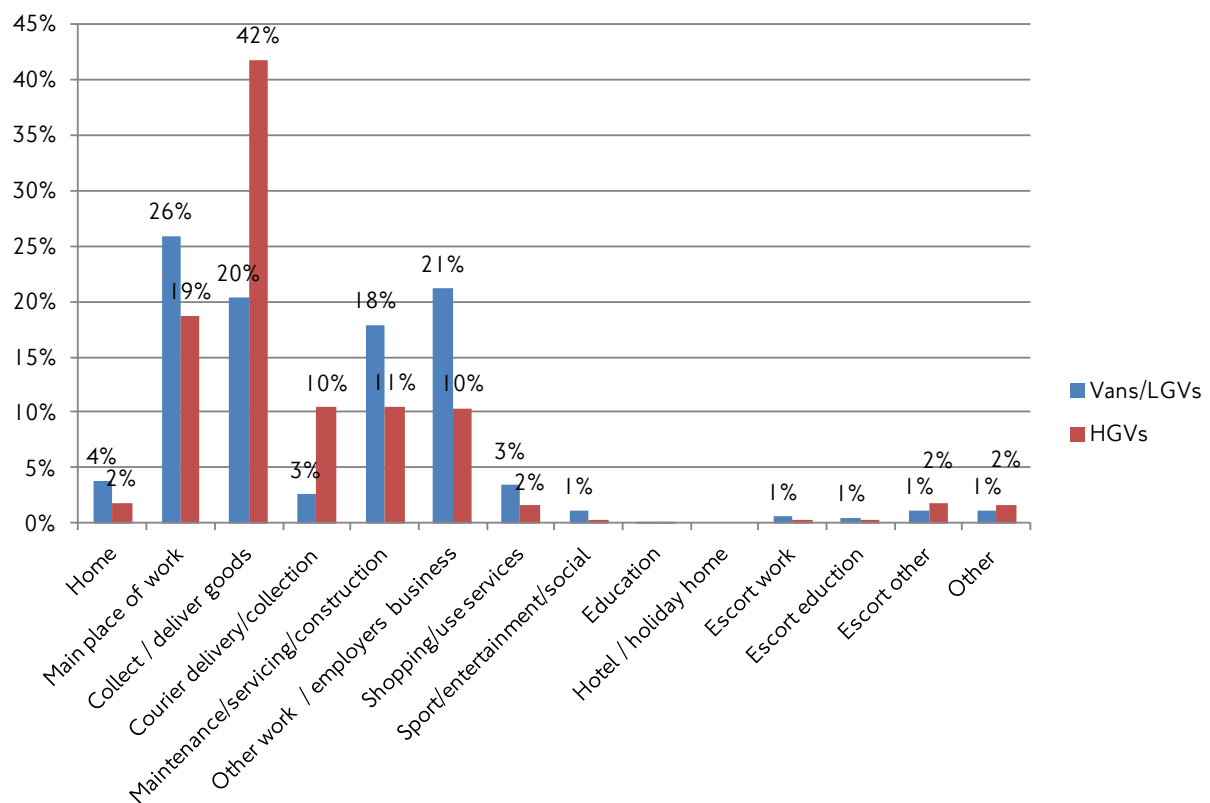
used for private rather than work purposes whilst Figure 61 shows the journey purpose of vans surveyed in the morning peak period in central London.

Figure 60 Summary journey purpose of van trips, 2008



Source: City Planning

Figure 61 Journey purpose of van trips, central London, morning peak, 2016



Source: TfL Surface Transport

The challenges with regards to freight are:

- As London grows and densifies, ensuring a smarter use of space so that traffic does not grow at the same pace, including kerbside loading space.
- Anticipating and mitigating the risk that hauliers will respond to rising congestion by increasing the number of vehicles and staff. Solutions might include retiming freight activity so that only traffic that must be on the road in peak periods is on the roads, with other traffic spread out to less congested times of day. In the centre, this might also include encouraging the use of more sustainable modes for freight, such as cargo bikes.
- Minimising other impacts, including the visual intrusion and noise impacts of goods vehicles, the impact on infrastructure and perceptions of goods vehicles in town centres.
- Ensuring that the costs imposed by freight upon the network are reflected in the costs experienced by customers (businesses and households), in order to keep demand at a reasonable and necessary level.

Furthermore, challenges remain in ensuring that freight activity is safe and clean. Whilst freight does not disproportionately contribute to casualties overall, HGVs cause a disproportionate number of fatalities on London's roads. LGVs and HGVs were responsible for 10 per cent and 13 per cent respectively of road transport CO₂ emissions in London in 2010.

A growing city will need more freight activity; transport policy therefore needs to ensure that necessary freight activity operates safe vehicles, in the right time and the right place; on a road network that delivers a predictable and timely travel experience.

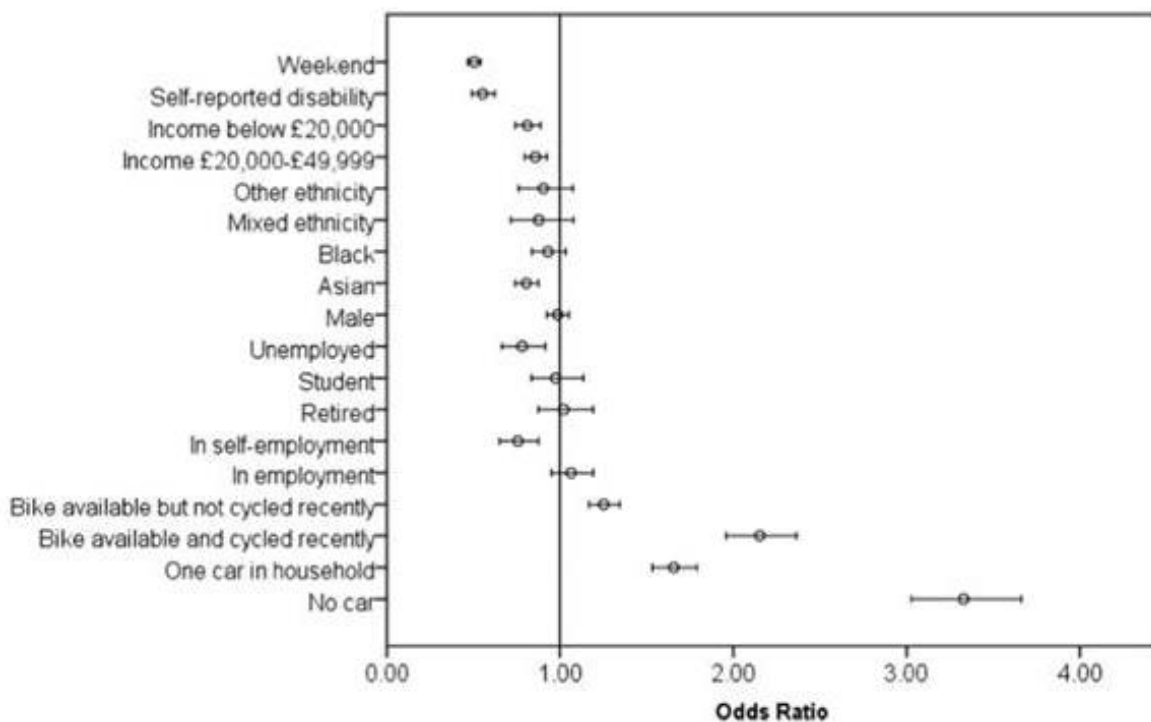
4.7 Car ownership and use

At present, 57 per cent of London households own a car, so that there are 2.7 million cars registered in London, and 9.5 million trips are made by car on an average day. In future, we expect the trend of falling car use to continue, with the proportion of trips made by car expected to fall from 36 per cent to 30 per cent. However, a shift in the distribution of trips, with more, longer trips expected in outer London, means that kilometres travelled by car is expected to rise by around 8 per cent.

Car ownership and health

Car ownership is the strongest determinant of inactivity. 70 per cent of people without a car do some active travel in a day compared to 50 per cent with access to one car and 40 per cent with access to two or more cars. People living in multi-car households are half as likely as non-car owners to do enough activity through active travel for good health. Figure 62 shows a comparison of the extent to which different factors can predict the likelihood that a resident of outer London does 30 minutes of active travel. This clearly shows that not having a car is the best predictor of adults being active.

Figure 62 Predictors of achieving 30 minutes of active travel, odds ratio compared to reference category with 95 per cent confidence limits, outer London residents 2013/14



Source: Active travel in London: The role of travel survey data in describing population physical activity (Fairnie, Wilby & Saunders, Journal of Transport and Health 2016)

In London, children living in households without a car are more than twice as likely to walk to school (2.3 times) and nearly twice as likely to walk during the summer or at weekends (1.8 times) than those living in households with a car.

While car ownership correlates with older age and living in outer London with poorer public transport access there are many younger adults who are using cars for trips that could reasonably be walked or cycled or done by public transport.

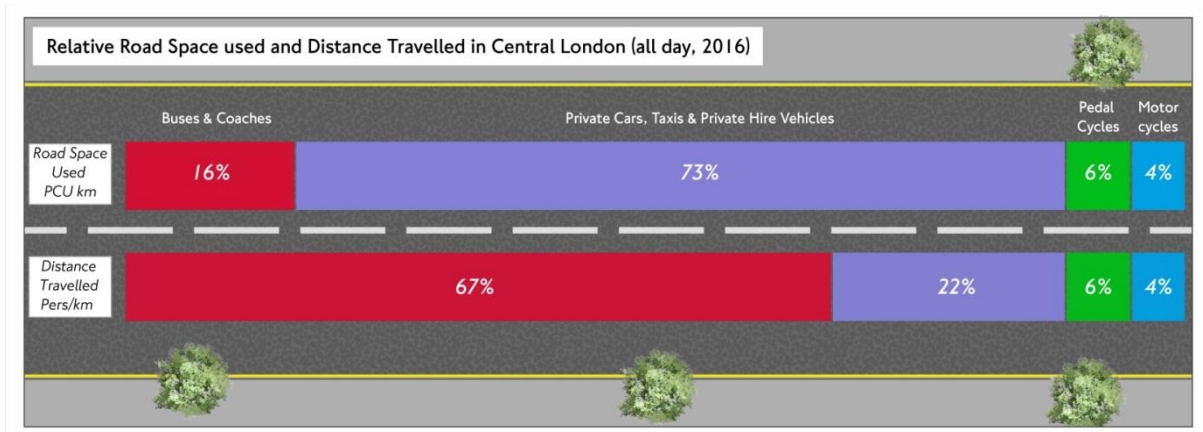
Why we need to reduce car ownership and use

Underlying the challenges of delivering Healthy Streets in London is a basic need to deliver population and jobs growth without a commensurate rise in car travel.

Space on London’s road network is highly constrained and private motorised traffic is a space inefficient way of moving people. Every day over 360,000 cars, Private Hire Vehicles (PHV) and taxis enter Central London, taking up 73 per cent of road space used for people movement but only carrying 22 per cent of the travel happening on the roads (in terms of person kilometres). In contrast, buses take up 16 per cent of road space used for people movement but account for 67 per cent of distance travelled by people on Central London roads. Figure 63 illustrates the relative use of road space and distance travelled in central London.

Similarly, initial findings into the road-space efficiency of the East-West and North-South Cycle Superhighways suggest that the new infrastructure carries on average 46 per cent of the traffic along the route at key locations, despite occupying only 30 per cent of the road-space. It is estimated that the East-West and North-South corridors are now able to carry 18 per cent more people per hour than they could without cycle lanes.

Figure 63 Relative use of road space and distance travelled by road-based mode, central London, 2016



Source: City Planning

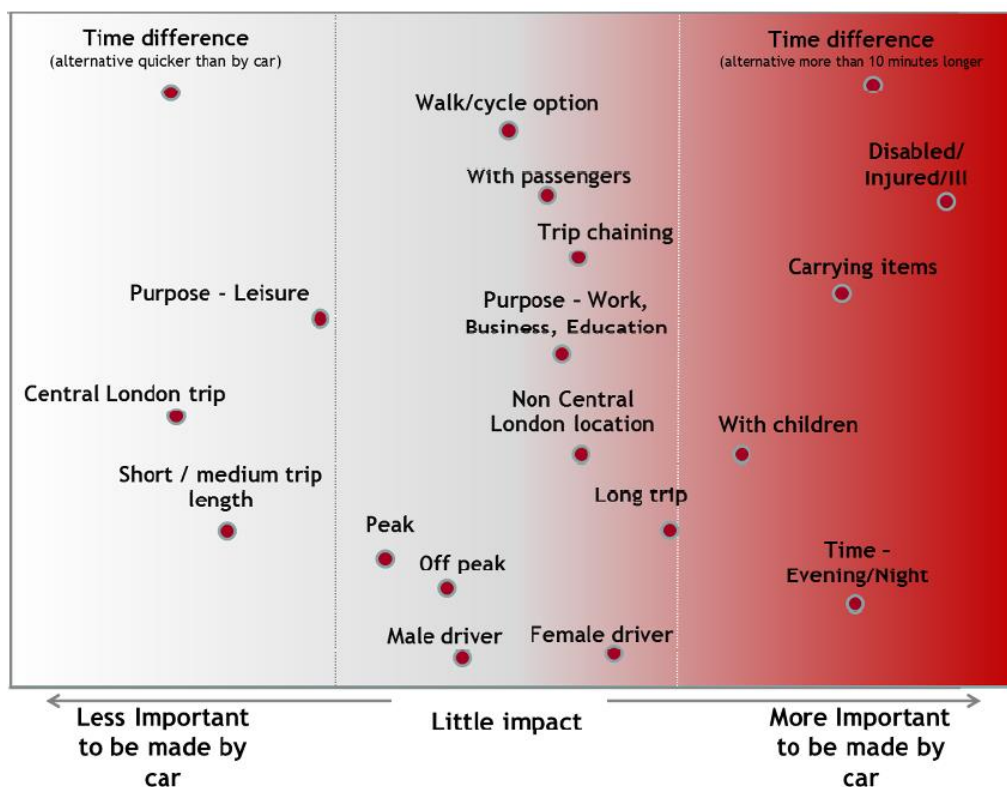
What is ‘essential car travel’?

Since its invention, the car has provided welcome connectivity and opened up new opportunities for people. Even in a densely populated city such as London, some journeys can only reasonably be made by car. However, the amount of space that can or should be taken up by private road transport is limited, and the population is growing. As well as prioritising more space-efficient and sustainable modes (pedestrians, cycles and buses), there is a general consensus that the limited remaining space should be prioritised for ‘essential’ traffic. It is more difficult to define exactly what traffic is ‘essential’.

Some journeys bring a direct economic benefit to the trip-maker – for example, commuting to bring in a wage – or to their employer. These journeys can be considered ‘essential’ and high value, but it may not be necessary for them to be made by car, if an alternative of equivalent quality and cost is available. Similarly, journeys can be essential for other reasons - attending school or medical appointments for example - but using the car may be unnecessary. Other journeys are traditionally considered more ‘discretionary’ in terms of the choice of the trip maker – such as shopping, leisure and socialising – but are still essential for the economy, as people spend money out and about, and provide vital social interaction.

TfL conducted research asking London residents to classify how important they thought it was that a range of journeys could be made by car. Very few people thought that it was essential for all trips to be able to be made by car, but very few people thought that the car was never necessary. Most fell somewhere in the middle, and believed that some car journeys were more essential than others. Figure 64 shows the factors considered important in determining whether a trip should be able to be made by car. Whilst London residents did consider work trips more important than leisure trips, this was less important than, for example, if someone was sick or disabled, was travelling with children or goods, or may be concerned about their safety. In general, the consensus was that an alternative needed to be within 10 minutes of the time taken by car to be considered acceptable, although a considerable minority thought that an alternative was only acceptable if it was quicker. This research suggests that it is acceptable to reduce car travel as long as it remains possible to make essential journeys.

Figure 64 Factors which determine the perceived importance of being able to travel by car for a given journey

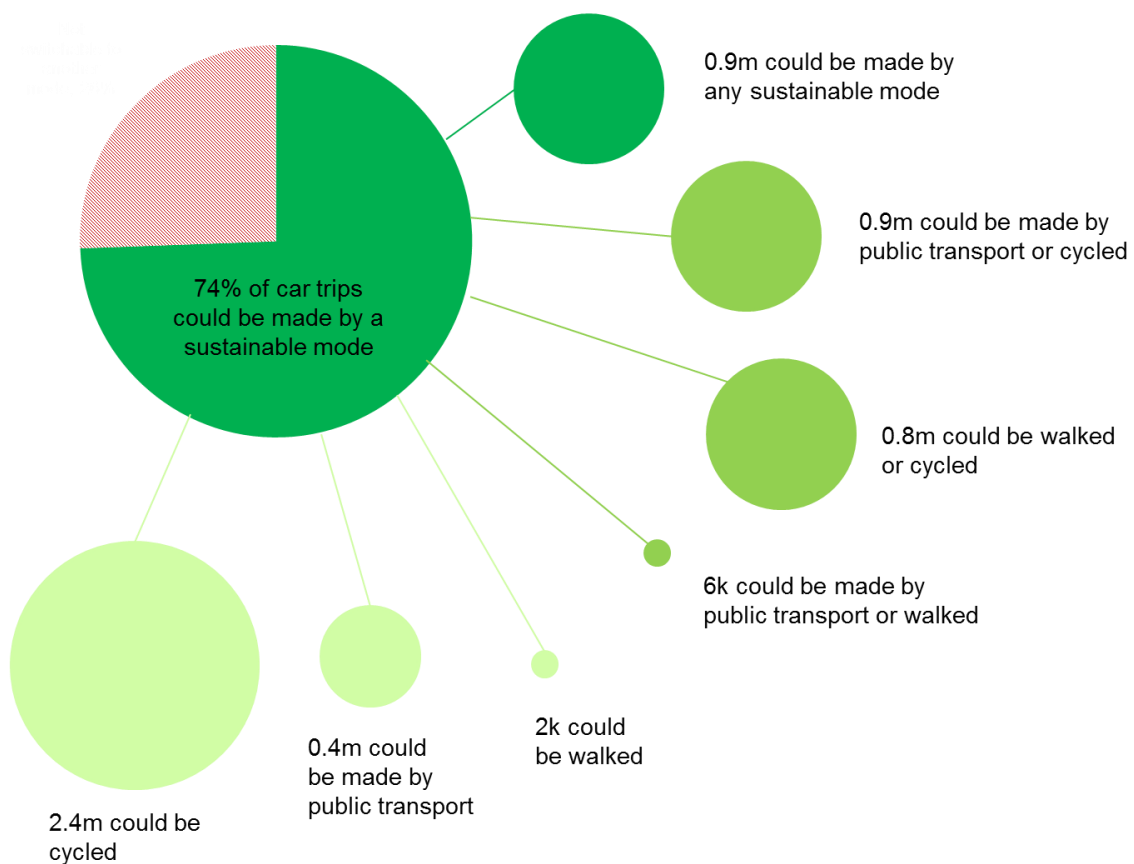


Source: City Planning

The potential to reduce travel by car

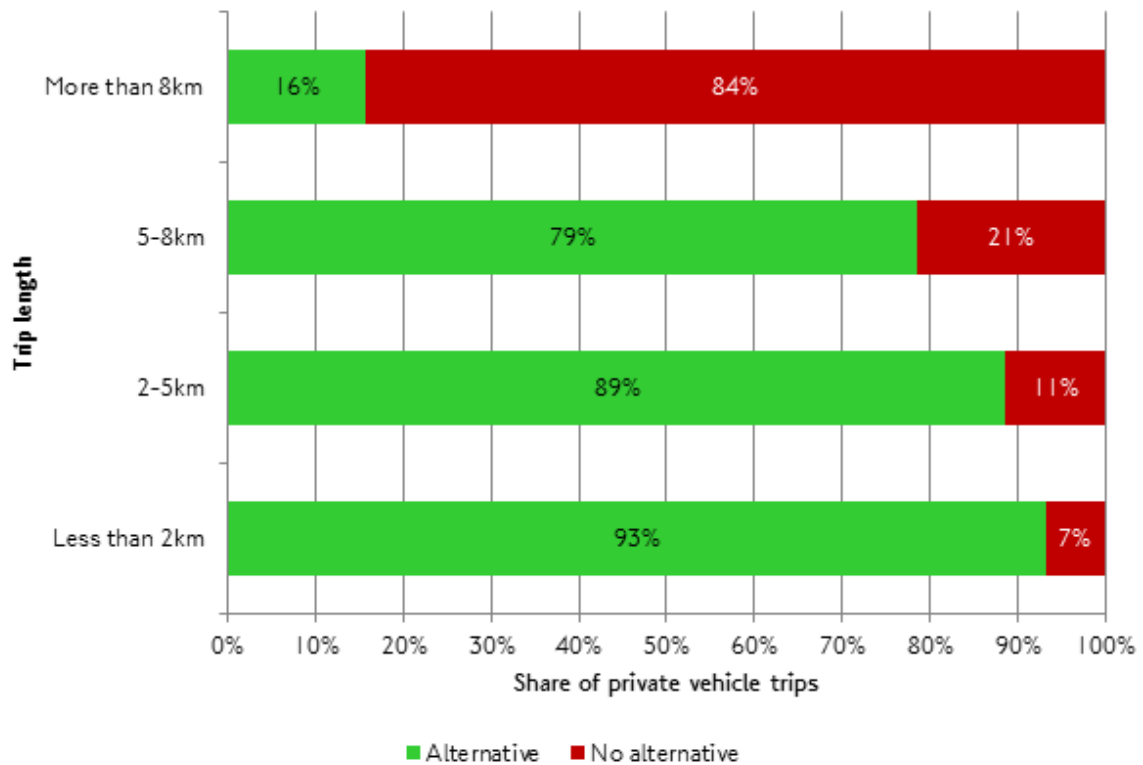
Research suggests that there is the potential to deliver mode shift from the car if the right policies were put in place. Analysis suggests three quarters of existing car trips have an alternative available, based on the known characteristics of the trip and trip maker, shown in Figure 65. Shorter trips were more likely to have an alternative available: around nine in ten journeys less than 5km had an alternative available compared to around one in six trips over 8km (see Figure 66). Shorter trips are also more likely to have more than one alternative option available. It's more difficult to assess if the quarter of car journeys made by non-Londoners have an alternative available, but it is reasonable to assume that some do.

Figure 65 Potential for existing car journeys to be made by a sustainable mode



Source: City Planning

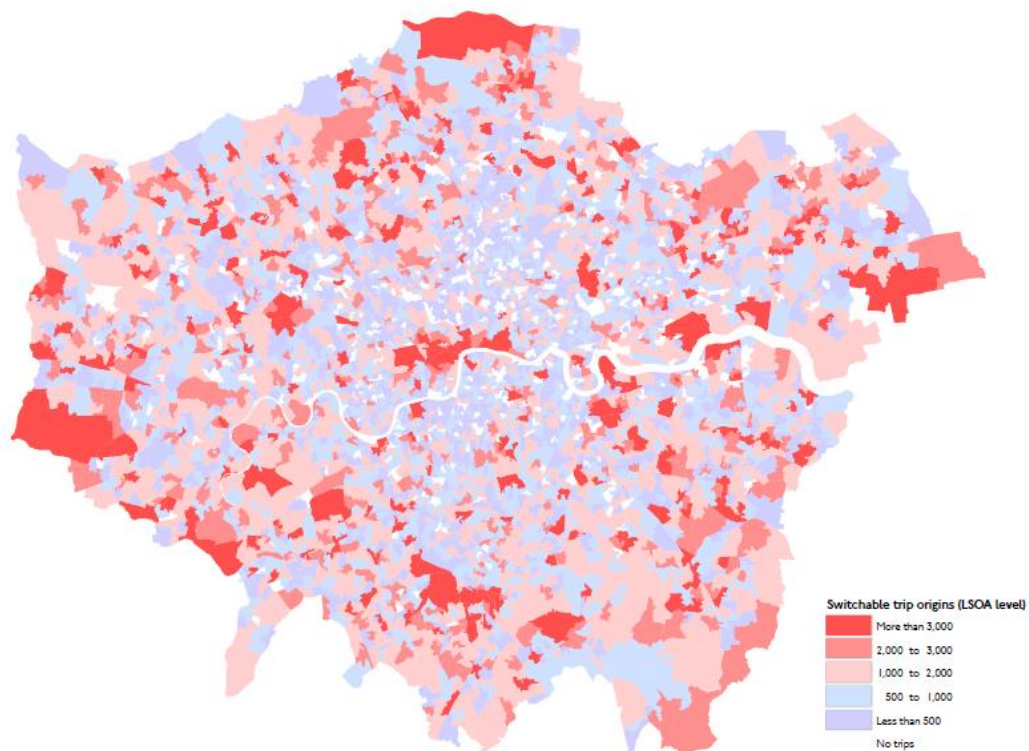
Figure 66 Potential for existing car journeys to be made by a sustainable mode, by distance



Source: City Planning

There is the potential to deliver mode shift from the car all across London, but the greatest potential - in terms of the number of trips that could be made by an alternative mode – is in outer London, as shown in Figure 67 below. This is challenging as outer Londoners are more committed to travelling by car and less amenable to using other modes, particularly cycling. 40 per cent of trips that could potentially be made by cycle are made by people who rarely or never cycle and who tell us that they would not consider cycling. It is also a challenge because the sheer size of outer London means that it is difficult to deliver significant change to the network.

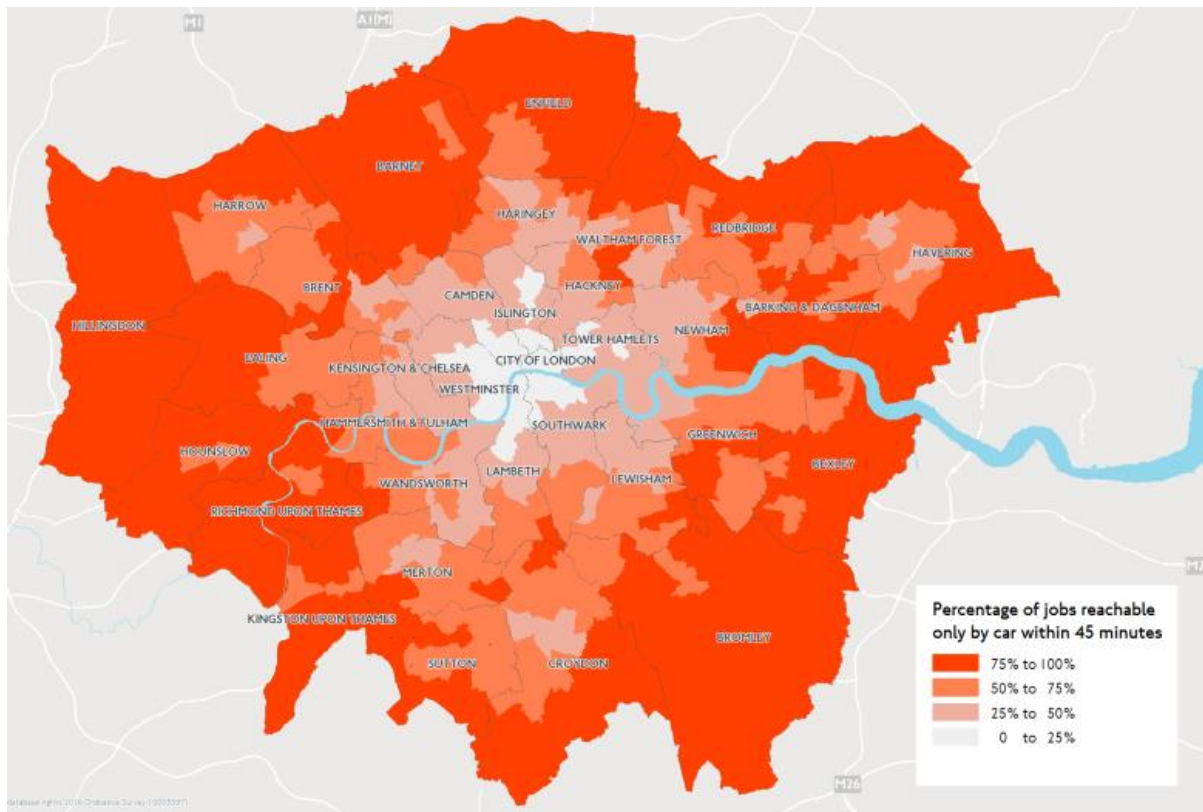
Figure 67 Potential for existing car journeys to be made by a sustainable mode, by distance, by origin



Source: City Planning

Around a quarter of all car journeys made by London residents do not have a realistic alternative mode available – they can only be made by car at present. These journeys are predominantly in less well connected parts of Outer London, reflecting the need to embed different priorities and aspirations for modal shift for different areas in London. Figure 68 shows an estimate of ‘car dependency’ in London – highlighting places where people are more likely to need to use the car to access opportunities and services. In these parts of London, improving access to public transport, particularly buses, and cycle routes has the potential to ‘unlock’ mode shift by making new journeys possible by modes other than the car. In terms of interaction between modes, the strongest link with car is travel by bus, so if car use is decreased the mode most likely to be used more is bus (and vice versa). With better public transport options, trips that currently ‘have’ to be made by car could be made by another mode instead.

Figure 68 Car dependency (for access to employment)



Source: City Planning

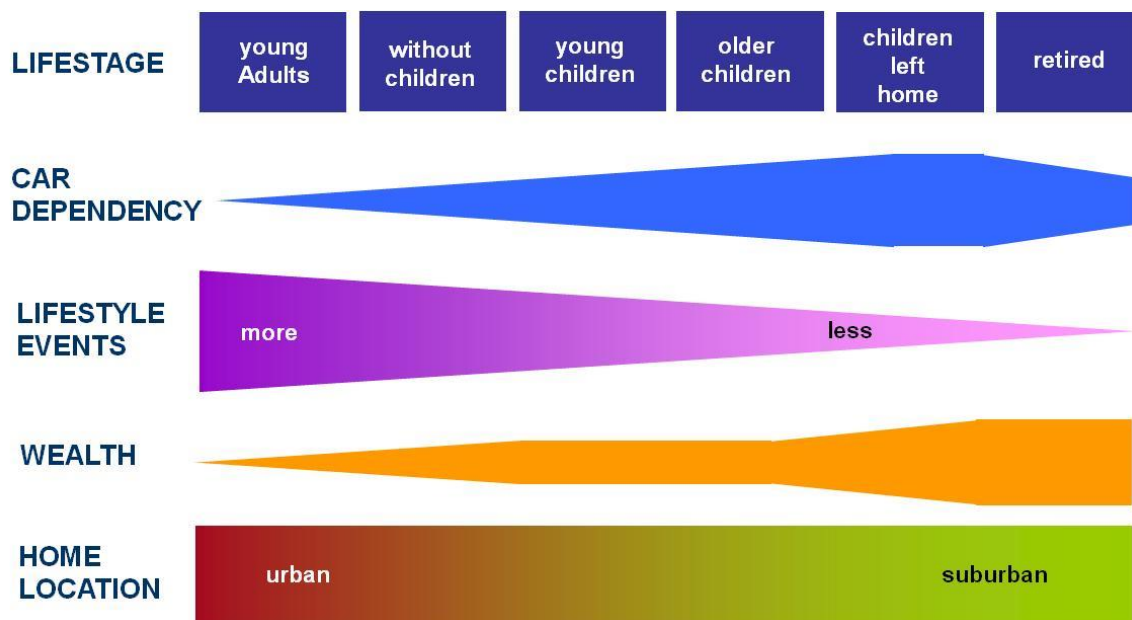
The fact that the potential exists for mode shift presents an opportunity. However, having an alternative available does not mean that people will switch. Their current preference is to use the car for the journeys they are making, and so one of a number of things would have to change for this choice to change, described in Figure 69 overleaf.

Figure 69 How change happens

Driver of change	Impact	Challenge
<p>Discovering a better alternative</p> <p><i>Some trip makers may have a better alternative available to them – one that better meets their needs - that they do not know about.</i></p>	<p>Evidence from the London 2012 Olympic and Paralympic Games was that this was particularly common where people were making an infrequent or unfamiliar trip, generally for shopping, leisure or other personal business purposes. In contrast, commuters generally had a good knowledge of the options available to them and few discovered a better option as a result of changes they made during the Games.</p>	<p>The challenge is to prevent a ‘car first’ mentality and create an environment in which people look at the sustainable options first, only using the car as a last resort.</p>
<p>Improved alternatives</p> <p><i>Improving the relative appeal of public transport, walking and cycling by investing in more and better services.</i></p>	<p>Where services are better, people are more likely to use them and less likely to travel by car – 75% of households in the least well connected parts of London own a car, compared to just 38% of those in the best connected places. Investment in cycle infrastructure has seen increases in cycle travel on those routes, and walking has increased where there has been investment in the public realm.</p>	<p>The challenge is to deliver a public transport and cycle network, and street environment that mean that sustainable modes are the best option for most journeys – quick, convenient and pleasant, and cost effective.</p>
<p>Current choice worsens</p> <p><i>Factors acting as a deterrent to car travel include increased costs, congestion, stress and unreliability.</i></p>	<p>When travelling by car gets more expensive, fewer people do it. The introduction of the Congestion Charge led to a 30% reduction in chargeable vehicles and car travel falls as fuel price rise. Car travel has fallen as congestion has risen. Londoners have told us that the car is becoming less convenient, driven by factors such as stress, difficulty parking, and unpredictable journey times.</p>	<p>The challenge is to deter people from travelling by car when it is not necessary, without unreasonably constraining access to opportunities and services, or preventing participation in the community.</p>
<p>Changing circumstances</p> <p><i>Other changes – where someone lives or works, or to their finances or health – makes people re-assess their choices.</i></p>	<p>Most changes in car use (over 90%) are associated with a change in circumstances or a life event, most commonly a change in job, moving house, or a change in family circumstances. Once drivers are prompted to think about their travel, other motivations come to play, such as a desire to save money or get fit.</p>	<p>The challenge is to ensure that when change happens, it is easy to make a sustainable choice – for example by ensuring new homes and workplaces are well served by sustainable transport.</p>
<p>Changing preferences</p> <p><i>As attitudes to the role of the car change over time, these are reflected in behaviour.</i></p>	<p>Traditionally, the car has been seen as providing freedom, independence, and status, and learning to drive has long been seen as a ‘rite of passage’ to adulthood. There is evidence that young people’s attitudes are changing, with fewer choosing to get a driver’s license. And many Londoners choose to live without a car, considering it an unnecessary hassle.</p>	<p>The challenge is to create a city in which people do not feel they need a car to provide freedom or independence, or to participate fully in society – a place where they can live happily car-free.</p>

Some people are more amenable to change than others. This partly reflects their life stage: younger people’s lives change more often as they start their careers, climb up the housing ladder, form partnerships and start a family. These wider life changes create opportunities for changes to travel behaviour. By contrast, as people get older their lives become more settled, incomes tend to rise and they are more likely to live in suburban areas, all making it more likely that they will settle into a pattern of habitual car use. Figure 70 shows the impact of life stage on car dependency. Over the past 15 years, London’s growth has come from a rising population of younger working-age adults, who wanted to live more centrally and were happy to live without a car. A London with more older people in it would lead to a more settled population who were, unless tomorrow’s older people are very different to today’s, less amenable to change.

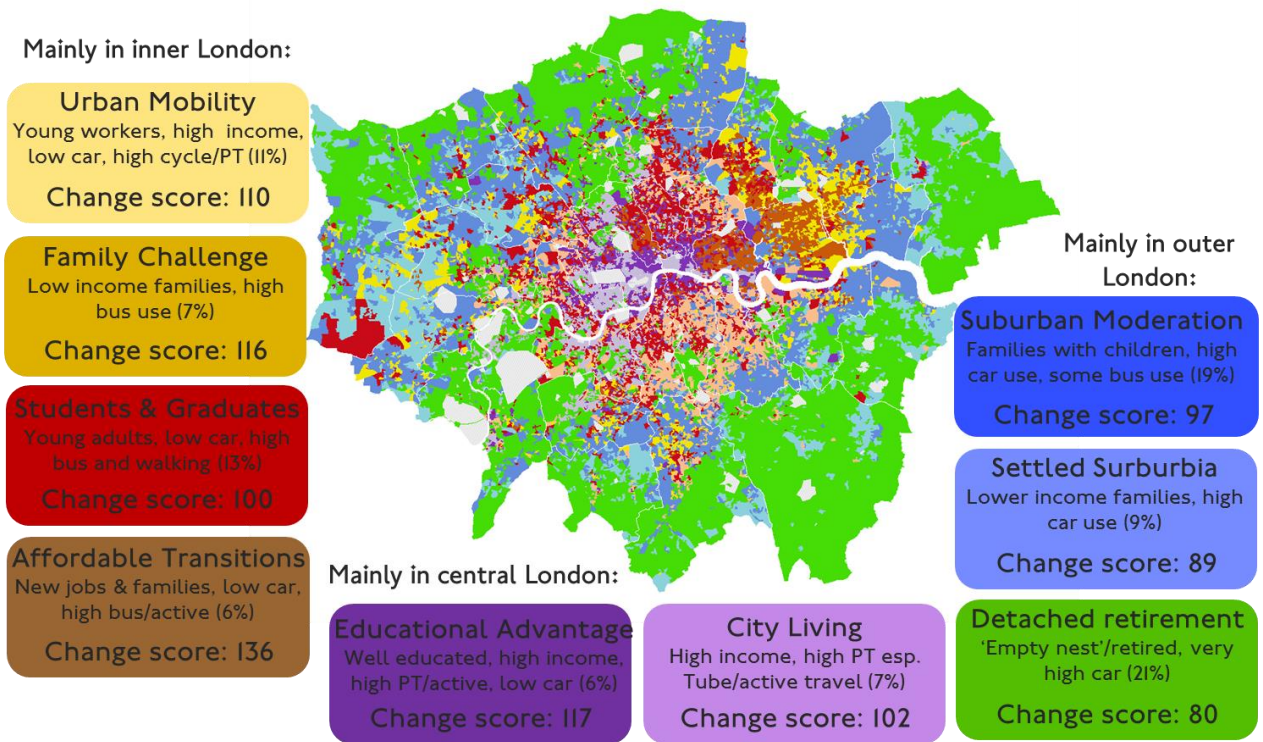
Figure 70 Relationship between life stage, car dependency and other factors influencing travel behaviour choices



Source: Roads Task Force Technical Note 16: Understanding why people change behaviour (TfL 2013)

TfL has developed a bespoke segmentation tool, the Transport Classification of Londoners or TCOL, to help us understand the characteristics of the London population in terms of their lifestyle and travel preferences, and how amenable to change they are. The tool uses data from the GLA’s London Output Area Classification, based on the 2011 Census; TfL’s segmentation survey; and the London Travel Demand Survey. TCOL helps us identify what type of people are living in London, what their preferences are, how amenable they are to change and what might be effective in persuading them to change. The classification is summarised in Figure 71 whilst Figure 72 shows London’s population by the propensity to reduce car use, based upon this classification. This shows that residents of inner London are more amenable to change and more likely to reduce their car use than residents of outer London. In general, residents of the least densely populated boroughs have the lowest propensity to reduce their car use. This presents a challenge to transport planners as – inevitably – the areas with the highest car mode shares contain the people least willing to consider shifting from the car.

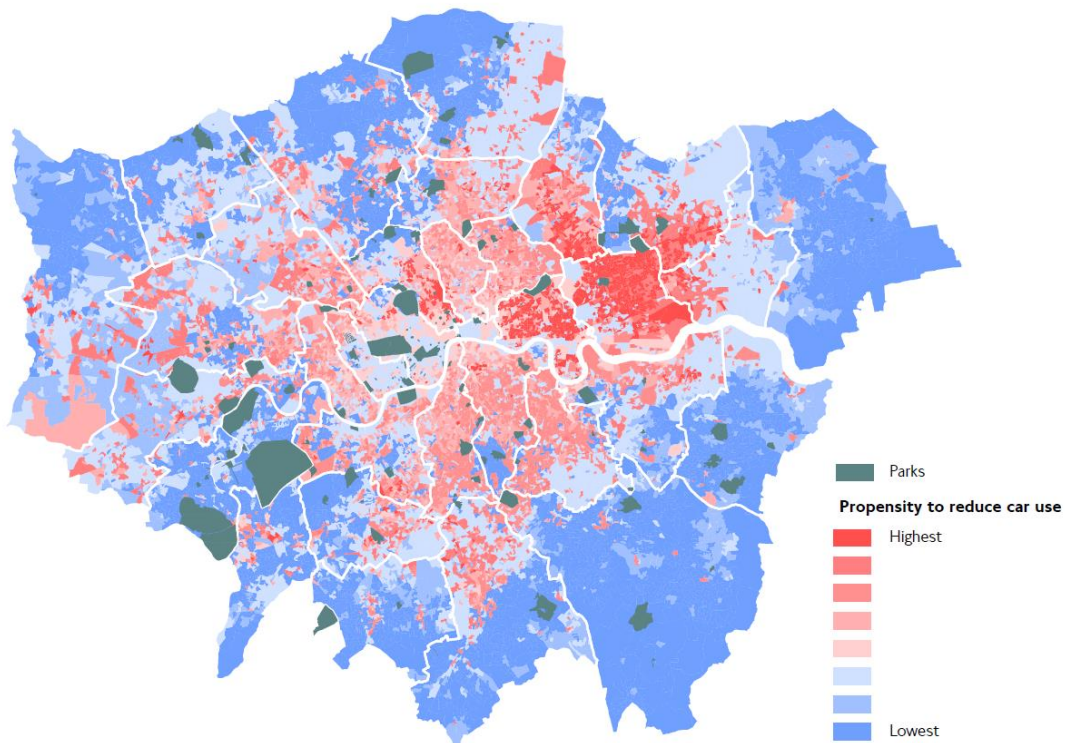
Figure 71 Transport Classification for London (TCOL)



Source: City Planning

Notes: Per cent in brackets refers to proportion of population in each group. A change score over 100 means someone is more likely than average to change behaviour, under 100 less likely.

Figure 72 Propensity to reduce car use, by Lower Super Output Area (LSOA)



Source: City Planning

The relative ease of realising mode shift will reflect the quality/convenience of alternatives and also how amenable the trip maker is to change. Based on a combined analysis of trips that could feasibly be made by another mode with segmentation data from TCOL, Figure 73 shows the composition of car trips by the quality of the available alternative and whether the trip-maker is amenable to change. The definitions used are as follows:

- A 'Good' alternative is defined as a trip which would be quicker or the same speed by PT, would take no more than 20 minutes by bike (defined as under 5km) or 10 minutes on foot (defined as under 1km).
- A 'Middling' alternative is defined as a trip which would take no more than 10 minutes longer by PT, or could be cycled in up to 45 minutes or walked in up to 20 minutes.

The importance of tackling both the 'pull' and 'push' factors determining travel choices is clear – 2.83 million trips which could be switched to a more sustainable mode are made by people who are committed to travelling by car and reluctant to consider other alternatives. It is unlikely that interventions targeted only at improving the alternatives would be sufficient to persuade this group to change mode.

Figure 73 Trips currently made by car that could feasibly be made by another mode, by the quality of the alternative and the propensity to change of the trip-maker

	Middling alternative	Good alternative
Top 3 segments	<p>126k private vehicle trips</p> <p>This group may consider shifting if the alternative options were better publicised or slightly more competitive, as this group is most amenable to considering an alternative option.</p>	<p>585k private vehicle trips</p> <p>This group represents the best opportunity for change and may be amenable to information about their alternatives. They will be most responsive to service improvements and initiatives to improve conditions for walking and cycling.</p>
Middle 3 segments	<p>222k private vehicle trips</p> <p>This group may be reluctant to change given the potential inconvenience of switching from the car, but may shift in response to a significant change in the quality or cost of alternatives.</p>	<p>1,030k private vehicle trips</p> <p>This group, whilst having a good alternative available to them, are still reasonably attached to the car, and may shift if travel by car becomes less appealing or if the alternative options were better publicised or slightly more competitive.</p>
Bottom 3 segments	<p>605k private vehicle trips</p> <p>This group has a strong attachment to the car and their trip is likely to be longer or more inconvenient if they were to switch. But – may shift in response to a significant change in the quality or cost of alternatives.</p>	<p>2,830k private vehicle trips</p> <p>This group has a strong attachment to the car and may be reluctant to change even where a good alternative exists and are unlikely to respond to information. But – may shift if travel by car became less appealing.</p>

Source: City Planning

The volume of car travel in London leads to noisy, polluted and unpleasant streets, deterring active travel and damaging health. The congestion caused by excess traffic brings stress and economic costs to drivers, as well as slowing down bus journeys. London residents recognise that some car journeys are more essential than others, and analysis shows that three quarters of car journeys could be made by a more sustainable mode. However, we know that many Londoners, particularly those who drive the most, are committed to travelling by car and relatively unwilling to try alternatives. Delivering mode shift will require changes to people's preferences, and to the relative appeal of travel by car and the alternatives. In reality, this means that car travel would need to be less appealing, and the other modes more appealing, to deliver significant change and realise the potential that has been identified.

4.8 Summary: Healthy Streets and healthy people

Walking is an active and enjoyable way to travel and more people could walk rather than drive.

At present, Londoners walk more than people living elsewhere in the UK, with 30 per cent of all trips in London made on foot. The shift from the car to public transport has brought with it huge increases in the amount of walking done to access stations and stops, but the share of journeys walked all the way has remained the same for several decades. Nevertheless, there is potential to deliver mode shift to walking, particularly for short journeys in outer London currently made by car. Doing so will mean meeting expectations for a Healthy Street environment. Whilst the car remains a cheap and convenient option, people will continue to drive walkable journeys

Cycling is an efficient and healthy way to get about and there is considerable potential for growth in cycle travel.

Cycling is now a major transport mode in London, with 670 thousand journeys made each day. Cycle growth has been particularly strong in central London, with flows across the central cordon increasing by more than 200 per cent since 2001. The rise of cycling has reflected considerable investment in infrastructure to make the experience safer and more appealing but there is much more to be done in order to truly make London feel like a city for cycling. Cycling is the mode of transport with the greatest untapped potential in London. There are 8.2 million trips currently made by a motorised mode that could feasibly be cycled, with a further 1.6 million that could be cycled part of the way. Many journeys could be cycled in under 20 minutes, and for many journeys cycling would be quicker than the current mode of travel used. Cycling is cheap, efficient and reliable, and most people agree that cycling can be a pleasant way to get about. People that don't currently cycle in London can be concerned about safety and worried that cycling may not be a convenient option for them – to help them start cycling means overcoming a range of practical and attitudinal barriers. More high quality, safe and pleasant routes, supported by plentiful and secure parking, will encourage new people to start cycling and existing cyclists to cycle more.

Vision Zero for London means our long term vision is to reduce road danger so that no deaths or serious injuries occur on London's streets – in 2015, nearly 2,100 people were killed or seriously injured on London's streets

In 2015, 2,092 people were killed or seriously injured (KSIs) on London's streets, 42 per cent below the 2005-09 baseline. The previous target was met six years early and London is on-track to achieve the target established in 2015 of a 50 per cent reduction in KSIs by 2020. Current forecasts show that if progress continued at a similar rate, KSIs would continue to fall to around 1,000 by 2040.

However, the proportion of KSIs made up of vulnerable road users has risen, as the greatest reduction has been amongst car occupants, and more than 2,000 people were killed or seriously injured on London's roads in 2015. Delivering Vision Zero will only be achieved through reducing the dominance of motorised traffic on London's roads and tackling all sources of road danger.

Buses and coaches are disproportionately involved in collisions with pedestrians and cyclists and in the last three years there were on average 200 people killed or seriously injured in collisions involving buses or coaches.

Improving the safety and security of transport and travelling in London remains a priority

The recent terror attacks in London and Manchester have highlighted the importance of ongoing efforts to reduce the likelihood and impact of these terrible incidents on London's streets and public transport networks and to improve the safety and security of transport and travelling.

Crime on the TfL public transport network fell more than 50 per cent between 2005/06 and 2016/17. Concerns about the risk of crime and disorder can act as a barrier to travel – surveys carried out in 2016 found that 18 per cent of Londoners could recall an incident in the last three months which had made them feel worried about their personal safety, and women, black and minority ethnic and disabled Londoners are more likely to be concerned about their safety. In future, reducing crime and improving people's confidence to travel will be challenging in the context of the threat of terrorism, financial constraints, growing passenger numbers and the changing risk and nature of crime

Rising traffic and falling road capacity for private vehicles means that congestion will rise for essential traffic

Congestion causes stress and frustration, and limits the amount people can travel because journeys are slow and unpredictable. For businesses, congestion costs money as workers spend time queuing in traffic, it is difficult to make deliveries on time, and an unreliable road network harms the reputation of London. Bus journeys become slower and less reliable. Despite a falling car mode share, without further action traffic is expected to rise across much of London, with 8.6 million more kilometres travelled by road on average day in 2041 compared to 2015. Over the same period, the amount of space available for use by general road traffic is expected to reduce by 3 per cent, more in central London. By 2041 the average Londoner could waste two and a half days a year sitting in congested traffic.

In central London, weekday daytime congestion has now returned to levels not seen since the introduction of the Congestion Charge in 2003 and outside of charging hours, traffic, speeds and congestion on the central London road network in the evenings and at weekends are as bad or worse than during charging hours, affecting central London's appeal as a shopping, leisure and entertainment destination.

Industry trends and economic growth will lead to more freight traffic, especially vans

London's continued success critically relies on safe, reliable, sustainable and efficient goods delivery and servicing – it is estimated that freight adds approximately £7.5 billion to the GVA of London. As London grows, the demand for freight activity will grow accordingly but, as with all travel, we must ensure that this need is met in a way that minimises its negative impact on the rest of the city. Between 2015 and 2041, van traffic is expected to increase by a quarter as a result of trends in ecommerce, an increase in just-in-time deliveries, and lengthening supply chains.

For Healthy Streets, we need to achieve population and jobs growth without a matching rise in car travel

Since its invention, the car has provided welcome connectivity and opened up new opportunities. Even in a densely populated city such as London, some journeys can only reasonably be made by car. But the amount of space that can or should be taken up by private road transport is limited, and the population is growing. Over the past 15 years, car use has been falling despite a rising population. Furthermore, car ownership is linked to inactivity – 70 per cent of people without a car do some active travel in a day, compared to 40 to 50 per cent of car owners – and car traffic causes emissions damaging to health and the environment and road danger. Traffic clogged streets deter people from walking and cycling and damage quality of life. Underlying the challenge of delivering Healthy Streets and healthy people in London is a basic need to deliver population and jobs growth without a commensurate rise in car travel.

Three quarters of car trips could be made by a more sustainable mode, but many people are reluctant to change

There remains great potential to deliver mode shift from the car to more sustainable modes across London, and particularly in outer London – 74 per cent of all Londoners' car trips and 93 per cent of car trips under 2km could feasibly be made by an alternative mode. Some people are more amenable to change than others – the challenge is that the greatest amount of car use happens in places where people are most committed to travelling by car and least willing to change. Delivering mode shift requires changing people's preferences. In practice, realising the potential that has been identified would mean car travel becoming less appealing and other modes more appealing in terms of their cost, convenience and freedom from stress.

5 Environment

Transport in London affects the local environment and quality of life in the city, and emissions from London's transport contribute to climate change. Currently, road transport is responsible for half of the main air pollutants harmful to human health. This section considers the range of environmental challenges facing London today and over the next 25 years, including emissions, noise, the built and natural environment and the need to adapt to a changing climate.

Environment: Summary

- Nitrogen dioxide (NO₂) and particulate matter (PM) pollutants are collectively estimated to cause around 9,400 equivalent deaths every year in Greater London and impose an economic cost somewhere between £1.4bn and £3.7bn a year.
- London is not compliant with legal limit values for NO₂ and is not expected to achieve compliance until 2025. About a quarter of London's roads are forecast to be non-compliant with NO₂ levels in 2020 and of these, more than four in ten require a reduction of more than a quarter in road transport emissions to achieve compliance.
- London is compliant with EU limit values in terms of levels of PM smaller than 2.5 micrograms (PM_{2.5}) but does not meet levels recommended by the World Health Organisation of PM smaller than 2.5 micrograms and is not expected to do so until well after 2030. Whilst new technologies such as regenerative braking have the potential to reduce emissions somewhat, all vehicles, including those that are zero emission from the tailpipe, create PM emissions through their tyres and brakes and thus mode shift from the car is the only effective solution.
- The Mayor has stated his ambition for a zero carbon London by 2050 and yet the current situation is that CO₂ emissions from road transport are forecast to reduce by around 50 per cent in 2050 compared to 2013. Long term emissions reductions will depend on technological advancement but will also require significant reductions in car use.
- London's transport CO₂ includes emissions arising from the taxiing, take-off and landing of aircraft at Heathrow and City Airports. There is no national policy to fully decarbonise aviation and the expansion of Heathrow would significantly increase CO₂ emissions.
- More than 1.6 million people in London are exposed to road traffic noise levels during the day above the level defined by the World Health Organisation as causing health problems. Heathrow alone exposes 750,000 people to significant aircraft noise and with a third runway that number could increase to almost a million people.
- For London, failing to adapt to climate change will damage the operational reliability of the transport network. Increases in extreme weather events brought by climate change threaten the resilience of the transport network and may increase the cost and complexity of maintaining operational performance standards. Failure to adapt could make London a less appealing place to live, work and do business.

5.1 Air quality

Transport is the biggest source of emissions damaging to health in London: around half of emissions (NO_x and particulate matter (PM)) in Greater London come from road transport. High levels of nitrogen dioxide (NO₂) and particulate matter (PM) damages the health of London residents, with transport a significant contributor to these pollutants. These pollutants are collectively estimated to cause around 9,400 equivalent deaths and 3,150 hospital admissions (from respiratory and cardiovascular events) every year in Greater London. The economic cost is somewhere between £1.4bn and £3.7bn a year. There is strong evidence that poor air quality affects children's lung development, and emerging evidence that improving air quality can reverse those effects. There is also increasing evidence of the link between exposure to pollution and dementia. A substantial reduction in deaths and hospitalisations could be achieved by a drastic reduction in pollutant emissions in Greater London.

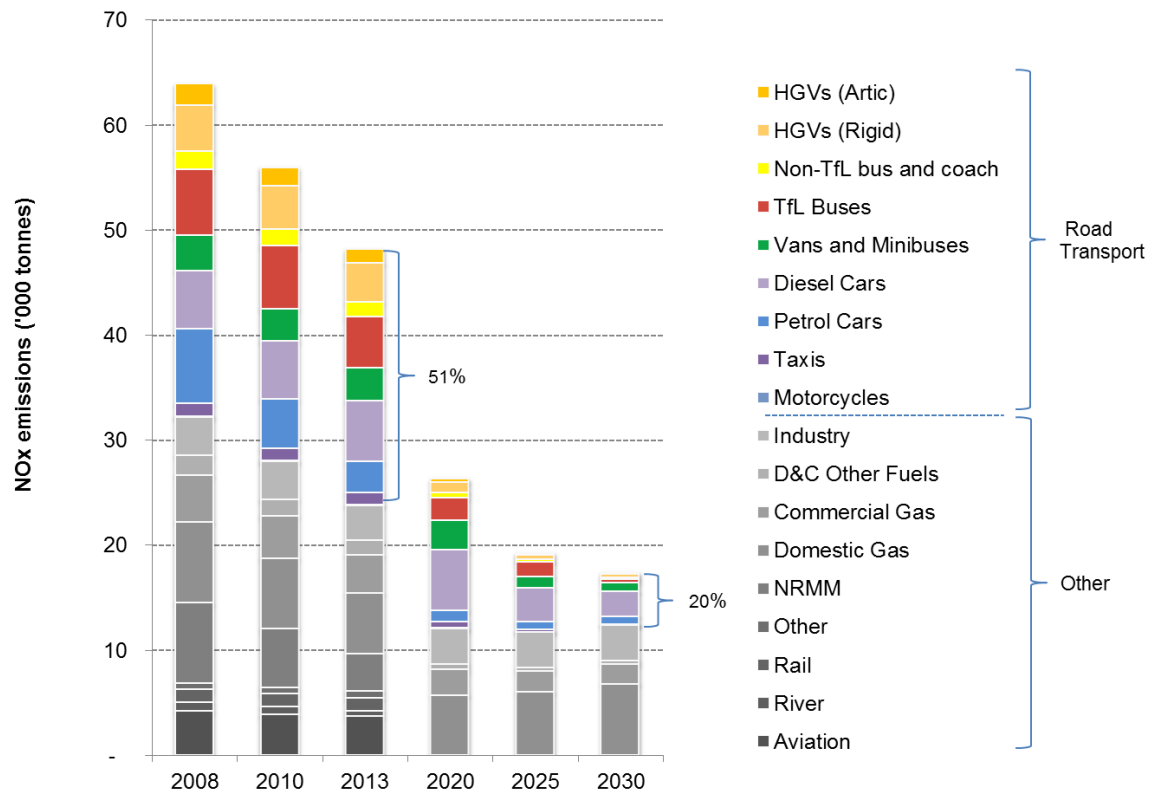
The communities suffering the most from poor air quality are often the most vulnerable in society. The health impacts of air pollution fall disproportionately on the most vulnerable communities, affecting the poorest, the youngest, oldest and those from minority ethnic groups more acutely. Populations living in the most deprived areas are on average currently more exposed to poor air quality than those in less deprived areas. Over 360 primary schools and 442 other educational institutions in the capital are located in areas exceeding safe legal pollution levels

Legal limits (called 'limit values') have been set for concentrations of pollutants in outdoor air which have been transposed into English law. London's air quality has improved significantly and London is now legally compliant for all pollutants except nitrogen dioxide (NO₂). Failure to meet these limits may result in significant fines being imposed on the UK Government under EU law. Although DEFRA has ultimate responsibility for meeting EU limit values and reporting on compliance, the Mayor leads on the implementation of measures in London.

Nitrogen Oxides

In 2013, around half of nitrogen oxide (NO_x) emissions in London came from ground-based transport, this is expected to reduce to about 20 per cent by 2030 as result of cleaner vehicles in the vehicle fleet over time. Figure 74 shows the sources of NO_x emissions in London.

Figure 74 Estimated source of NO_x emissions, 2008 to 2030

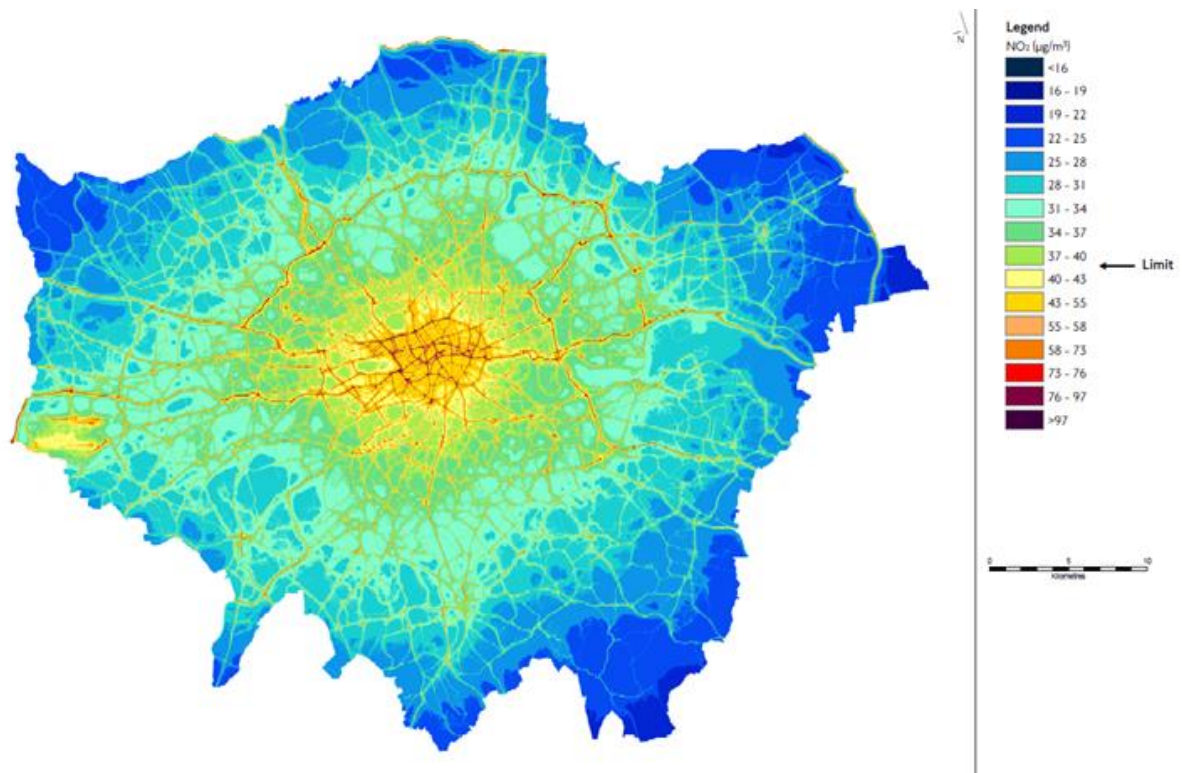


Source: City Planning, London Atmospheric Emissions Inventory

Figure 75 shows annual mean NO₂ concentrations in 2013 and Figure 76 shows the expected NO_x emissions by vehicle type for the period 2020 to 2050. Under the most recent government plans, London will not comply with legal limits for NO₂ until 2025, 15 years after the original deadline. About 25 per cent of London’s roads are forecast to remain non-compliant with NO₂ by 2020. Of these, about a third require reductions of between 25 and 50 per cent of road transport NO_x emissions, and a tenth require at least a 50 per cent reduction. However, reductions in emissions from other sources in London (such as from domestic and commercial heating) and from sources outside London also play an important roll in delivering improving air quality over time. The introduction of ‘real-world’ testing for cars and vans into the ‘Euro 6’ European vehicle-type approval process should mean that new vehicles are far less polluting than previous models. Real world testing has proved this to be effective for lorries, buses and coaches.

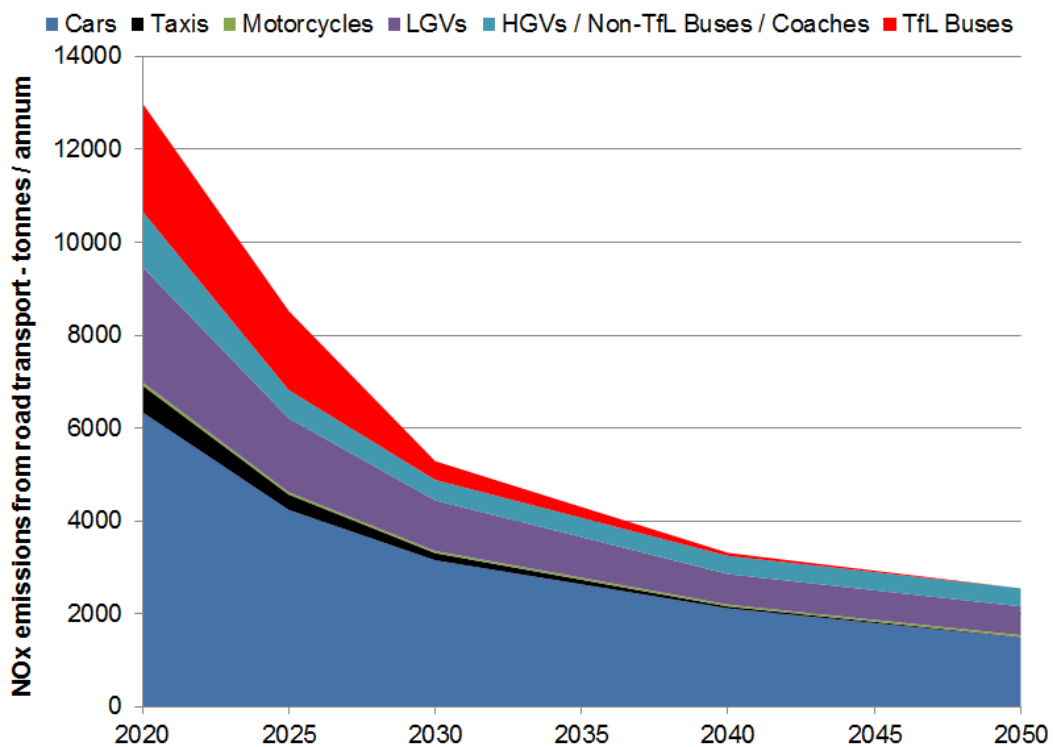
Diesel is the most significant source of nitrogen oxide (NO_x) emissions – diesel vehicles emit significantly more NO_x than petrol. The reason for this is partly because of the under-performance of diesel light vehicle emission standards (cars and vans) over time, with significant discrepancies between official emission measurements and real-world vehicle performance in urban environments. Diesel vehicles have been incentivised by national Government in order to achieve CO₂ savings, at the expense of local air quality – reversing the ‘dieselisation’ of the fleet by simply reverting to petrol vehicles would do the reverse, reducing air quality pollutants but increasing carbon emissions, however this can be balanced with petrol hybrid and plug-in hybrid vehicles which would provide additional reductions in CO₂ emissions over a purely conventional petrol vehicle.

Figure 75 Baseline NO₂ concentrations, 2013



Source: City Planning, London Atmospheric Emissions Inventory 2013 (Update)

Figure 76 Baseline (without interventions proposed in MTS) NO_x emissions, 2020 to 2050

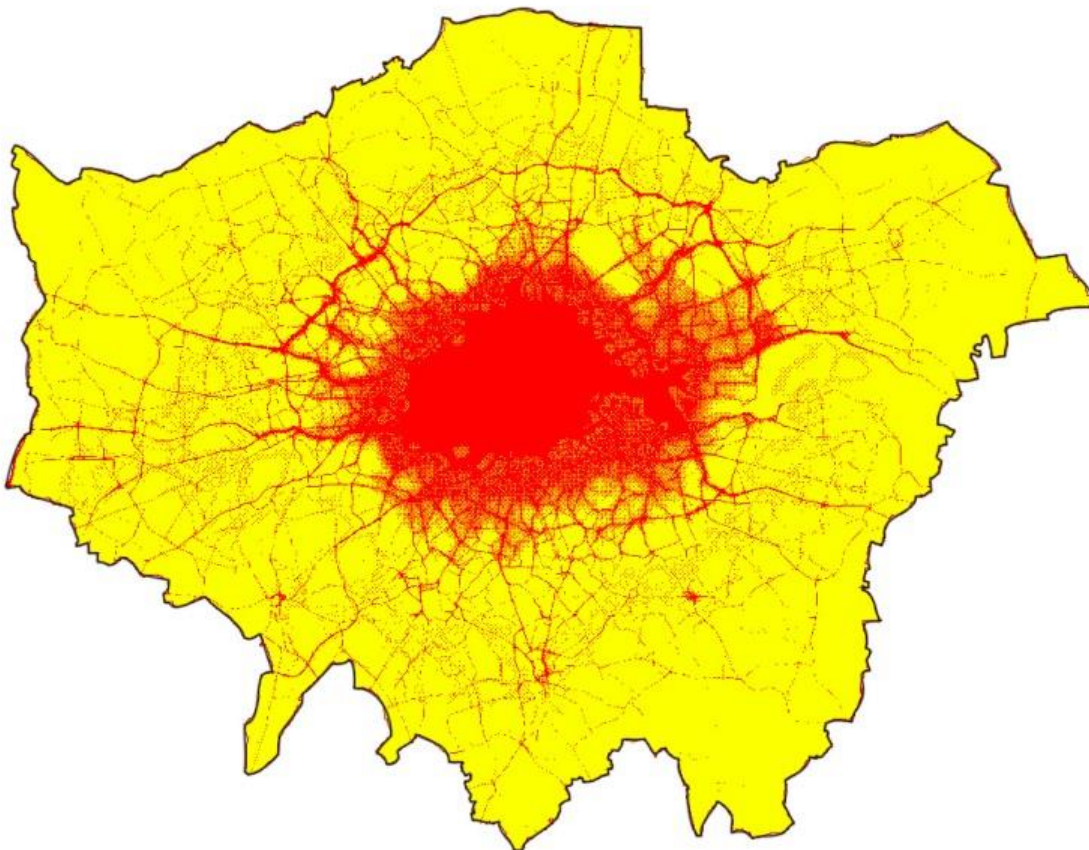


Source: City Planning

Particulate matter (PM)

About 50 per cent of small particle (PM_{10}) pollutants in London come from ground-based transport. London is currently compliant with EU limit values in terms of levels of PM smaller than 2.5 micrograms ($PM_{2.5}$). However, while there is no safe level for particulates, London does not meet levels recommended by the World Health Organisation (WHO) of PM smaller than 2.5 micrograms. The current legal limit is an annual mean of 25 micrograms per metre cubed and the WHO recommended limit is 10 micrograms per metre cubed. Without further action; this is projected to be the case until well after 2030. Figure 77 shows the forecast concentrations of $PM_{2.5}$ that are expected across London by 2030 unless further action is taken.

Figure 77 Baseline (without interventions proposed in MTS) $PM_{2.5}$ concentrations, 2030 compared to WHO limits

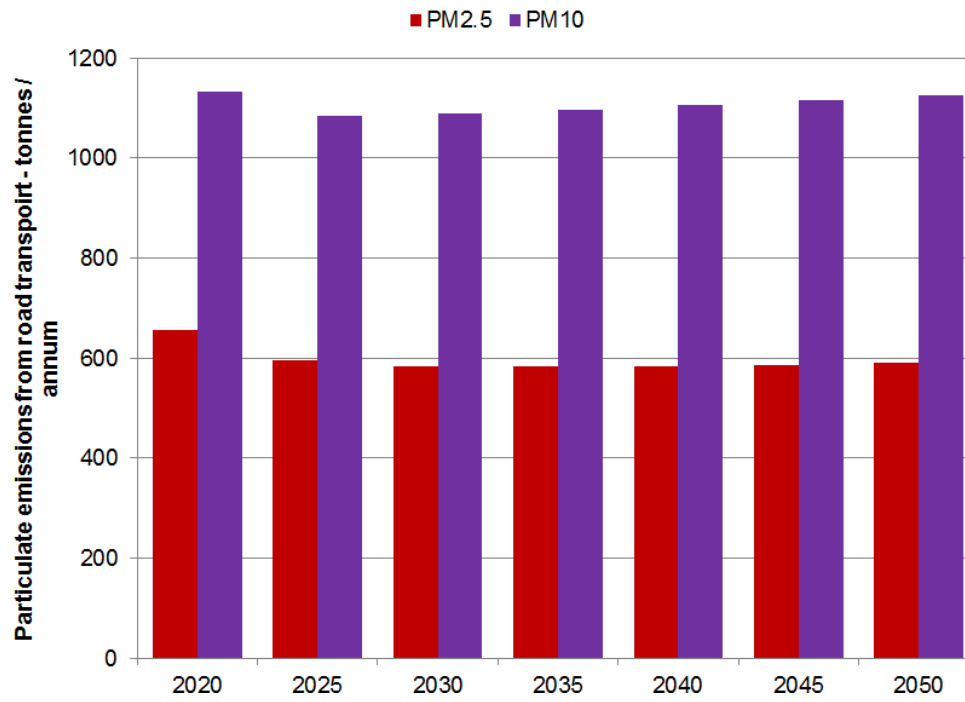


Source: City Planning

Notes: Yellow: >10 and < 15 $\mu\text{g}/\text{m}^3$, Red: >15 $\mu\text{g}/\text{m}^3$

At present, over 75 per cent of PM emissions from road transport come from tyre and brake wear and by 2030, estimates suggest this may increase to 90 per cent. Figure 78 shows the forecast profile of PM emissions from road transport between 2020 and 2050. Initial reductions are delivered through measures designed to clean up vehicle exhausts, after this, emissions increase in line with traffic. Whilst new technologies, including the use of regenerative braking, have the potential to reduce emissions somewhat, all vehicles, including those that are zero emission from the tailpipe, create PM emissions through their tyres and brakes and thus mode shift from the car is the only effective solution.

Figure 78 Baseline (without interventions proposed in MTS) PM emissions from road transport, 2020 to 2050









Source: City Planning

5.2 Climate change

Climate change is a serious threat to global quality of life. Figure 79 summarises why climate change matters globally – and, section 5.3 of this report lays out the possible implications of a changing climate on London’s transport network. Carbon dioxide concentration is 40 per cent higher than in pre-industrial times and between 1880 and 2012, the earth’s surface warmed by 0.85° Celsius. Transport emissions account for 23 per cent of CO₂ emissions in London and thus London’s transport providers must play a significant part in reducing carbon emissions.

Figure 79 Summary of Global Climate Change Challenge

Reality Check

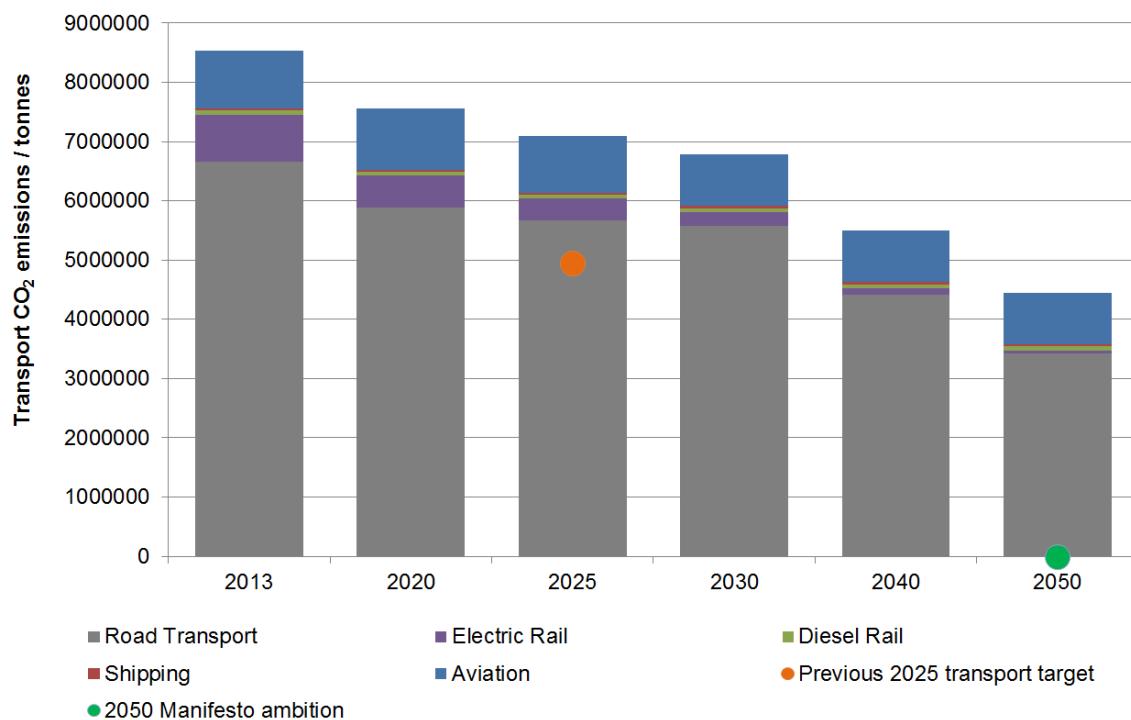
-  **1.** **Carbon dioxide** concentration is 40% higher than in pre-industrial times.
-  **2.** **Human activity** caused most of the warming between 1951 and 2010.
-  **3.** Earth’s surface **warmed 0.85°C** over the period 1880 to 2012.
-  **4.** **Heatwaves and heavy rains** have become more frequent since the 1950s.
-  **5.** Arctic sea **ice has declined** on average 3.8% per decade since 1979.
-  **6.** Global **sea level is expected to rise** between 26 and 82 cm by 2100.
-  **7.** Only an **aggressive mitigation scenario** can keep temperature rise below 2°C.

Source: IPCC Working Group 1: Fifth Assessment Report

The EU has committed to cutting its CO₂ emissions to 20 per cent below 1990 levels by 2020 and has offered to increase this to 30 per cent if other major emitting countries in the developed and developing worlds increase their commitments. The Climate Change Act 2008 set the UK’s emission reduction targets - the legally binding target is a reduction of at least 80 per cent by 2050 (against the 1990 baseline). London’s Climate Change Mitigation and Energy Strategy (CCMES) published in 2011 sets a target of a 60 per cent reduction in CO₂ by 2025 compared to 1990. The Mayor’s goal is more ambitious – his aim is for a zero carbon London by 2050.

The current situation is that CO₂ emissions from road transport are forecast to reduce by around 50 per cent in 2050 compared to 2013 (shown in Figure 80). While transport CO₂ emissions are projected to have fallen by more than 2 million tonnes by 2025 from 1990 levels, they will still be 2.35 million tonnes above the target previously set for 2025. Meeting this would require a reduction in emissions equivalent to a 40 per cent reduction in road traffic. The current trajectory (without further action) leaves a lot to do in the period 2030-50 and much more would be required throughout the period to 2050, and particularly in the early years of the Strategy, to deliver the Mayor's goal.

Figure 80 Total transport CO₂, no Heathrow, baseline (without interventions proposed in MTS), 2013 to 2050



Source: City Planning

Delivery will be particularly challenging given the growing population, the lack of progress to date and the fact that measures designed to improve air quality, such as the reversal of dieselisation, could have the effect of increasing CO₂ emissions. Technological advances will reduce vehicle emissions but this will be made quicker and more feasible if the distance travelled by car is reduced.

Long term emissions reduction is dependent on the transition to zero emission vehicles which will only happen if the infrastructure and incentives are in place to support an ambitious rate of conversion to electric vehicles and alternative technologies.

London's bus fleets are on a pathway to reach zero emission by 2037 and taxis and private hire vehicles by 2033. London's rail services are primarily electric and their CO₂ emissions will decrease in line with the decarbonisation of the energy supply. Improving the energy efficiency of rail services will also reduce pressure on the grid

and support decarbonisation. Achieving zero carbon will also require government to electrify all remaining diesel lines into London.

Long term electrification of the road vehicle fleet will add significant additional demand to London's energy system, increase the challenge of reducing CO₂ from electricity and reaching the zero carbon target. The forthcoming London Environment Strategy will set out measures to manage London's future energy system needs including transport.

London's transport CO₂ includes emissions arising from the taxiing, take-off and landing of aircraft at Heathrow and City Airports. Plans to build a third runway at Heathrow are unclear on what this would mean for meeting the UK's climate change targets.

In order for London to play its appropriate role in reducing carbon emissions and meet the Mayor's ambition for a zero carbon London by 2050, action will need to be taken to support the transition to zero emission vehicles alongside a significant shift away from private motorised modes and towards more sustainable modes.

5.3 Noise and the natural and built environment

Noise from transport

The World Health Organisation identifies environmental noise as the second largest environmental risk to public health in Western Europe. Noise affects health directly by causing sleep disturbance, stress/anxiety and damage to mental health, high blood pressure, cognitive impairment in children (and related impacts on school performance) and increased risk of cardiovascular disease. Indirectly, noise also discourages people from doing activities which are good for their physical and mental health, such as walking, cycling and socialising or participating in leisure activities. Exposure to noise from transport damages the health of Londoners, particularly those living on busy roads or on the flight path.

Many Londoners are not adversely affected by noise from transport, with average satisfaction with the reasonableness of noise from transport standing at 77 out of 100 London-wide. However, for those who are affected by noise, the most common cause of this noise disturbance is road traffic and more than 1.6 million people in London are exposed to road traffic noise levels during the day above 55dB, the level defined by the World Health Organisation as causing health problems. Particularly for Londoners living on a busy road or on the flight path, or close to construction works, noise is a source of disturbance:

- 29 per cent of London residents said they were disturbed by traffic noise, including 9 per cent disturbed to a great extent; and
- 20 per cent of London residents said they were disturbed by aircraft noise, including 6 per cent disturbed to a great extent.

Heathrow alone exposes 750,000 people to significant aircraft noise (above 55dB) – the majority of whom reside in west and southwest London – and which amounts to 28 per cent of all those exposed to noise by airports across Europe. With a third runway, that number could increase to almost a million people.

The natural and built environment

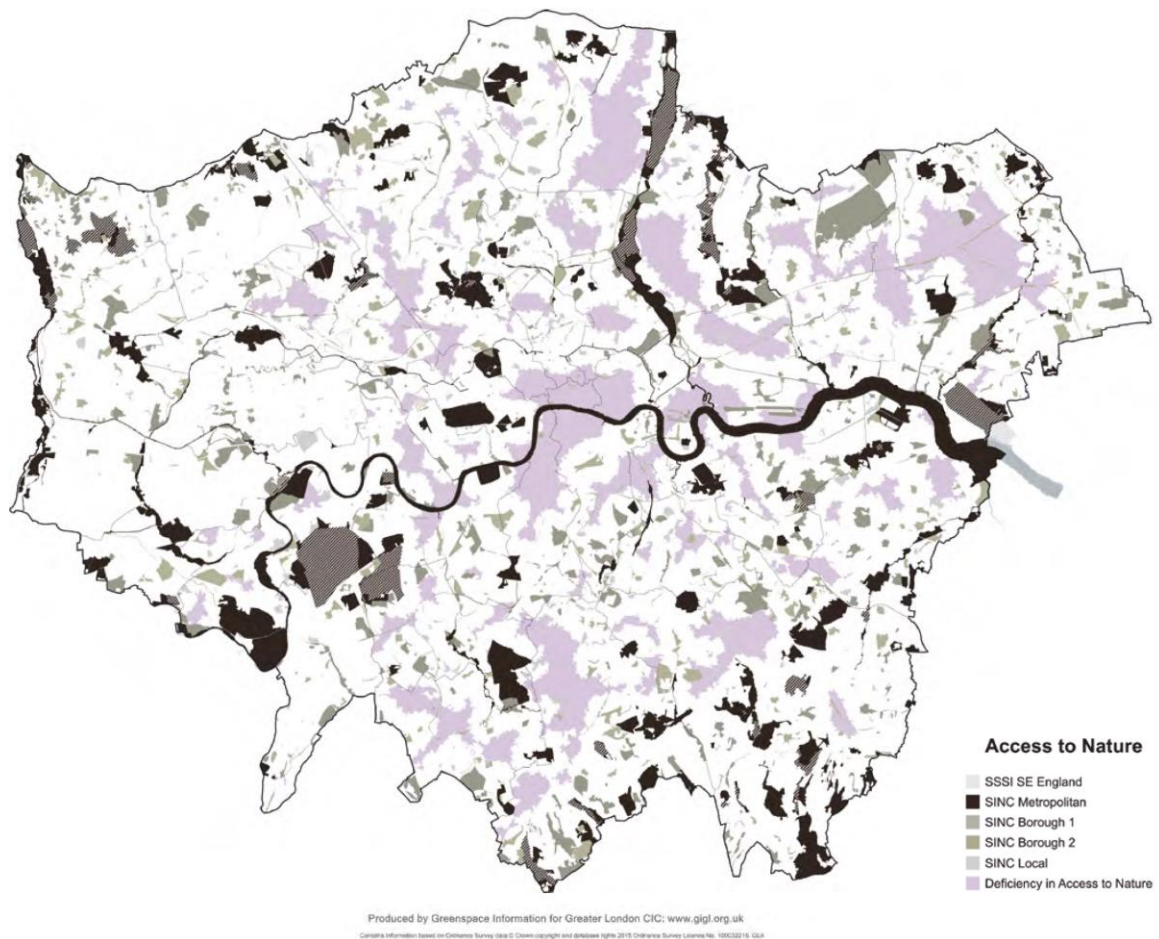
London's built heritage and sites of cultural importance include four world heritage sites, 19,000 nationally listed buildings and their settings, locally listed assets and their settings, 1,000 conservation areas, over 150 registered parks and gardens and over 150 scheduled monuments. Buildings make a significant contribution to defining the identity and character of London, through their design and the associated public realm.

London's built heritage and sites of cultural importance are vitally important to defining the character of the city. But, they could be potentially under threat as a result of the development of new transport infrastructure. As well as affecting human health, road vehicle emissions also adversely impact on the natural and built environment. They can lead to dirty deposits on buildings and the corrosion of some building materials. Increasing levels of nitrogen in the soil also result in damage to natural ecosystems.

A biodiverse natural environment provides many physical and mental health benefits and aids access to green space.

Transport land accounts for 14 per cent of land in London and 25 per cent of land in central London. Therefore, how we use transport land has a significant impact on biodiversity in London. Nationwide, the goal is to conserve biodiversity. This will be challenging given competing demands for land for housing and transport infrastructure. As London becomes more urban, access to green space will become more important, and transport land can contribute. Figure 81 shows localities that are more than one kilometre's walking distance from a publicly accessible Site of Borough or Metropolitan Importance for Nature Conservation. Opportunities to provide green infrastructure on transport land include street trees, green roofs on buildings and roadside raingardens. Such features can provide a range of benefits including improved resilience to severe weather and climate change, better air and water quality, the encouragement of walking and cycling, and enhanced biodiversity. Street trees provide shade, shelter and a cooling effect, helping to reduce the urban heat island effect and enabling everyone to use our streets.

Figure 81 Deficiencies in Access to Nature



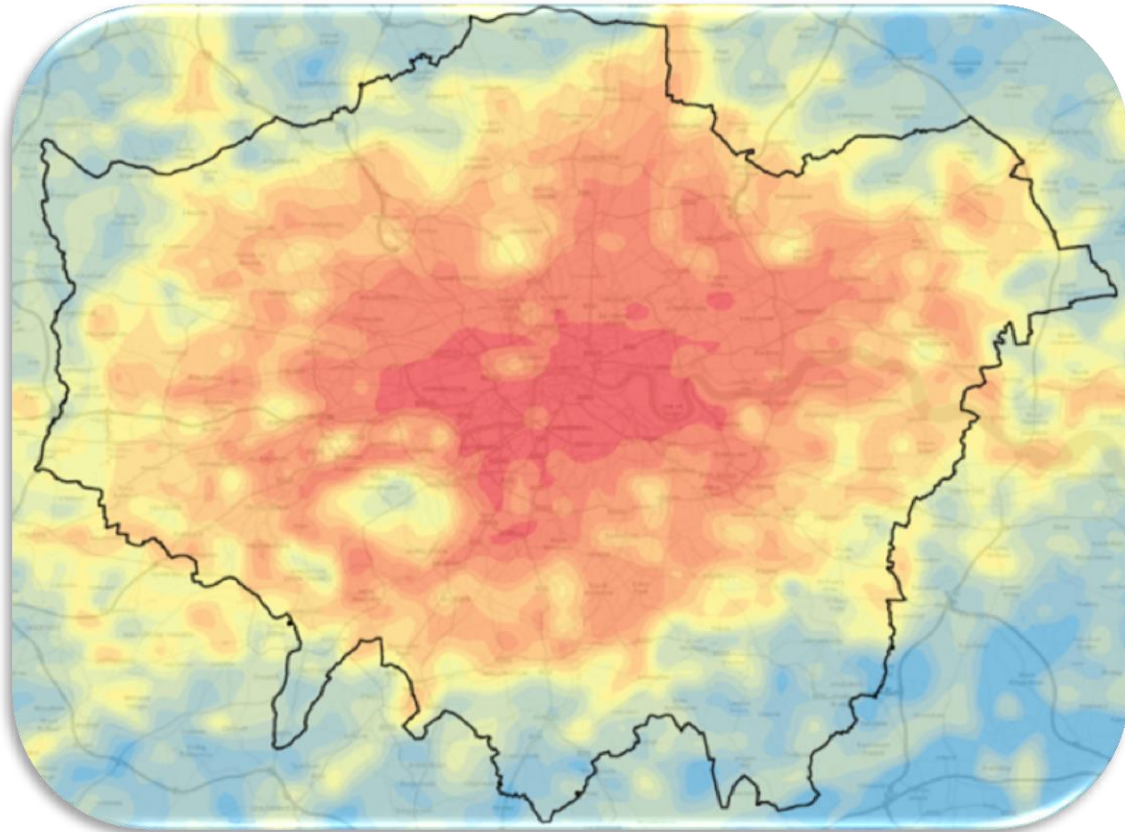
Source: GLA

As a large consumer of resources, such as building materials used for new infrastructure and energy to run public transport, there are significant opportunities for transport providers to decrease consumption of natural resources and minimise and re-use waste in order to reduce impacts on the natural environment.

Resilience to the impacts of climate change

London is already suffering from the adverse effects of climate change – summers are getting warmer and winters are getting wetter. Unmitigated climate change would mean that the summer of 2003, where we broke the highest temperature record in the UK (37°C) and an estimated 2,000 UK residents died, will be considered an average summer by the 2040s and a cool summer by the 2080s. Figure 82 shows the average surface temperature during the hot summer of 2006.

Figure 82 Average surface temperature during summer 2006



Source: City Planning

Major flooding has occurred in London in three of the last four years – causing significant disruption to transport and having a detrimental impact on the economy. Whilst annual rainfall is likely to remain broadly similar to current levels, seasonal changes are likely to mean summers becoming drier and winters wetter. The rainfall that does occur is likely to be in more intense storms. This will increase the risk of flooding, especially surface-water flooding. The equivalent of two-and-a-half Hyde Parks is being paved with impermeable surfaces every year, which is resulting in an increase in surface water flooding. The installation of more permeable surfaces, including Sustainable Drainage Systems, on transport land can help make London as a whole more resilient to surface, river and sewer related floods.

London is likely to be at higher risk of drought as there will be less water to be captured in the summer, and quite possibly more demand on water during the hotter periods.

Current projections estimate that the sea level will rise by around 0.9m by the end of the century. This will require moderate-scale action and investment over the short to medium term (up to 2050) to maintain London's current good standard of tidal flood protection. Beyond 2050, sea-level rise is expected to become more significant. Greater investment, including a new Thames Barrier, may be required to protect London from tidal flooding.

In particular, the increased incidence of extreme weather conditions is expected to present a range of challenges to the operation of the transport network, such as:

- Flooding – affecting stations, roads and tracks and cutting power supplies, as in February 2014.
- Extreme heat – leading to materials failure, need for ventilation and cooling, and issues with passenger health and discomfort affecting operational performance.
- Humidity, drought, storm winds – affects signalling, ground movement and leads to debris on tracks.
- Hail, freeze thaw, snow and ice – blocks drains, affects signalling, damages embankments, cuttings and road surfaces, and leads to operational costs for gritting and repairs.

Events such as the closure of large sections of London's rail network in June 2016 due to flooding highlighted the potential disruption that can be caused. The costs of these impacts are hard to quantify, but the 2006 Stern review estimated that the costs of uncontrolled climate change could be between 5-20 per cent of GDP, whereas the costs of acting now were estimated at between 1-2 per cent of GDP.

For London, failing to adapt to climate change will damage the operational reliability of the transport network. Increases in extreme weather events brought by climate change threaten the resilience of the transport network and may increase the cost and complexity of maintaining operational performance standards. Failure to adapt could make London a less appealing place to live, work and do business.

5.4 Summary: environment

Poor air quality damages health and causes the equivalent of up to 9,400 deaths per year

Transport is the biggest source of emissions damaging to health in London - around half of emissions (NO_x and particulate matter) come from road transport. These pollutants are collectively estimated to cause around 9,400 equivalent deaths every year in Greater London and impose an economic cost somewhere between £1.4bn and £3.7bn a year. London is in breach of legal limits on NO₂ and while there is no safe level for particulates, does not meet levels recommended by the World Health Organisation of PM smaller than 2.5 micrograms (PM_{2.5}). The communities suffering most from poor air quality are often the most vulnerable and at least 360 primary schools are in areas exceeding safe legal pollution levels.

Under the most recent government plans, London will not comply with legal limits for NO₂ until 2025, 15 years after the original deadline and will exceed World Health Organisation levels of PM_{2.5} until well after 2030. About a quarter of London's roads are forecast to be non-compliant with NO₂ levels in 2020 and of these, four in ten require traffic reductions of at least 25 per cent. Three quarters of road transport particulate matter comes from tyre and brake wear. There are limited technological solutions so only a reduction in road traffic can effectively tackle PM in the medium/long term.

Action must be taken to reduce carbon emissions so London can play its part in tackling climate change

Climate change is a serious threat to global quality of life. Carbon dioxide concentration is 40 per cent higher than in pre-industrial times and between 1880 and 2012, the earth's surface warmed by 0.85° Celsius. London's transport providers must play their part in delivering reductions in carbon emissions. The Mayor's ultimate ambition is to make London a zero carbon city by 2050 and yet the current situation is that CO₂ emissions from road transport are forecast to reduce by around 50 per cent in 2050 compared to 2013. London's public transport services are on a pathway to zero emissions; emissions from the largely electrified rail network will fall in line with the decarbonisation of the energy supply. Technological advances will reduce vehicle emissions but this will be made quicker and more feasible if the distance travelled by car is reduced.

London's transport CO₂ includes emissions arising from the taxiing, take-off and landing of aircraft at Heathrow and City Airports. There is no national policy to fully decarbonise aviation and the expansion of Heathrow would significantly increase CO₂ emissions.

Noise from transport causes stress and damages the health of Londoners

The World Health Organisation identifies environmental noise as the second largest environmental risk to public health in Western Europe. More than 1.6 million people in London are exposed to road traffic noise levels during the day above 55dB, the level defined by the World Health Organisation as causing health problems. Heathrow alone exposes 750,000 people to significant aircraft noise – the majority of whom reside in west and southwest London – and which amounts to 28 per cent of

all those exposed to noise by airports across Europe. With a third runway, that number could increase to almost a million people.

A biodiverse natural environment is good for nature and good for people

Transport land accounts for 14 per cent of land in London and how this land is used has a significant impact on biodiversity in London. Nationwide, the goal is to conserve biodiversity. This will be challenging given competing demands for land for housing and transport infrastructure. As London becomes more urban, access to green space will become more important, and transport land can contribute.

The transport network must be resilient to extreme weather and the adverse effects of climate change

London is already suffering from the adverse effects of climate change as summers are getting warmer and winters are getting wetter. Major flooding has occurred in London in three of the last four years, causing significant disruption to transport and having a detrimental impact on the economy. For London to remain an attractive place to live, work and visit, the transport system must be resilient to the extreme weather conditions likely to become more common as a result of a changing climate.

6 A good public transport experience

This section describes the current and future challenges affecting London's extensive public transport network. London's success as a world city is due in no small part to its integrated public transport network, one of the most extensive in the world. Every day, 13.8 million journeys are made by public transport in London. Public transport is as important for health as it is for connectivity – half of all walking in London is done to or from public transport stations or stops. This section describes London's public transport network, how it is used now and will be in future, and describes the challenges in terms of customer service, affordability, accessibility, crowding, safety and security. It also describes the future challenge in terms of providing a fit-for-purpose bus network.

A good public transport experience: key findings

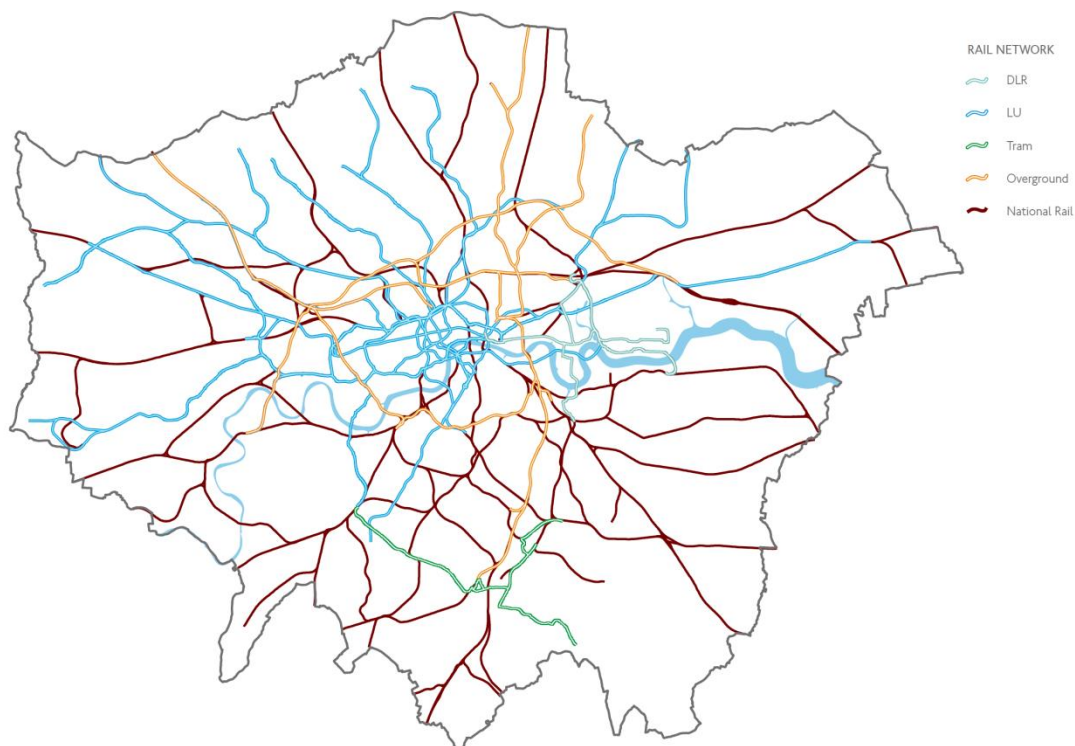
- London's public transport network has been transformed since 2000, delivering a better experience for customers, with significant increases in capacity on all public transport modes. The amount of travel has increased accordingly.
- Demand for public transport services is expected to rise by nearly 50 per cent by 2041, with particularly strong growth expected on the rail network, reflecting planned investment in new capacity and jobs growth in central London.
- The Mayor has frozen fares to make travel more affordable. In recent years, fares have been rising and incomes falling. In the early years of TfL, fares increased at a slower rate than average earnings, and bus fares fell. However, between 2008 and 2015, single Tube fares increased by almost 60 per cent and bus fares increased by even more.
- Customers will expect TfL and London's other transport providers to get the basics right and deliver journeys that are reliable, easy to plan, stress-free, person-friendly, safe and secure, and comfortable; this will be increasingly challenging as demand rises and emerging technology raises customer expectations
- By 2041, we expect the number of Londoners over 70 to have grown by 85 per cent and 17 per cent of Londoners will have some form of disability. This growth presents a challenge both because of increased demand for accessible services and because crowding on the network is the biggest barrier to travel.
- Significant improvements have been made, nevertheless, journey times are still considerably longer on the accessible network than the full network and a number of barriers to travel remain.
- Demand for bus travel has grown by 71 per cent since 2000/01, but has started to fall in recent years, largely as result of slowing bus speeds but also reflecting changes to travel patterns.

- There is significant potential to deliver mode shift from car to bus, with around three million journeys that could feasibly be made by bus. In order to realise this potential, buses will need to provide connectivity, journey times and convenience to compete with the car.
- Between 2015 and 2031, a significant programme of funded rail and Underground investment will increase the capacity of the rail network by 26 per cent by 2021 and by 34 per cent by 2031.
- In the short term, the new capacity will reduce crowding but with demand increasing faster than supply, by 2041 the crowded passenger experience, defined as passenger-km exceeding a standing passenger density of two people per square metre, is expected to increase by 60 per cent on London Underground and 150 per cent on National Rail.
- Key sectors which have been identified as in need of additional capacity include the North East (Victoria, Piccadilly, Central and Northern lines) – South West corridors (Northern, District, and rail lines to Waterloo); the DLR (Canary Wharf); and Trams (east of Croydon). In order to deliver the capacity that London will need in the 2040s we have to start planning now.
- Congestion within stations leads to delays as passengers move slowly through the station, are forced to wait to board trains, or are disrupted by temporary closures. At present, many London Underground stations suffer regular temporary closures as a result of overcrowding and this is expected to increase.
- With the number of rail passengers travelling into Central London projected to rise considerably over the next twenty years, the need for efficient onward dispersal from Central London's fourteen rail termini will become even greater. Already, crowding is an issue and the street environment is often poor for those walking and cycling the final part of their journey.
- In recent years, the number of people killed or seriously injured on the London Underground has remained broadly stable, set against growing passenger numbers, and the safety of bus and coach passengers has improved considerably. After many years of safe operation, there was a major tram derailment at Sandilands Junction in November 2016 in which seven people lost their lives and over 50 people were injured. This tragedy serves as a reminder that safety is paramount and that it is vital to work to continuously improve passenger safety despite growing demand for services.
- Over the last ten years, river patronage has doubled with over 10.5 million people travelling on the river in 2016/17 and the Port of London Authority (PLA) Thames Vision has set a target to double annual river patronage to 20 million.
- Coaches provide affordable long distance transport options; however, TfL does not operate services directly but has historically provided the London terminus at Victoria Coach Station.
- Whilst the number of licensed taxis and licensed taxi drivers in London has remained stable for many years, the number of private hire vehicles has increased by 58 per cent since 2008/09 with the number of licensed drivers increasing by 81 per cent over the same period.

6.1 London's public transport network

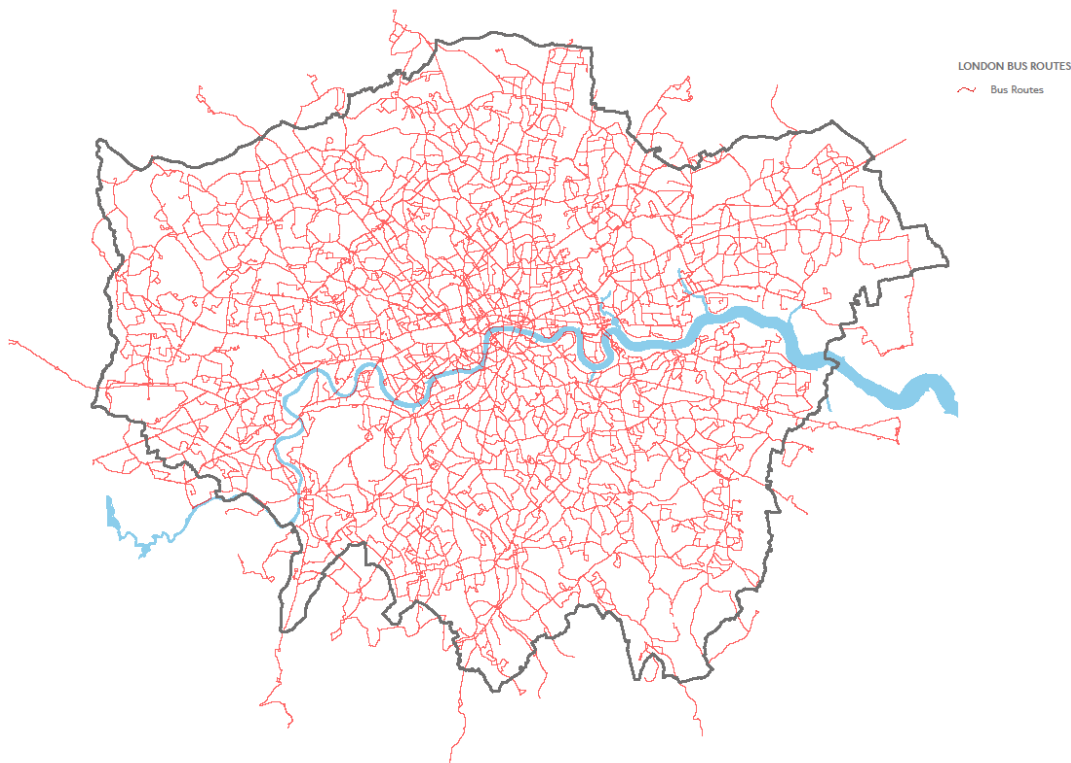
London's public transport network encompasses a dense rail network, incorporating the London Underground, London Overground and rail services operated by TfL as well as a National Rail network of suburban rail services and a network of non-TfL operated commuter coaches. To the east and south east of London is found the Docklands Light Railway (DLR) and Tram services operate in the south of London. Buses operate London-wide throughout the day and night, and river boat services, a commuter coach network and a cable car complete the picture. Figure 83 shows all rail services and Figure 84 all TfL operated bus routes in London.

Figure 83 Map of all London Underground and rail services in London



Source: City Planning

Figure 84 Map of all Bus Routes in London



Source: City Planning

Current demand for public transport services

London's public transport network has been transformed since 2000, delivering a better experience for customers, with significant increases in capacity and service quality on all public transport modes:

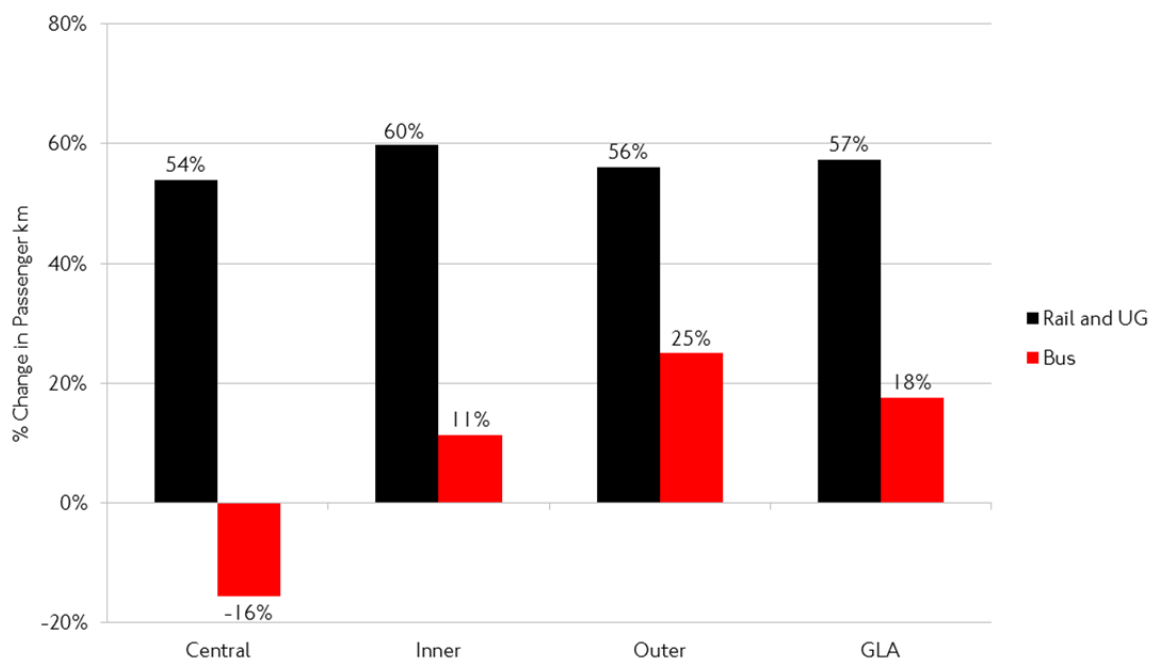
- In 2015/16 the Underground carried a total of 1.35 billion journeys, 39 per cent higher than 2000/01. Consistently more than 97 per cent of scheduled services were operated in 2015/16 against 92 per cent in 2000/01.
- Buses carried 2.3 billion journeys in 2015/16, 71 per cent higher than in 2000/01. Bus service reliability has improved by 46 per cent over the period, although recently reliability and patronage have suffered in line with a rise in general traffic congestion.
- National Rail (by London and South East operators) carried 1.18 billion journeys in 2015/16, 78 per cent higher than in 2000/01. General reliability has also improved.
- Patronage has increased considerably on London Overground, carrying 184 million journeys in 2015/16 and over the period since 2000/01, the Docklands Light Railway (DLR) has increased its service offering by 103 per cent, with demand up by 205 per cent.
- Trams – centred on Croydon – carry 27 million passengers per year.
- Significant reductions in transport crime since 2005/06 when crime levels peaked, with a 50 per cent reduction in crime on London Underground, the DLR and the bus network alone.

Future demand for public transport services

Demand for public transport services is expected to rise by nearly 50 per cent by 2041. In particular, we expect there to be strong growth in demand for rail services between 2015 and 2041, reflecting the rising population, higher number of jobs particularly in the centre, and investment in the network. Forecasts suggest that the number of passengers on rail and London Underground services will rise by 54 per cent over this period, leading to a 57 per cent increase in the distance travelled by rail.

Unless further action is taken, and notwithstanding the comprehensive recast of the network following the opening of the Elizabeth Line, bus travel is expected to grow more slowly than rail travel, reflecting lower capital investment and service enhancements. The TfL Business Plan proposes a reallocation of bus services from central to inner and outer London. Unmitigated, planned changes to the road network in central London would reduce general traffic and bus speeds. These supply issues are likely to result in less distance travelled by bus in central London and modest growth in inner London. Bus usage would only keep pace with population growth in outer London. Figure 85 shows the forecast changes in demand for public transport services by region.

Figure 85 Change in passenger kilometres travelled by rail and bus, by region, 12 hour average day, 2015 to 2041



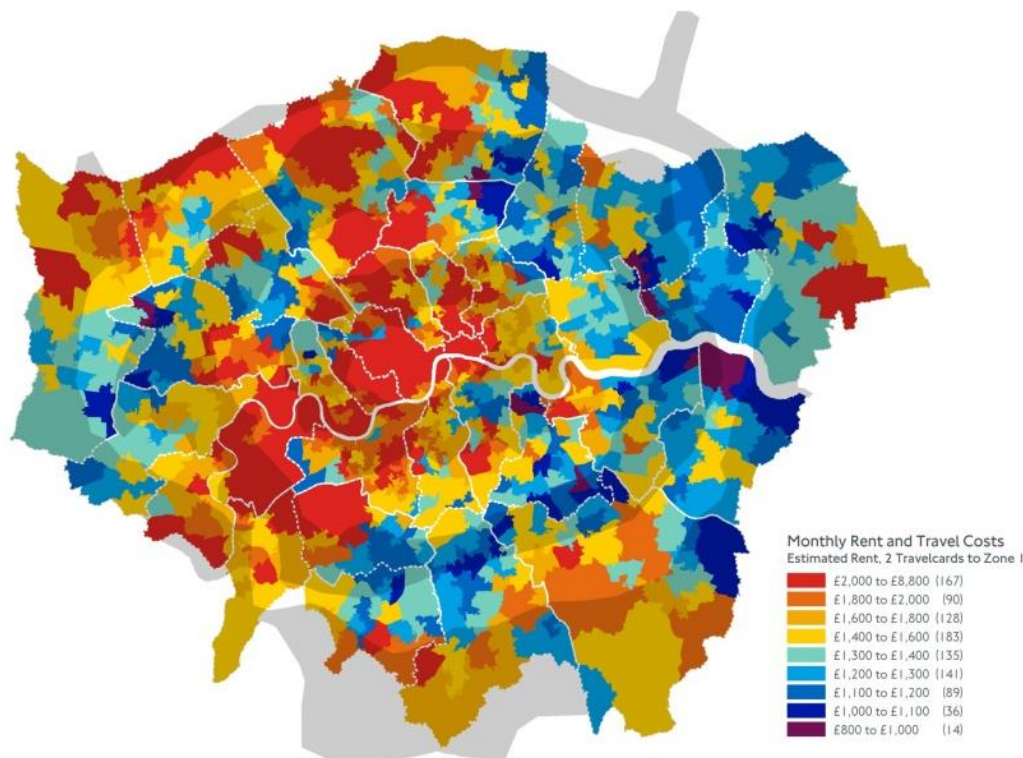
Source: City Planning

6.2 Affordability

London is one of the most expensive cities in the world. The biggest driver of living costs in London is house prices. Average house prices are around double the national average, and have risen by 32 per cent since the peak before the financial crisis in 2008. Average private sector rents in London are more than twice the national average and rents have also been rising much faster in London than elsewhere. Wages have not kept up with housing costs and in particular the minimum wage has risen by just 17 per cent over this period. The London Living Wage is an estimate of the earnings required to live above the poverty line in London. More than a fifth of Londoners in work do not receive the London Living Wage.

While transport costs account for a lower share of expenditure than housing, it is still a notable outgoing for many households (especially in outer zones) with average spend on transport fares of £27 per week. The impact of transport costs on households has also been gradually increasing since 2010, with fares spending rising in real terms and incomes falling in the past five years. This impact has been most keenly felt by lower income households with fares rising significantly faster than the National Minimum Wage. Figure 86 shows average housing costs combined with travel costs (assuming two travelcards to zone 1 per household), with the more affordable areas marked in blue and purple. This shows that affordable places to live tend to be further from the centre, and are particularly concentrated in east and south east London. The places with the lowest cost of living also tend to be particularly poorly connected by public transport – for example, Thamesmead, Lewisham, and Ilford stand out here.

Figure 86 Estimated cost of rent and travel for a two-adult household with zone 1 travel

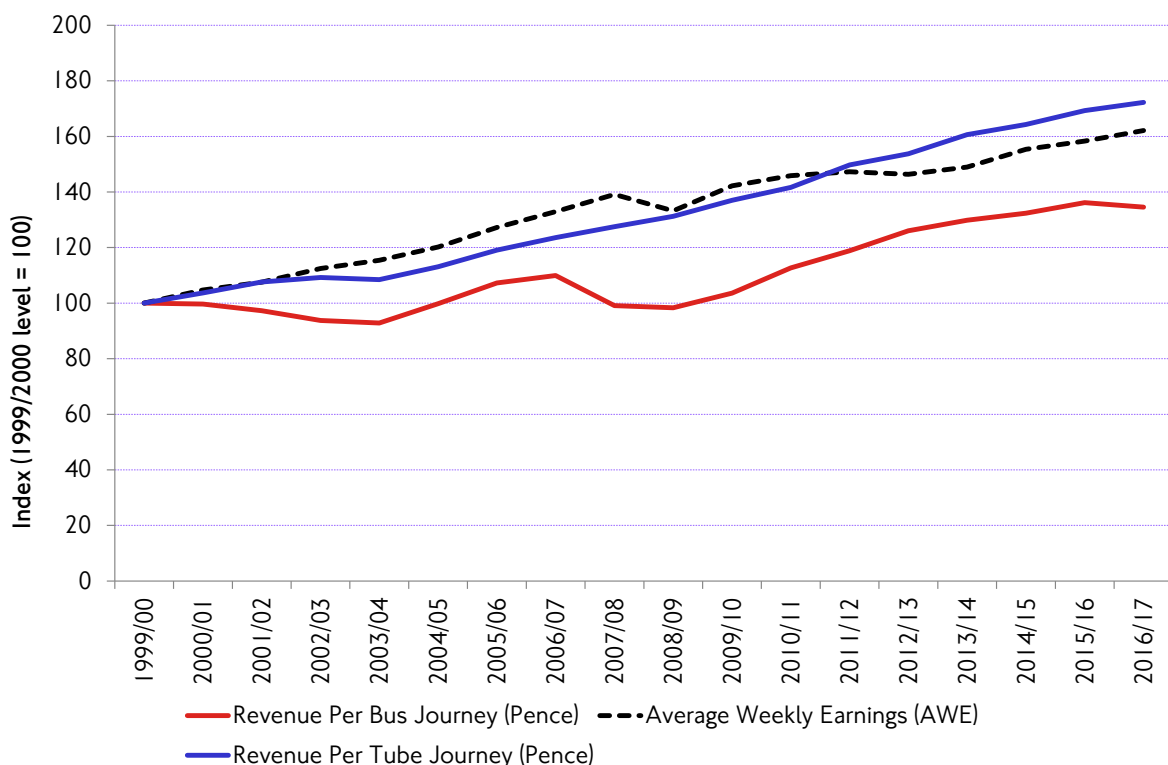


Source: City Planning

In the early years of TfL, fares increased at a slower rate than average earnings, and in particular bus fares were reduced while average earnings were increasing.

However, between 2008 and 2015, single Tube fares increased by almost 60 per cent, while bus fares increased by even more (shown in Figure 87). The rate of fares increase during this period was greater than the rate of increase in average earnings. As a result, travel has become more unaffordable for low income fare payers. In 2014, it took at least an additional hour of work at National Minimum Wage to cover travel costs from outer London compared to 2005. The Mayor has frozen fares from 2016.

Figure 87 Index of bus fares, Tube fares and average weekly earnings (nominal terms), 1999/00 to 2016/17



Source: TfL Customer Experience

A range of concessionary fares provide support to a number of groups to help make travel affordable, including the over 60's card, Freedom Pass for older and disabled people; over 60s pass; free travel for veterans; and discounts for students, apprentices, and those claiming Jobseekers Allowance and other benefits for those seeking work. There are a range of benefits to the various concessions that are available, including the increasing social inclusion by making access to public transport more affordable, and promoting the use of public transport among younger and older Londoners who may otherwise be more likely to travel by car.

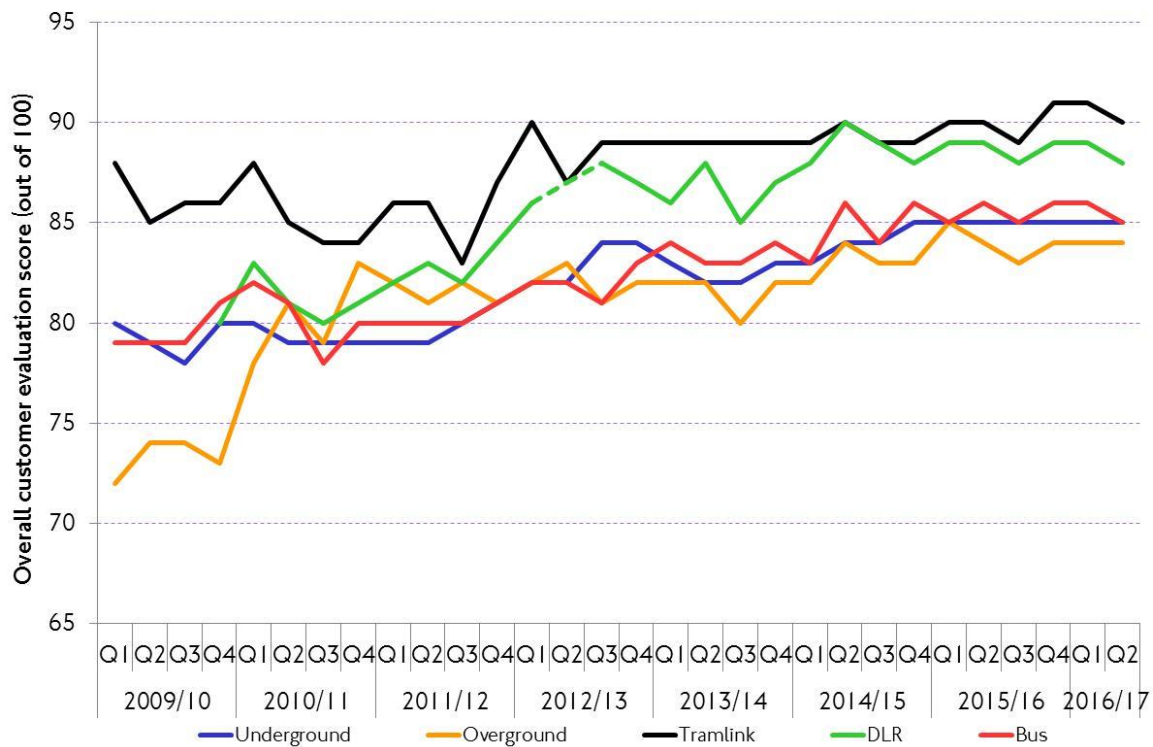
Travel costs becoming unaffordable could make it harder for Londoners to make the journeys they need and want to by public transport.

6.3 Customer Service

Transport has a key role in defining life in London - transport has the potential to be one of the best things about living in London but at times is experienced as one of the worst. Since the forming of TfL, indicators of customer satisfaction have shown a steady but continuous upward trend, shown in Figure 88. Nevertheless, occasions where transport operators fail to get the basics right demonstrate a lack of care to customers. The day to day challenge is to run a safe and secure, efficient, reliable and customer-centric service against a backdrop of continuous growth in demand for transport services.

In particular, Figure 88 illustrates the major improvements in satisfaction with journey experiences following the takeover of the franchise by London Overground (shown in orange on this graph) so that customer experience quickly reached similar levels as that of the London Underground and bus networks.

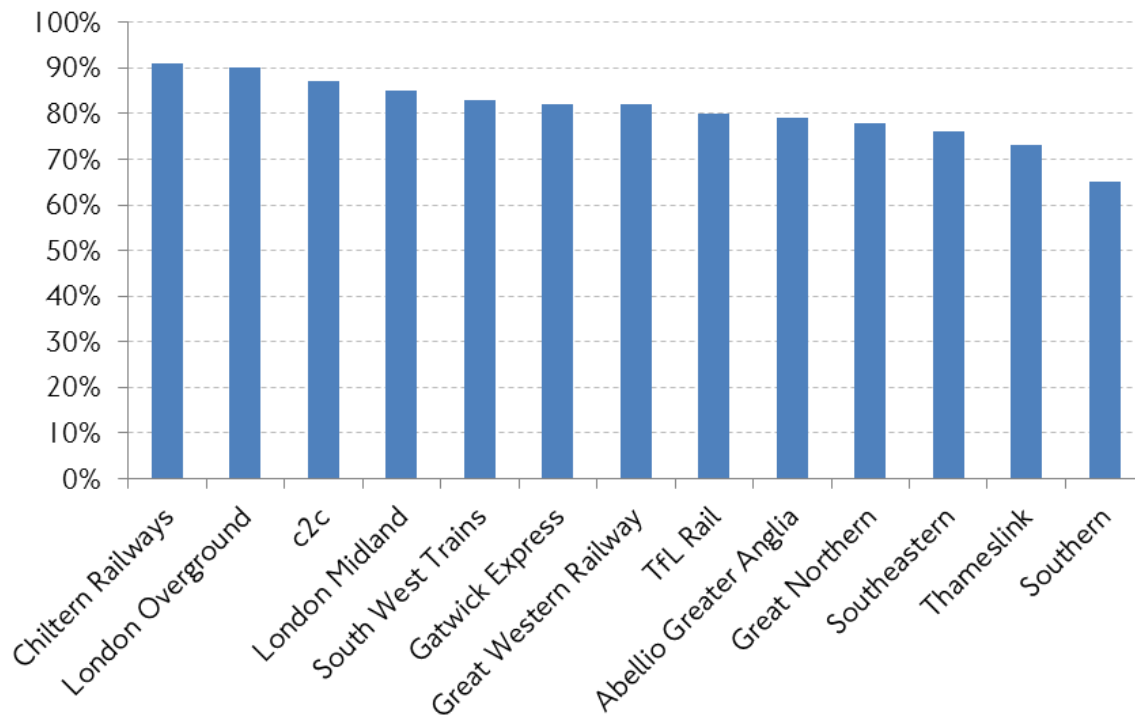
Figure 88 Customer experience by mode, 2009/10 to 2015/16



Source: TfL Customer Experience

Customer experience is not consistent across all providers. Rail customers in London and the South East are less satisfied than regional and long distance travellers, particularly with punctuality, value for money and room to sit or stand. In Autumn 2016, satisfaction varied by 26 percentage points between the best and worst performing operators. Figure 89 shows customer satisfaction by rail operator. Passengers travelling on Southern and Thameslink services were the least satisfied.

Figure 89 Customer Satisfaction by rail operator, Autumn 2016



Source: National Rail Passenger Survey

TfL's customer model sets out five aspects of what customers want; these factors contribute to the overall travel experience and drive customer satisfaction:

1. **Reliability**, and therefore congestion on the roads, is at the heart of the customer experience. Customers want to be able to get from A to B, to know how long their journey will take and for their journeys not to be delayed or disrupted.
2. It should be **easy to plan a journey**, to know where to catch the bus or how to find a station, and to buy a ticket for travel or pay the congestion charge. If there are diversions or delays it should be easy to find an alternative route and be reassured you can complete your journey.
3. The system should **minimise stress** - crowding, not being able to get on the first tube or bus, lack of information and the behaviour of other customers or road users all contribute to stress levels.
4. All transport systems should feel like they are designed for people not machines. Customers appreciate it when we recognise the impact we have on them emotionally when they travel in London. So, customers want **a pleasant, welcoming environment**, such as well-lit stations, well designed town centres and green spaces. Staff can have a big impact on customers, especially when they are approachable and helpful.
5. Customers should be **able to travel in comfort**. Personal comfort is influenced by crowding, temperature, noise, cleanliness and being able to get a seat on public transport.

Over time, what is considered essential can and does change. In recent years, mobile connectivity has soared, so that seven in ten people now have a Smartphone and around half use a tablet computer. A key consequence of this is increasing customer demand for real time information they can access on their journey. As well as improving its own services, TfL has responded to this by providing travel data freely and openly; there are now 30 data feeds available to developers and more than 360 apps have been developed. TfL launched a re-designed website in April 2014, used by four fifths of Londoners; 263 million tailored email updates across more than 1,000 campaigns were sent out in 2014/15; and TfL has 2.3 million followers on Twitter and Facebook receiving real-time service updates. As technology develops, and customer expectations follow, transport providers will need to continually review the service provided to ensure it meets customer needs.

Customers will expect TfL and London's other transport providers, and in particular the Train Operating Companies, to provide a consistently good quality service, get the basics right and deliver journeys that are reliable, easy to plan, stress-free, person-friendly, safe and secure, and comfortable; this will be increasingly challenging as demand on the network rises and emerging technology raises customer expectations.

6.4 Accessibility

An inclusive, accessible, affordable transport network benefits all Londoners. Transport provides people with the ability to access work, opportunities and services and to participate in social and community life; an accessible travel environment is a vital requirement for an inclusive society. The need for accessible transport will increase considerably over the coming decades and it is therefore vital that accessibility is embedded into everything we do, tackling barriers to customer service, physical infrastructure and information and marketing across the public and private transport network.

By 2041:

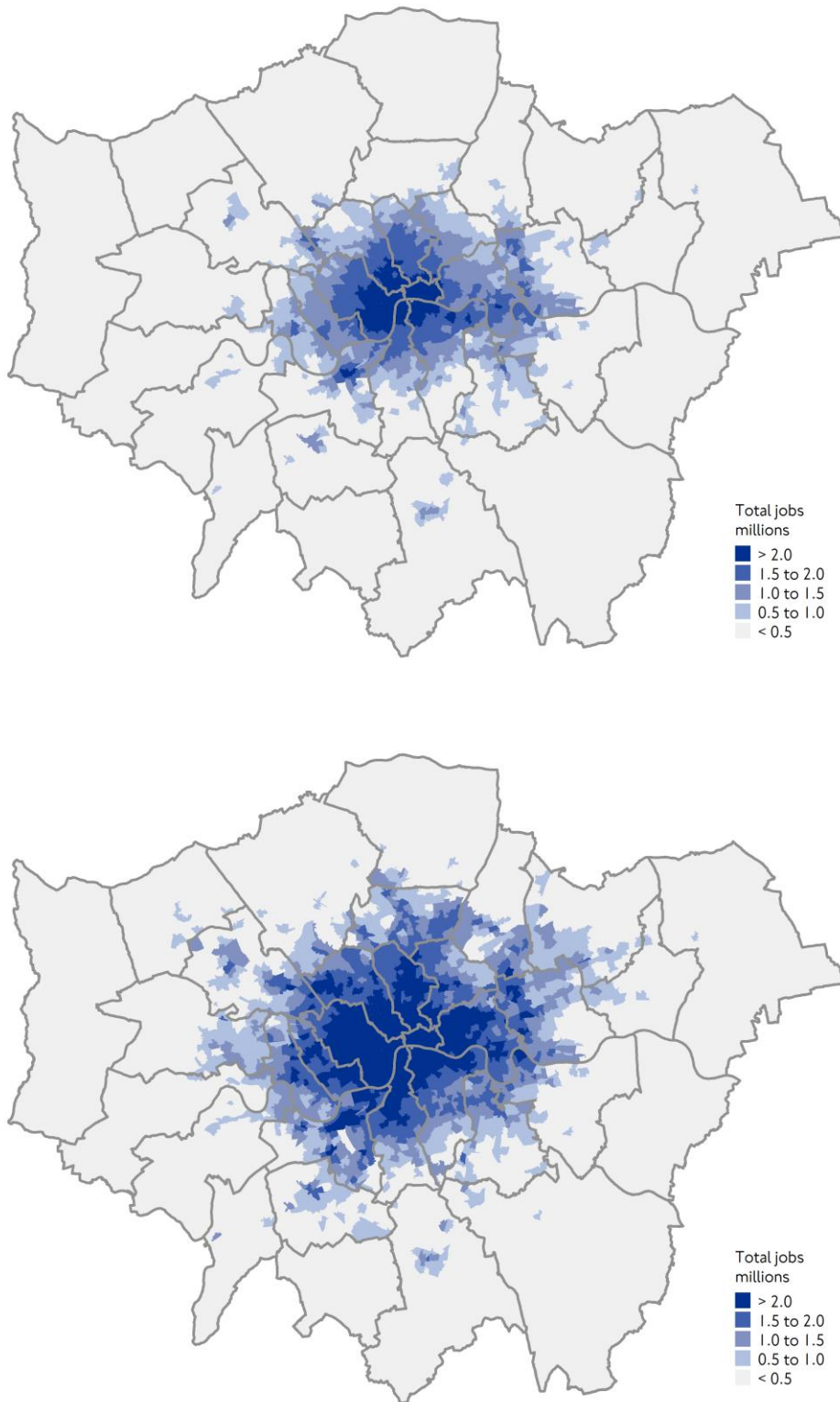
- The number of Londoners over 70 will have grown by 85 per cent; and
- 17 per cent of Londoners (1.8m people) will have some form of disability, 56 per cent more than in 2011.

Population growth will present a challenge for accessibility both because of increased travel demand from those needing accessible services and because crowding on the network is the biggest barrier to travel for vulnerable users.

Significant improvements have been made: 93 per cent of bus stops are now wheelchair accessible and 50 per cent of Overground stations in London are now fully accessible, while London's buses are entirely low-floor. Nevertheless, journey times are still considerably longer on the accessible network than the full network and a number of barriers to travel remain. Figure 90 shows how many jobs can be accessed within 45 minutes from each residential area in London. These show the stark limitations in access to jobs for people with accessibility needs – and transport is cited as a barrier to accessing employment by three in ten disabled people. Partly as a result of this, disabled people travel less often, making 1.6 trips per person per day compared to around 2.3 for all Londoners.

Accessibility will improve in future as a result of planned and funded upgrades and the opening of the fully accessible Elizabeth Line, but much more still needs to be done.

Figure 90 Comparison of the number of jobs accessible within 45 minutes, step-free (upper map) and full (lower map) networks, 2015



Source: City Planning

Customer research identifies clear areas to address that will encourage both non-users and users alike to travel more often. Cost, journey time, lack of step-free access and crowding are the clearest deterrents to travel among equalities groups.

- **Improving customer service, particularly on buses.** Currently 54 per cent of disabled people use the bus at least once a week but only 16 per cent uses the tube as often. Improving the customer experience on buses can therefore have a big impact on addressing issues currently cited by disabled passengers. Driver behaviour is the most common accessibility-related complaint and is challenging to address given the multiple operator model; issues with driver attitudes are also a barrier for those travelling by taxi or private hire vehicle. On the tube, the use of ramps and the availability of staff to assist is one of the top complaints. As stations are made step free to platform, the availability of staff and communication between stations will be vital to realising the benefits of the new infrastructure for customers.
- **Improving the pedestrian environment.** Almost all journeys involve walking but currently the pedestrian environment is considered poor by many disabled people, who are much less satisfied with London's streets than other Londoners. Issues include the poor condition of footway surfaces, obstructions, lack of seating, crowded and narrow pavements, and cyclist presence and behaviour. Traffic speeds are particularly important for older people, who are less able to cross the road quickly and more likely to die if hit by a vehicle.
- **Increasing step-free access.** A quarter of stations on the tube network, half of London Overground stations and all DLR and Tram stations are step free, and the funded programme will provide a further 30 step free stations by 2022. However, there remains a significant difference in journey time between step free and non-step free routes, limiting connectivity to opportunities and services. Once outside the central area, public transport journey time for those who require step free access increases dramatically.

A new measure of physical accessibility is currently under development, to provide a total proportion of the population within 400m of a step free station; this will help prioritise investment to deliver the greatest population benefit. New research suggests we may be underestimating the benefits of step free access in terms of increasing travel opportunities.

- **Providing new capacity to tackle crowding.** For many people with a disability, experiencing overcrowding can deter them from repeating the journey or trying out new routes. Providing additional capacity and reducing crowding benefits all users and, provided it is step free, can be of particular benefit to disabled users.
- **Improving access to information to ensure everyone can access the services available.** Planning in advance is more important to customers with a disability, and they require more information to make plan their journeys, both in advance and in real time as they travel. Marketing and information is also important in terms of making disabled people aware of improvements that have been made – and thus able to take advantage of them – and also to raise awareness amongst the general population of accessibility needs and addressing issues with customer behaviour.

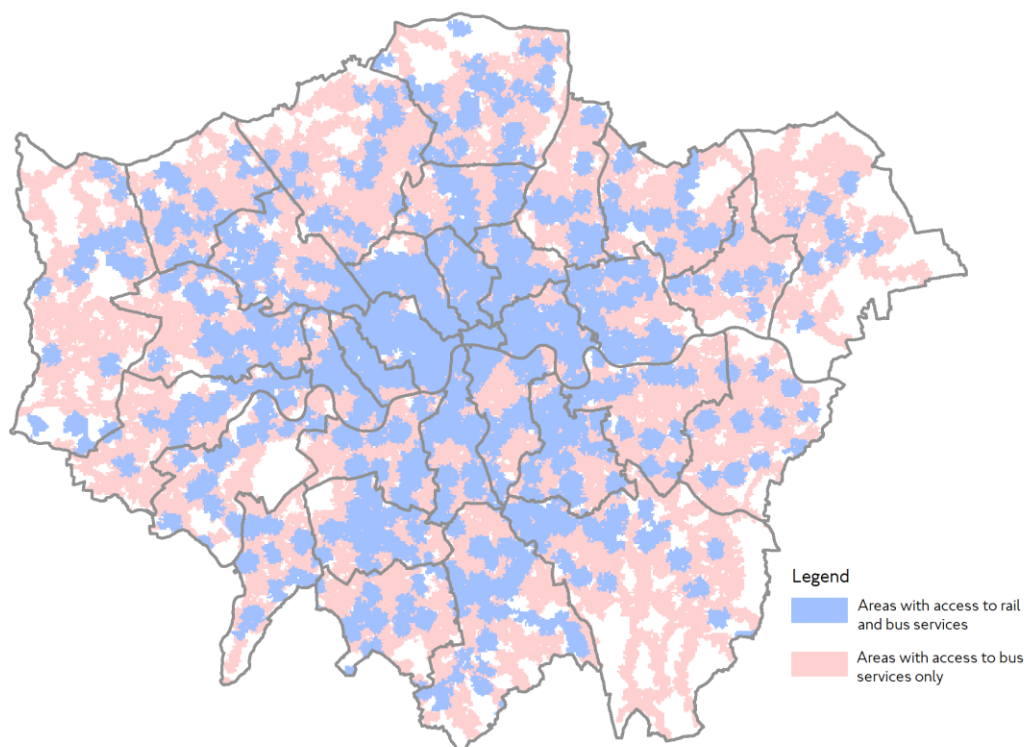
6.5 Shaping the bus network

The role of buses in London

The size of the bus network - more than 95 per cent of households live within 400m of a bus stop - and the affordability of bus services mean that it is the most accessible and most used type of public transport in London, carrying 2.3 billion passengers per year. London's bus network now carries half of all the bus journeys in England. London buses operate on nearly 700 routes, with 100 routes operating through the night. Figure 91 shows the region of London connected by bus and rail – shown in blue – and the area connected by bus services only – shown in pink. Nearly all populated parts of London are served by the bus network. The map is derived from the London-wide Public Transport Access Index (PTAI) which calculates an access index for an area by combining walk time to the nearest bus stop or station with wait time. The indices are split by mode for a network of 100m grid points across London.

In particular, this shows the vital role played by buses in Outer London. Whereas in Central London, more than 90 per cent of the area is served by bus and rail services, in Outer London the coverage by rail is much less and buses play a more significant role. For example, in Havering, only 11 per cent of the area is served by rail services but 53 per cent has access to bus services.

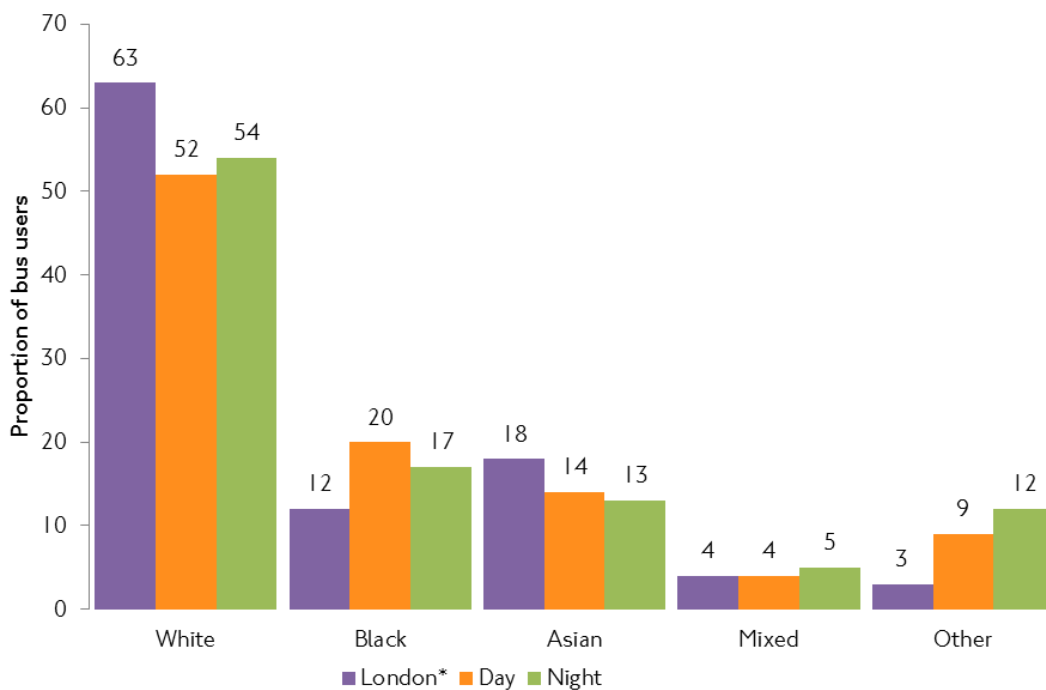
Figure 91 Connectivity provided by bus and rail services in London



Source: City Planning

Buses are the most affordable mode of public transport, with fares currently fixed at £1.50 until 2020 and the new Hopper service allowing interchange within the same fare. Furthermore, around one third of customers don't pay for their journey at the point of use with significant proportions using bus or freedom passes or making use of other concessionary fare schemes. The size of the network and the affordability of bus services mean that it is the most-used type of public transport in London, carrying 2.3 billion passengers per year. London's bus network carries half of all the bus journeys in England. As the only public transport service operating throughout the city, bus users reflect London's diversity and the network's position as a system for everyone. Figure 92 illustrates the diverse ethnic profile of bus users.

Figure 92 Ethnicity of bus users, day, night and London average



Source: City Planning

Changing demand for bus services

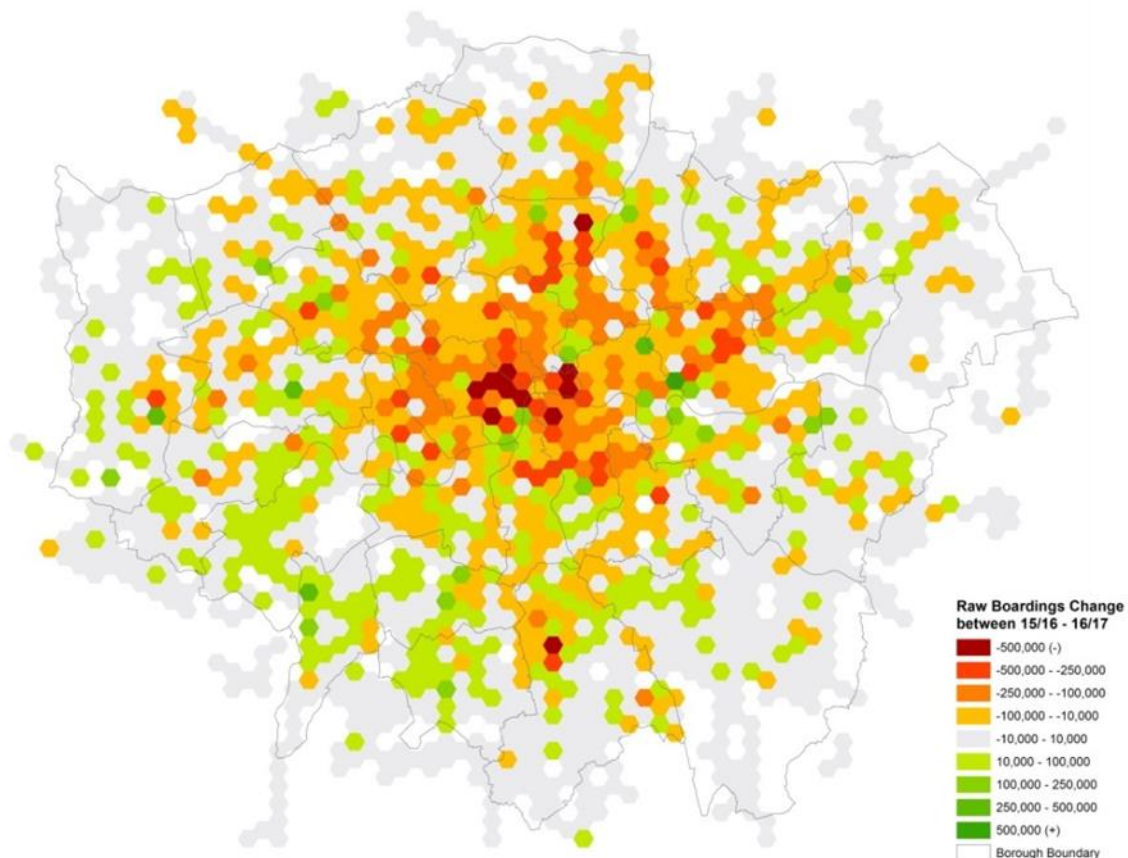
Demand for bus travel has grown by 71 per cent since 2000/01 and around 6.5 million passengers use the network every day.

However, in recent years demand has fallen away somewhat. Bus patronage has declined by 5.6 per cent across 2015/16 and 2016/17 with ridership for 2016/17 123 million trips per annum lower than in 2014/15. Patronage has not fallen uniformly across London. Figure 93 illustrates the drop in bus boarding numbers over the last year.

Inspection of this map shows:

- Central London observed the most significant decline in bus boardings (down 12 per cent, Period 2 2015/16 compared to Period 2 2016/17). Demand was expected to reduce as rail capacity came online, but this has occurred sooner than forecast
- Inner London also saw significant decline (down 6 per cent, for the same period). A number of radial Transport for London Road Network (TLRN) corridors have shown significant declines in bus boardings including the A23, A11 and A2
- Growth occurred in South London, although declines in boardings were observed around some other outer London town centres such as Croydon

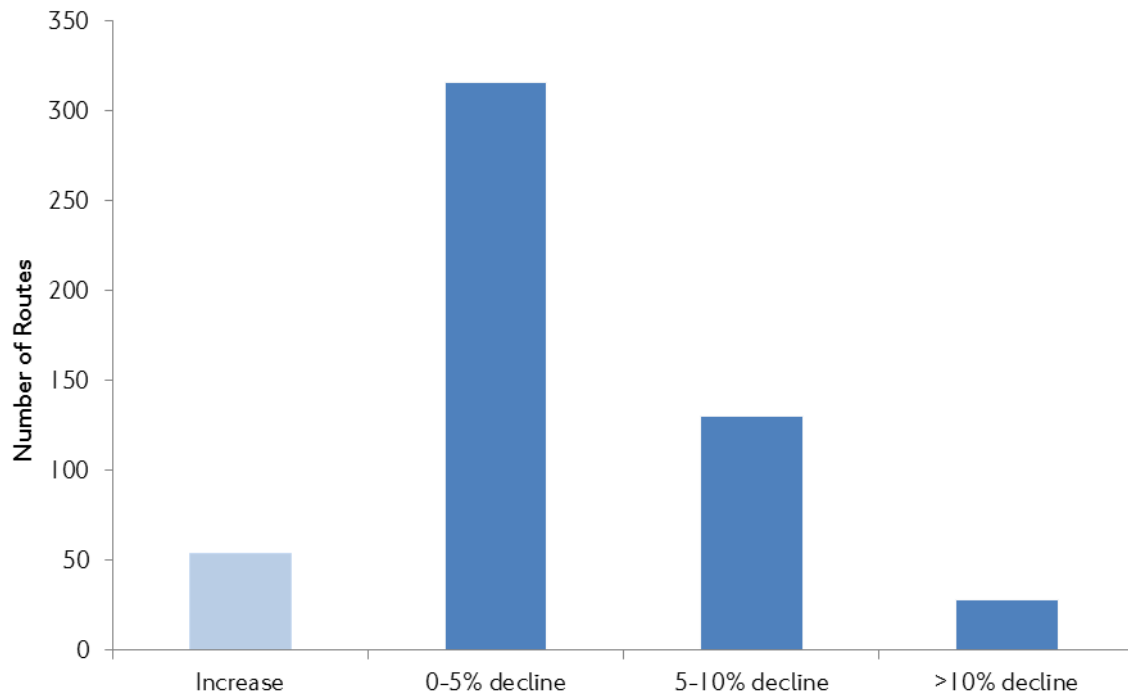
Figure 93 Change in bus boardings from Oyster data, full year 2015/16 compared to 2016/17



Source: TfL Surface Transport

The primary cause is considered to be the deterioration in bus speeds (2.1 per cent year-on-year, see Figure 94) caused by increased levels of traffic congestion. International case studies show that improving customer experience (particularly improved journey times and reliability) will deliver increased bus patronage and TfL's has shown that on-bus journey time is the number one issue for bus users.

Figure 94 Change in bus speeds, 2013/14 - 2015/16



Source: TfL Surface Transport

Bus ridership has also been affected by the trend for Londoners to travel less, particularly for their discretionary trips such as for shopping and leisure. Data collected via the London Travel Demand Survey (LTDS) shows that Londoners have been travelling less each day since 2013/14 – shown in Figure 95. Shopping and personal business public transport trips are made predominately by bus (72 per cent of trips made by public transport, shown in Figure 96) and a high proportion occur in the inter-peak. The largest decline in observed bus travel has occurred in the inter-peak period (40 per cent of the total decline) where discretionary trips such as shopping make up two thirds of bus journeys. Discretionary and therefore inter-peak trips have high elasticities to change. Smaller declines were observed for morning and evening peak commuting trips and morning and late afternoon education trips.

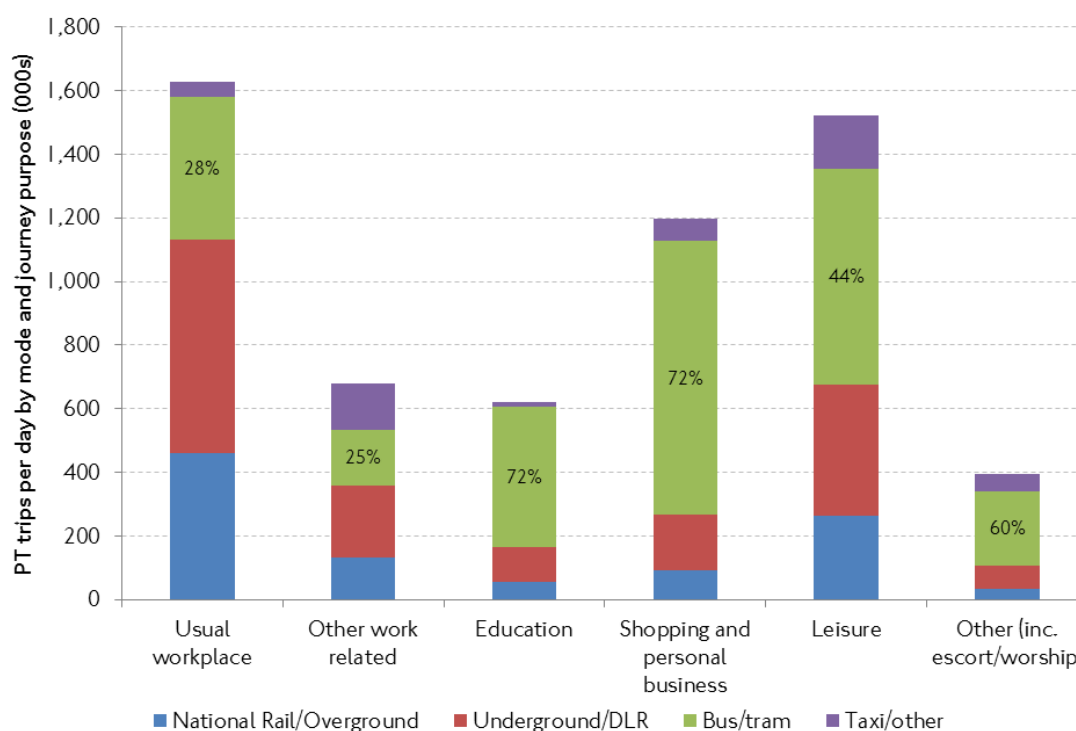
This suggests a proportion of bus patronage decline is attributable to Londoners not travelling or reducing their discretionary travel. The causal relationship here is unclear – it could be that Londoners are reducing the amount they travel for journeys typically made by bus due to wider societal factors such as the increase in internet shopping, or it could be that the decline in bus speeds is deterring discretionary trips, which are being replaced by another activity rather than being made by a different mode (or some combination of the two).

Figure 95 London Trip Rates by Purpose

	London Overall Trip	Shopping and Personal Business Trips	Leisure Trips	Bus Trips
2013/14 Trip Rate	2.52	0.65	0.73	0.37
2015/16 Trip Rate	2.32	0.57	0.66	0.33
Percentage Difference	-8%	-11%	-10%	-12%

Source: City Planning

Figure 96 Public Transport trips per day by mode and journey purpose, London residents, 2013/14-2015/16



Source: City Planning

Some of the reduction in bus travel is likely to be a result of people switching to active travel and rail modes. LTDS analysis reveals that although Londoners are travelling less overall, those travelling less frequently by bus have increased their use of other modes. The pattern of take up of other modes broadly reflected the average London-wide mode share, with more than four in ten having increased their car travel. Whilst the switch to active and rail modes may in part reflect enhancements to cycle and rail services, the high proportion who reduced their bus use and increased their use of private motorised modes shows the risk if London's bus services are not able to offer an appealing option to the car. Maintaining acceptable bus speeds and reliability is a vital part of delivering sustainable growth in future.

The potential role of buses in delivering mode shift from the car

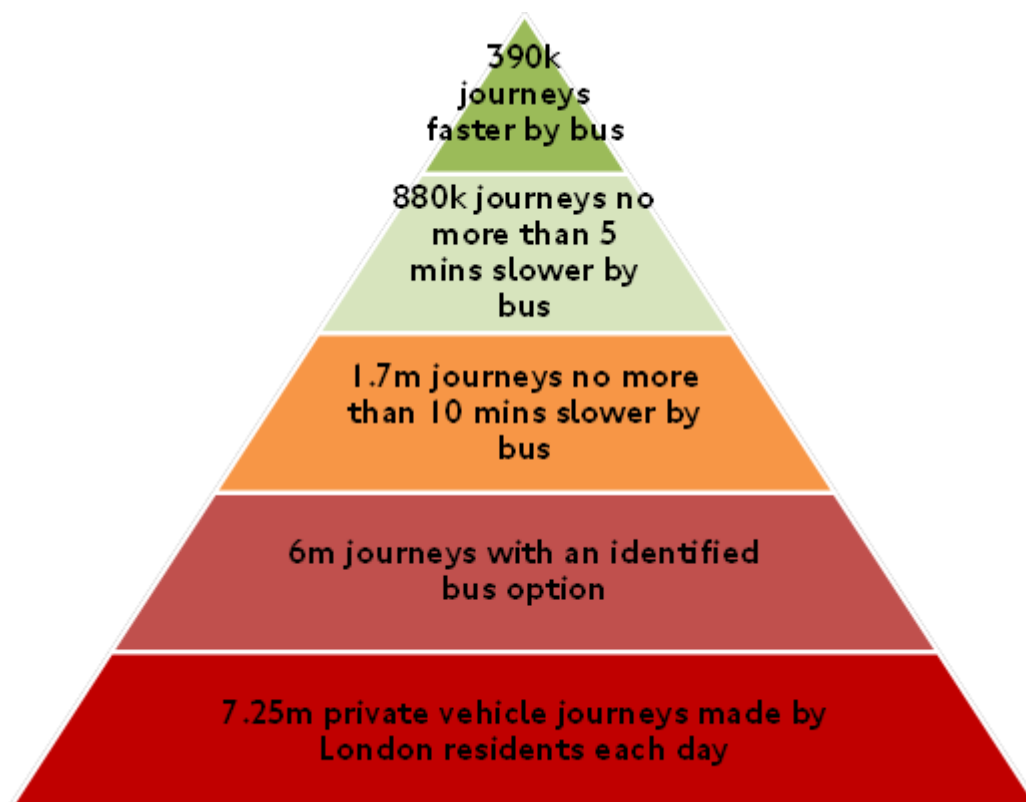
The flexibility of bus service provision to respond to new and changing demand patterns and to fill gaps in connectivity means that buses can play a key role in delivering mode shift from the car to public transport. Bus services are more viable than rail where demand is widely dispersed. To challenge the dominance of the car, buses will need to offer similar journey speeds and convenience for passengers.

Analysis has been carried out to understand the potential for mode shift from car to bus. Figure 97 illustrates the scale of potential switchable trips to bus from the total 'pool' of private car trips undertaken daily. The greatest potential for switching to bus lies in outer London: 63 per cent of trips that would be faster by bus involve travel in outer London, with 53 per cent of the potential made entirely within outer London.

Most trips that could be made by bus are for reasons other than work and the greatest potential lies in the inter-peak period between 10am and 4pm, which accounts for around 45 per cent of switchable trips. There is greater potential in the afternoon peak (23 per cent) than the morning peak (19 per cent).

The people currently travelling by car who could feasibly use a bus instead have a higher income on average than current bus users: 35 per cent had a household income over £50,000 compared to just 19 per cent of existing bus users.

Figure 97 Characteristics of car journeys that could feasibly be made by bus



Source: City Planning

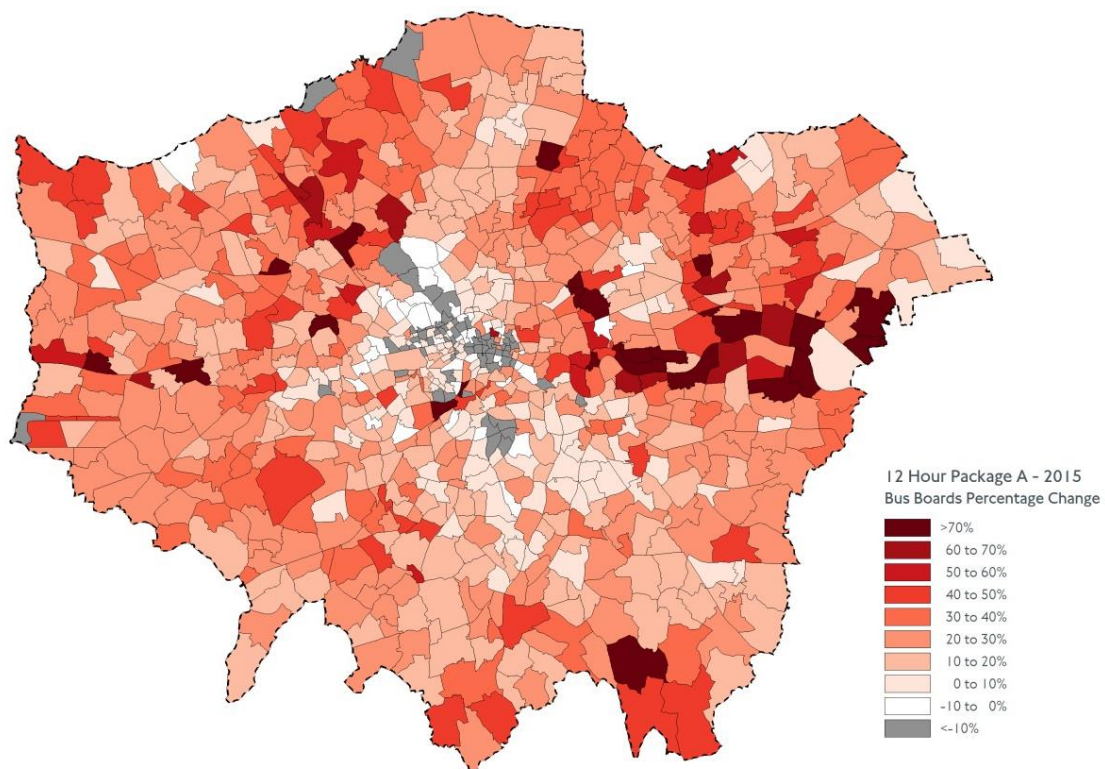
Expected demand for bus services in future

The bus network will be vital for supporting growth and regeneration initiatives across London and looking to the future the service will need to continue to react quickly to meet the pace of London's change:

- Challenge of serving London's growing and ageing population
- Service patterns adapting to the increased densification of suburban areas
- Bus priority also keeping pace, to ensure bus services remain quick and reliable
- Continuing to improve the environmental performance of our fleet

In the future, under the Reference Case scenario that includes only funded future interventions and London Plan growth, bus journeys are predicted to continue to be affected by rising congestion on the network. Morning peak traffic congestion (delay rate per kilometre) across London is predicted to rise by between 30 to 50 per cent by 2041. Despite this and in response to population and employment growth across the capital, bus demand is still expected to grow by around 30 per cent over the same period, with the strongest growth expected in the east of London. Figure 98 illustrates where the growth in bus use is expected.

Figure 98 Expected change in daily bus use, 2015 to 2041



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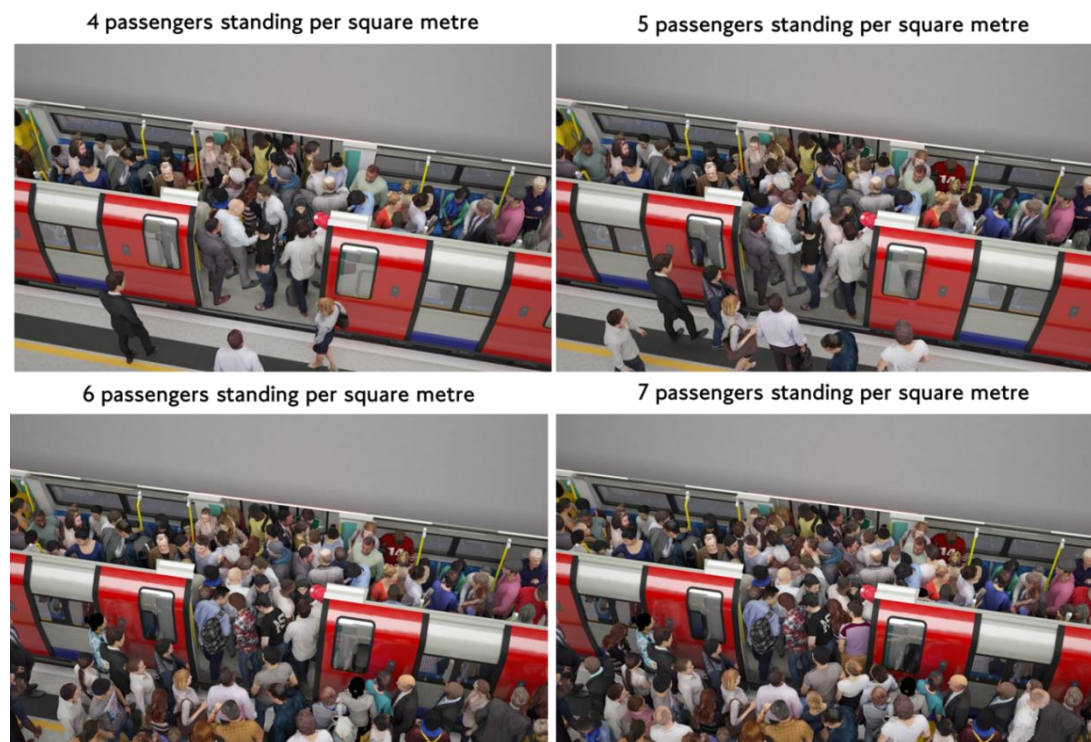
Source: City Planning

6.6 Crowding on public transport

Public transport crowding in London has significant impacts on individuals and the economy. Customers find travelling in crowded conditions stressful and unsatisfying. Some groups are particularly affected by crowding – those with mobility impairments for example find it difficult or impossible to travel in crowded conditions. Crowding can also lead to increased levels of aggression between passengers. It is likely that crowding increases journey times, as customers are forced to wait for a less crowded train, and that this damages real-world connectivity.

Crowding arises where the demand for travel on a particular service exceeds certain capacity thresholds – often a combination of number of seats with some allowance for standing. A standing density above two passengers per square metre in peak hours is uncomfortable for passengers and is used as an acceptable threshold for planning purposes (shown in Figure 99). Very high crowding densities on services will cause passengers to be ‘left behind’ on the platform and degrade operational performance, further reducing effective passenger capacity.

Figure 99 Crowding bands - Passengers per Square Metre

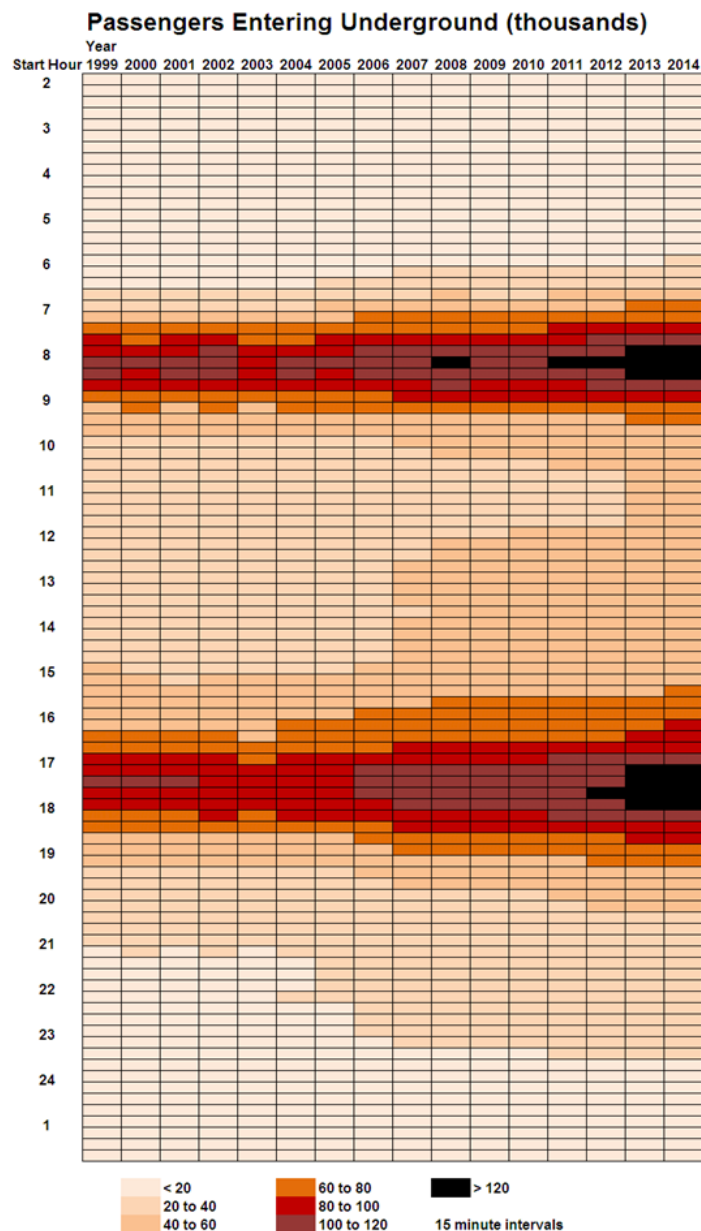


Source: City Planning

Current conditions on the rail network

Since 2000, rail capacity into London has increased substantially. Nevertheless, demand for rail services has risen faster than the increase in space offered, and as a result more people than ever are travelling in crowded conditions. Crowding particularly affects London Underground services due to its role as both a local metro and onward distributor through the Central Activities Zone. Figure 100 graphically illustrates the rising demand for London Underground services since 1999, showing how the peak period is spreading out and intensifying.

Figure 100 London Underground station entry profile, 1999 to 2014



Source: City Planning

Trains are considered crowded when there are more than two passengers standing per square metre, and severely crowded when there are more than four passengers standing per square metre. In the morning peak, a significant proportion of passenger journeys are made in crowded conditions:

- 70 per cent of London Underground journeys
- 41 per cent of National Rail journeys
- 42 per cent of DLR journeys
- 59 per cent of Tram journeys

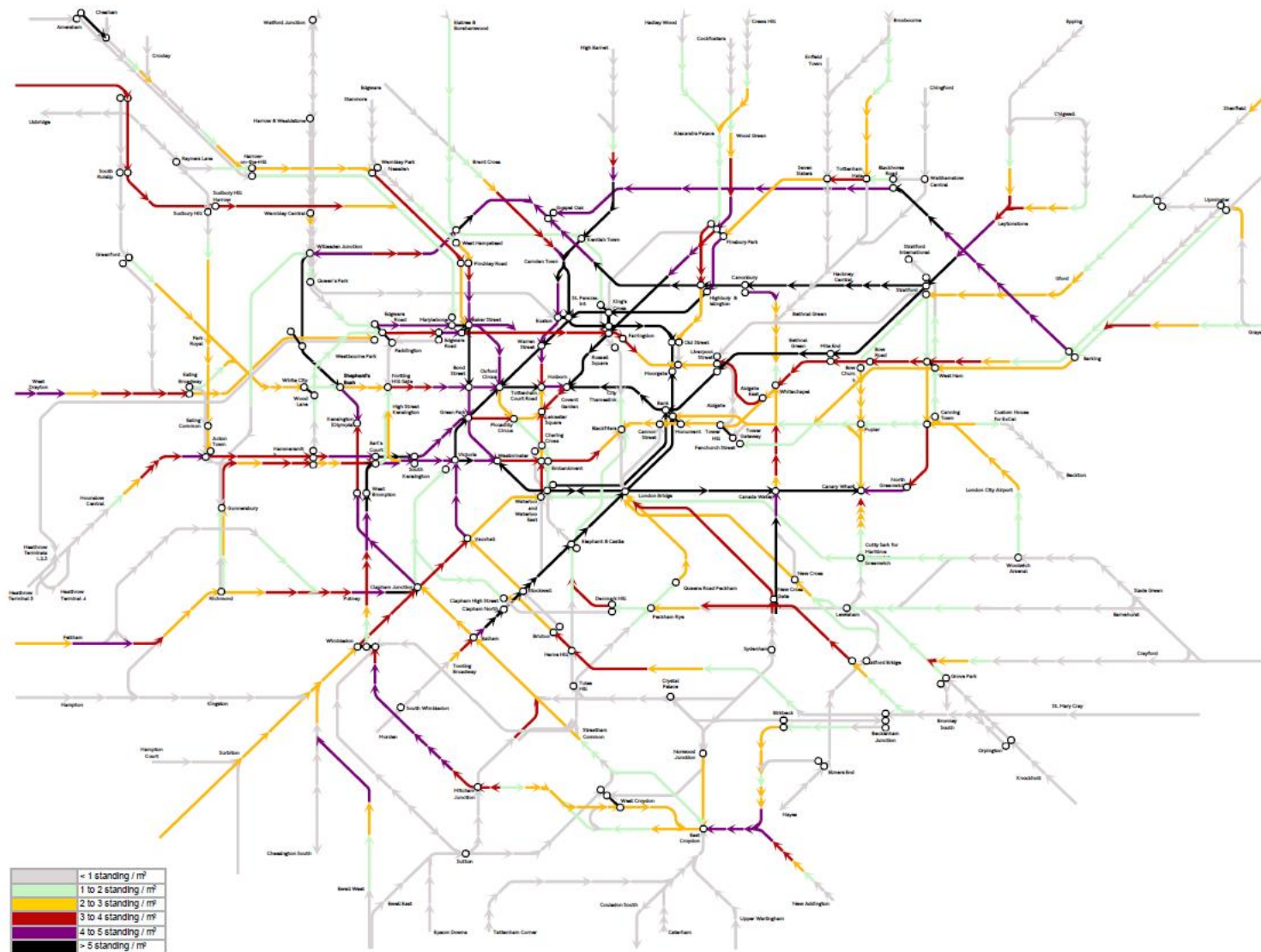
Figure 101 shows the current level of crowding on the rail network during the morning peak – including London Underground, National Rail, DLR and Tram services. The diagram uses coloured bands to represent increasing levels of standing per square metre, with yellow representing two passengers standing per square metre, rising through red and black with purple representing the most severe crowding. There is wide-spread crowding across the London Underground network, with most lines experiencing crowding within central London.

The longest sections suffering the most severe crowding in the peak directions are:

- Victoria Line between Victoria and Highbury and Islington;
- Northern Line Bank branch between Clapham South and Camden Town, and continuing to Archway;
- Central Line between Oxford Circus and Leyton;
- Jubilee Line between Baker Street and Canary Wharf;
- DLR - West India Quay to Canary Wharf; and
- Waterloo & City Line.

As conditions worsen, some customers will re-time their journeys to avoid the worst - it is desirable that only those who need to do so travel at peak times, and campaigns have been successful at encouraging people to shift their journey by a short time to avoid the 'peak of the peak'. However, the agglomeration benefits of the central London economy can only be achieved if the people that need to can travel into the central area in peak hours. Therefore, achieving a good balance between peak supply and demand on the public transport network is required to support growth of London's economy.

Figure 101 Crowding on the rail network, 2015



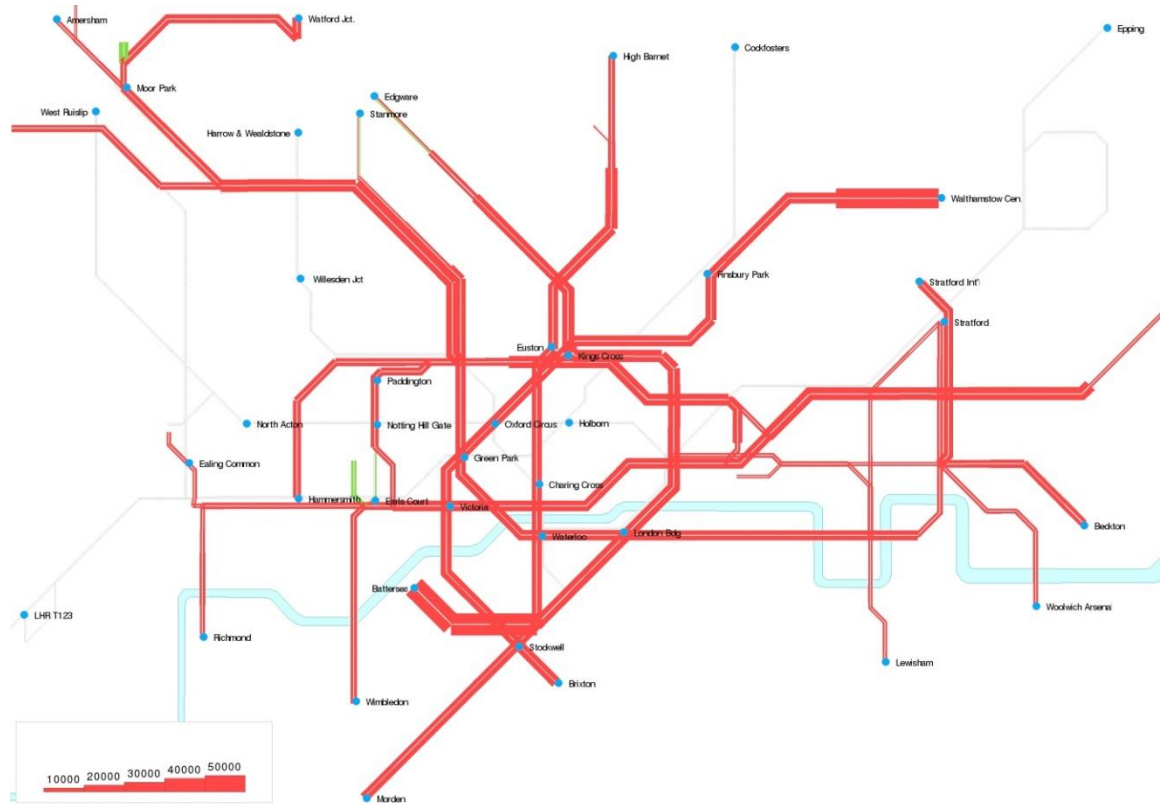
Future conditions on the rail network

Employment growth in Central London will place significant pressure on the public transport network, and in particular on rail modes. A million additional daytime public transport trips are expected by 2041 to, from, or within central London. Eight in ten arrivals to central London in the morning peak are by rail, underground or DLR. These journeys must then disperse by foot, cycle or bus to their final destination.

Between 2015 and 2031, a significant programme of funded rail and Underground investment will be undertaken, detailed in Figures 102 and 103. Funded projects through to the early 2020s add 70 per cent extra capacity to the national rail network and 50 per cent to the LU, DLR and Tram network. In 2019 Crossrail, named the Elizabeth Line, will open in London, increasing central London rail capacity by 10 per cent. The Elizabeth Line route will run over 100km from Reading and Heathrow in the west, through new tunnels under Central London to Shenfield and Abbey Wood in the east. There will be 40 Elizabeth Line stations including 10 new stations at Paddington, Bond Street, Tottenham Court Road, Farringdon, Liverpool Street, Whitechapel, Canary Wharf, Custom House, Woolwich and Abbey Wood. The Elizabeth Line will bring an extra 1.5 million people to within 45 minutes of Central London and will link London's key employment, leisure and business districts – Heathrow, West End, the City, Docklands – enabling further economic development.

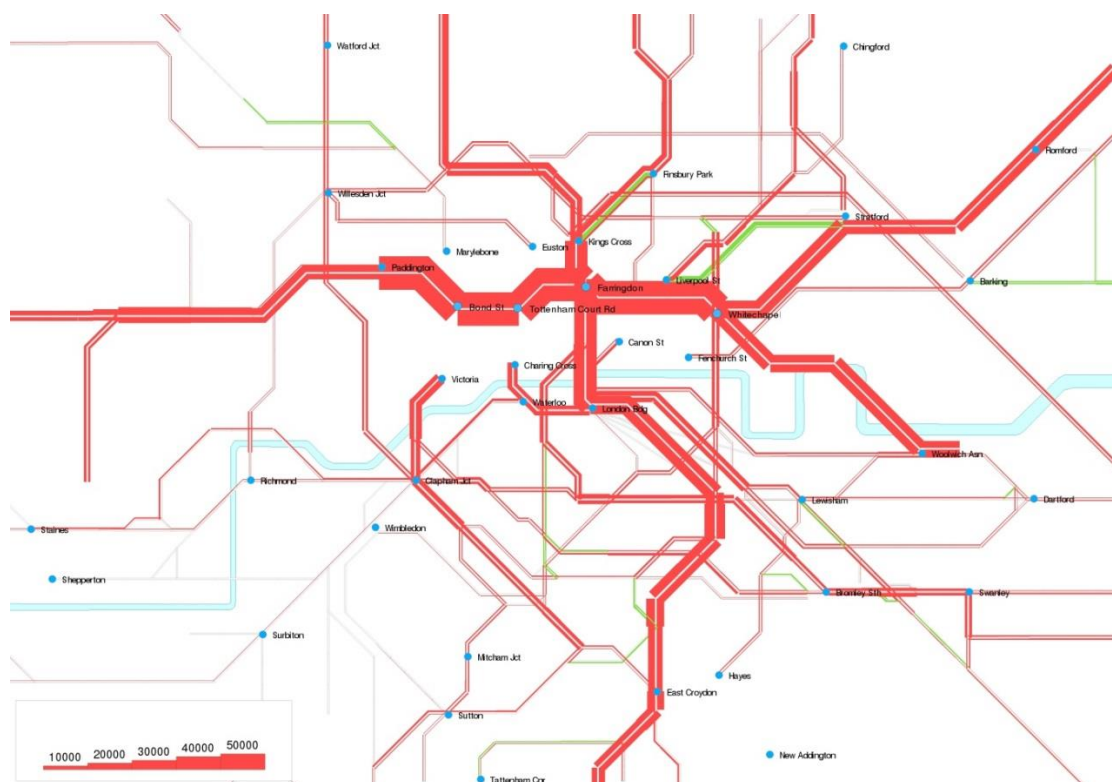
At present, no schemes have been committed to between 2031 and 2041, so the funded programme ends in 2031. Schemes under development, such as Crossrail 2 and the Bakerloo Line Extension, are not yet funded and committed.

Figure 102 Committed capacity increases on London Underground to 2031



Source: City Planning

Figure 103 Committed capacity increases on National Rail to 2031



Source:

City Planning

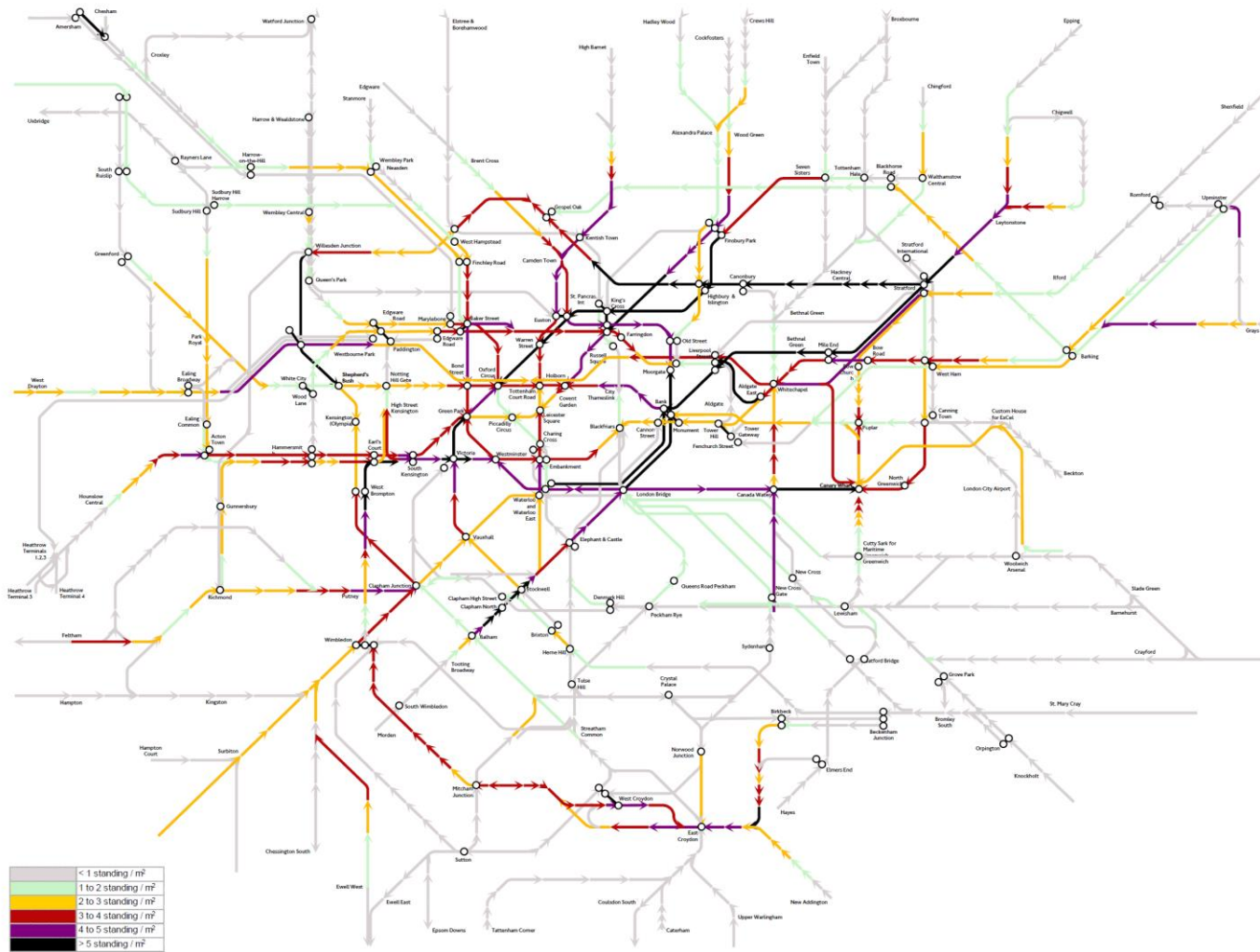
Where investment increases the available capacity, crowding is expected to reduce in future years – and in particular crowding will reduce following the opening of the Elizabeth line. Nevertheless, with demand increasing faster than supply, by 2041 the crowded passenger experience, defined as passenger-km exceeding a standing passenger density of two people per square metre, is expected to increase by 50 per cent on London Underground and 90 per cent on National Rail. Figure 104 summarises the proportion of passenger kilometres expected to be travelled in crowded conditions in the morning peak in 2015 to 2041, whilst Figures 105, 106 and 107 show forecast crowding by line in each of the years 2021, 2031 and 2041.

Figure 104 Proportion of passenger kilometres travelled in crowded conditions, actual and forecast, 2015 to 2041

	2015	2021	2031	2041
London Underground	70%	65%	70%	71%
National Rail	41%	51%	32%	40%
DLR	42%	39%	44%	44%
Trams	59%	69%	70%	71%
Total	52%	56%	44%	46%

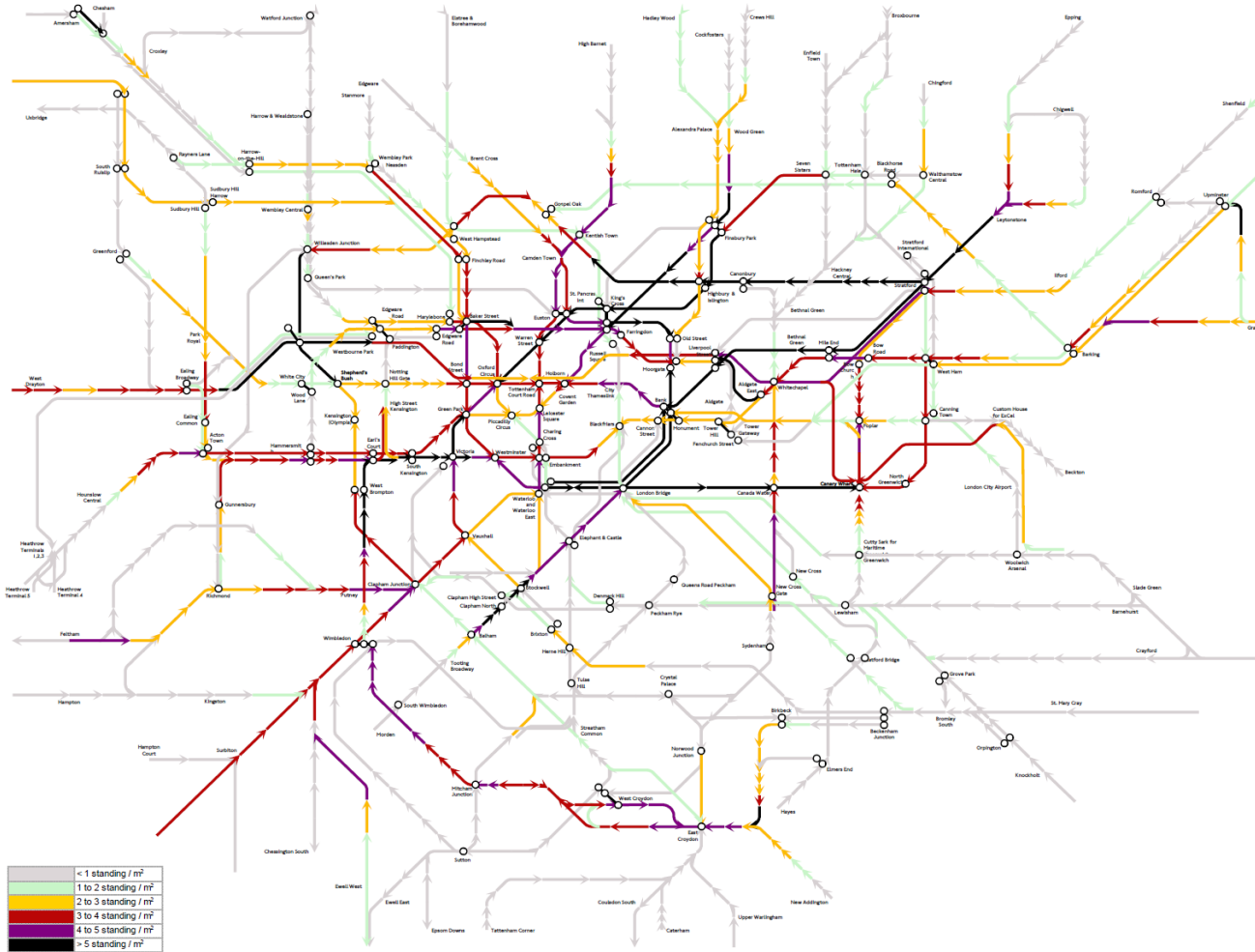
Source: City Planning

Figure 105 Forecast crowding on the rail network, funded programme, 2021



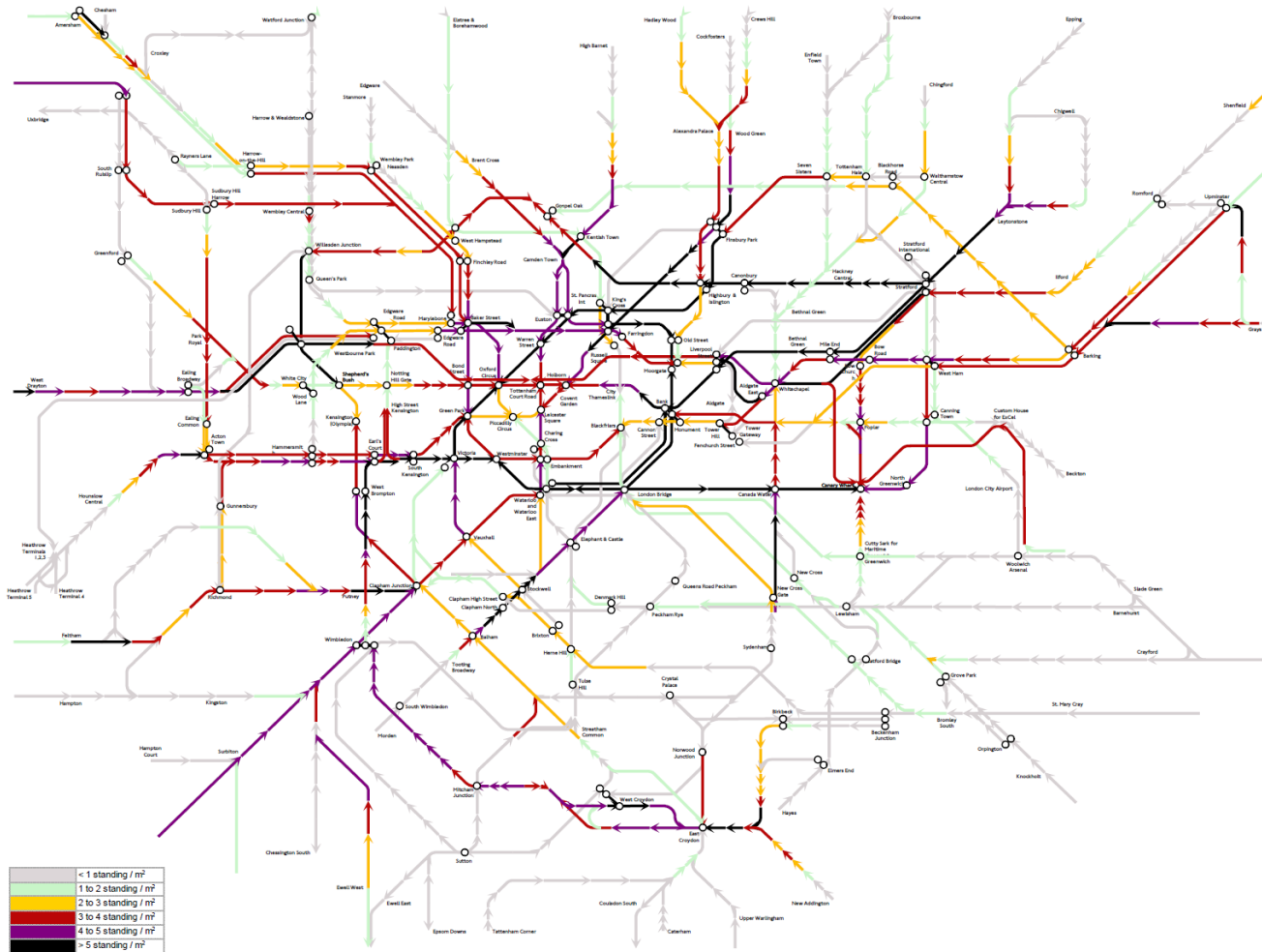
Source: City Planning

Figure 106 Forecast crowding on the rail network, funded programme, 2031



Source: City Planning

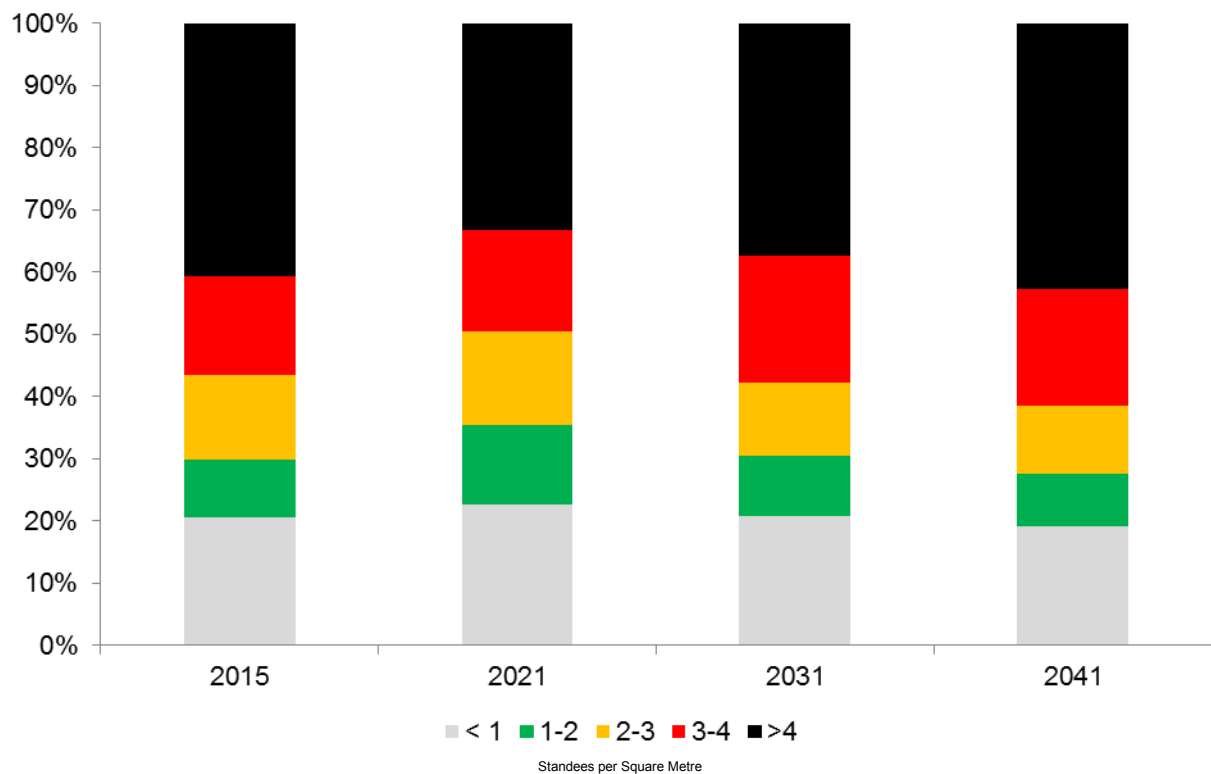
Figure 107 Forecast crowding on the rail network, funded programme, 2041



Source: City Planning

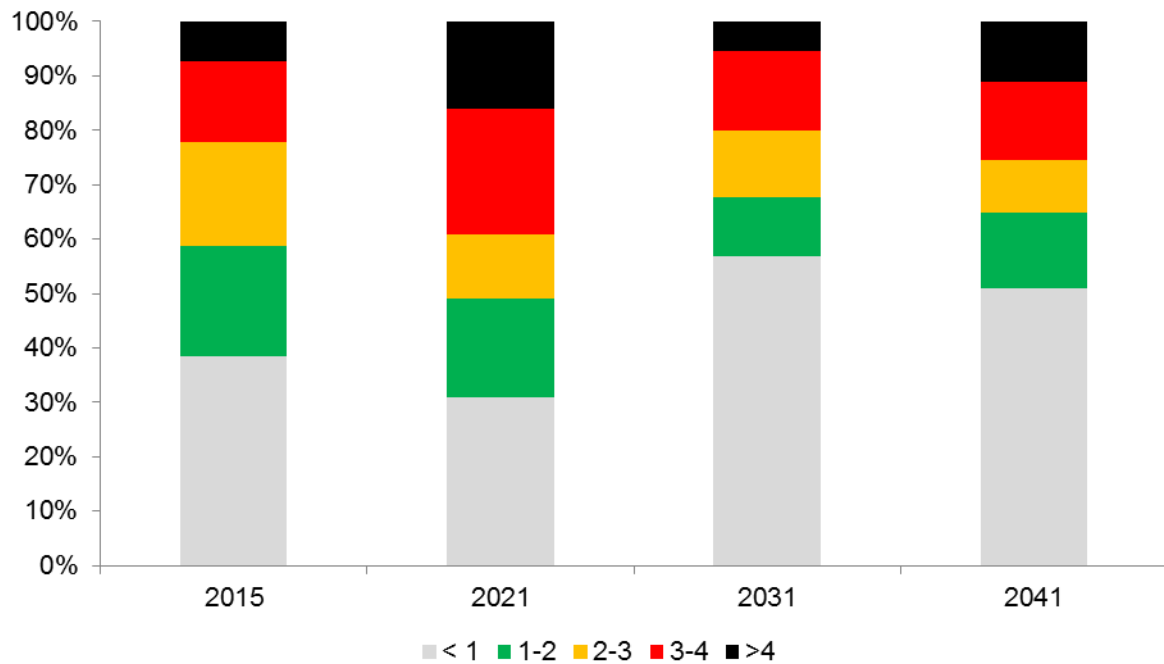
In total, by 2041 around 11 million passenger kilometres will be travelled in crowded conditions – greater than 2 passengers per square metre - on the London Underground network during the morning peak period, and around 14 million passenger kilometres on the National Rail network. This represents a much higher proportion of the total kilometres travelled by London Underground, with much of the travel on the National Rail network taking place in relatively uncrowded conditions in outer London. In total, around three quarters of passenger kilometres travelled by London Underground will be in crowded conditions by 2041, compared to around half of the distance travelled by National Rail. Figures 108 to 111 show the proportion of passenger kilometres travelled in crowded conditions, by the level of crowding experienced, for 2015 to 2041, by each of the rail modes. Note that a far greater distance is travelled in total by National Rail and London Underground than by the DLR or Tram services.

Figure 108 Proportion of passenger kilometres travelled in crowded conditions, London Underground, funded programme, 2015 to 2041



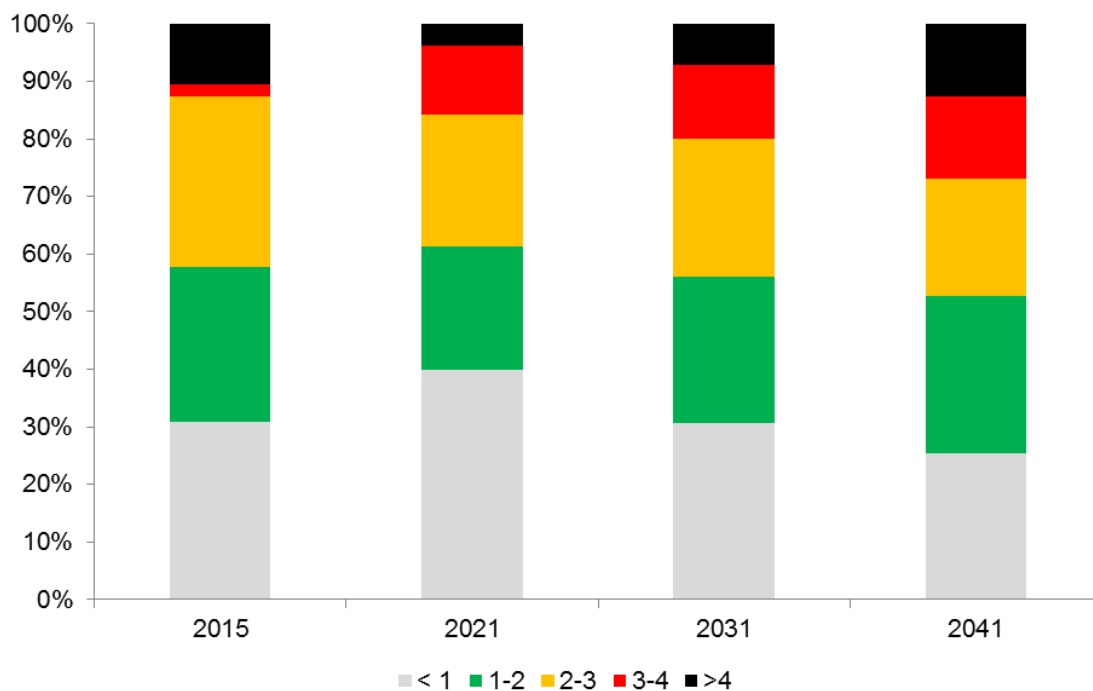
Source: City Planning

Figure 109 Proportion of passenger kilometres travelled in crowded conditions, National Rail, funded programme, 2015 to 2041



Source: City Planning

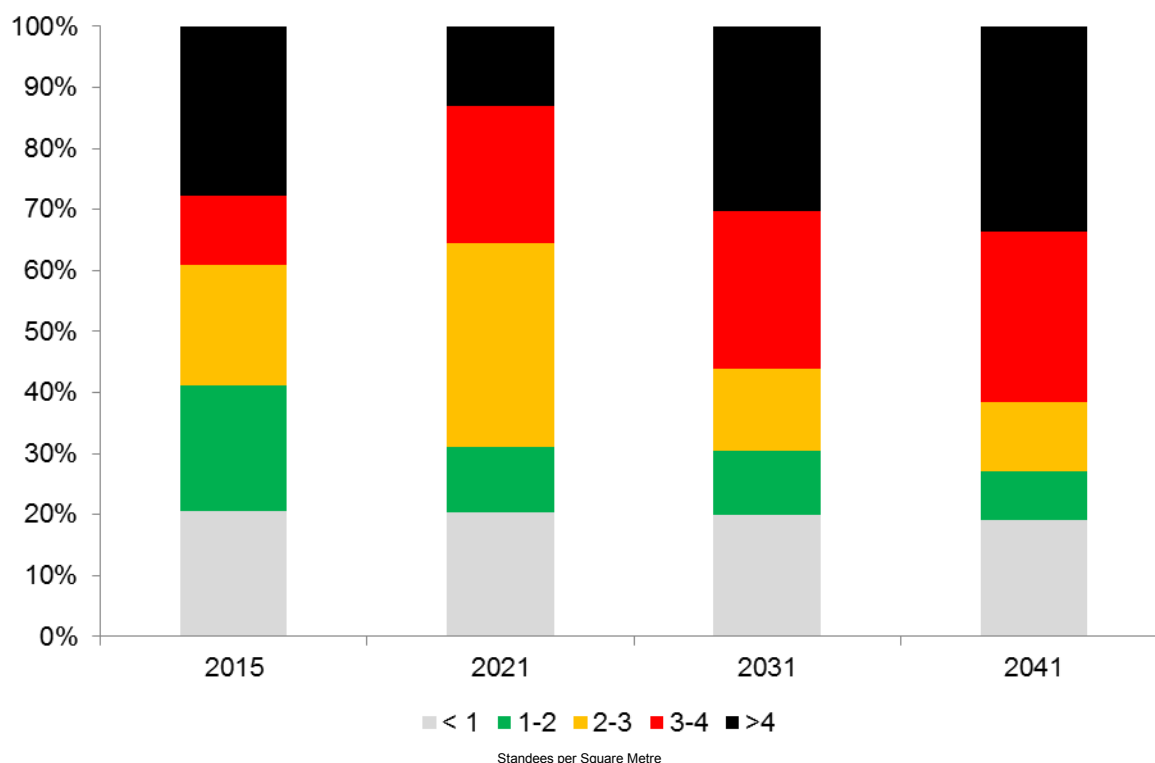
Figure 110 Proportion of passenger kilometres travelled in crowded conditions, DLR, funded programme, 2015 to 2041



Source: City Planning

Standeer per Square Metre

Figure 111 Proportion of passenger kilometres travelled in crowded conditions, Trams, funded programme, 2015 to 2041



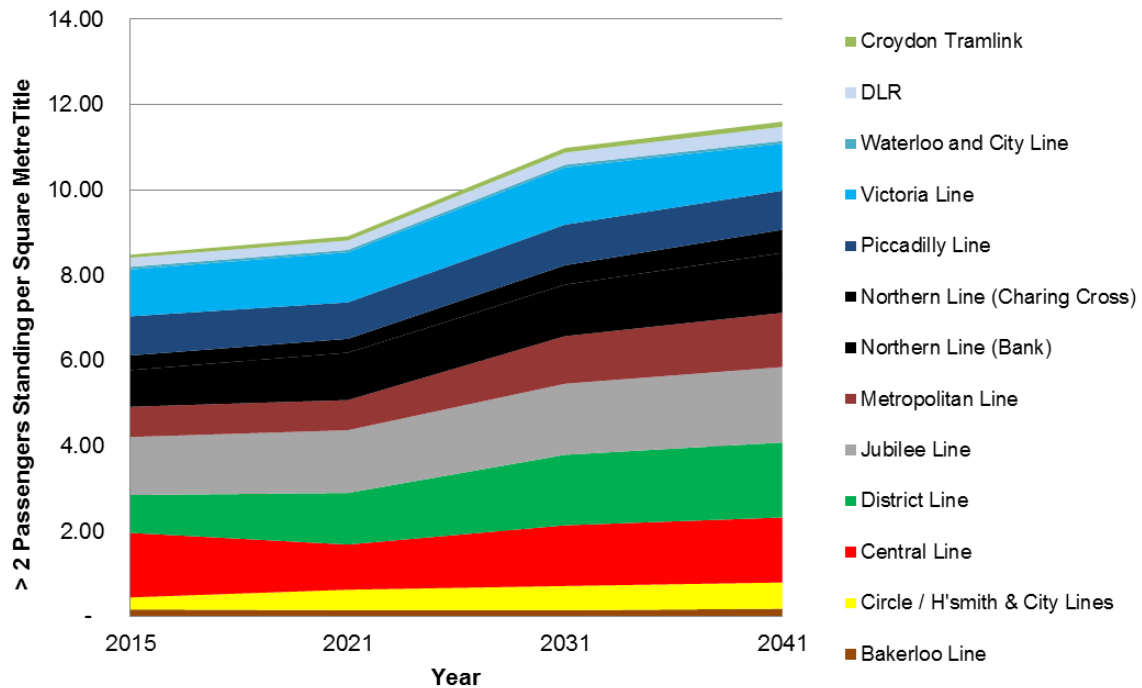
Source: City Planning

Overall, crowding is expected to reduce by 2021, primarily due to the opening of the Elizabeth line and other new capacity, but will begin rising again by 2031 and returning to similar levels as today by 2041. Even committed new lines such as Crossrail will be crowded by 2041, particularly in the east. Without further investment beyond 2031, many areas could see severe crowding, particularly if economic and population growth again exceed expectations. This will affect connectivity and damage quality of life in London.

By 2041, only three London Underground lines will experience fewer than two people per square metre when entering Fare zone 1, with nine lines experiencing crowding of more than four people per square metre – shown in Figure 112. Furthermore, some lines will experience crowding far outside the central zone, with the Northern line northbound seeing crowding of more than four people per square metre from Balham to Bank (18 minutes travel) and the Central line crowded to a similar level from Leytonstone to St Pauls (17 minutes travel).

On National Rail, crowded travel increases on most lines; even new services such as the Elizabeth Line and Thameslink will experience crowding by 2041. By far the most crowded services will be those entering Waterloo. Crowding on Crossrail is also increasing and lines initially relieved by Crossrail, such as services to Liverpool Street, are expected to experience rapid increases in congestion by 2041. Similarly, whilst Thameslink services are initially relieved by upgrades, crowding then increases rapidly. The exception is that services to Paddington and Euston will be relieved by HS2 over this time period.

Figure 112 Passenger kilometres with more than two passengers standing per square metre in the morning peak, 2011 to 2041



Source: City Planning

Key sectors which have been identified as in need of additional capacity include:

- North East (Victoria, Piccadilly, Central and Northern lines) – South West corridors (Northern, District, and rail lines to Waterloo)
- DLR (Canary Wharf)
- Trams (east of Croydon)

In order to deliver the capacity that London will need in the 2040s we have to start planning now. Schemes such as Crossrail 2, the Bakerloo Line Extension and the South London Metro would add much needed capacity, relieve crowding on some of the busiest corridors and connect communities to support homes and jobs growth. Our analytical approach assumes that employment continues to grow and that the employment forecasts are realised. However, it is possible that London's economic growth would in reality be constrained if the transport network was not fit for purpose, as reflected in highly crowded commuter services.

6.7 Stations

The same demographic and economic factors that lead to busier trains will result in increased passenger numbers at stations across the network, be it entries and exits to the station itself or in some cases interchange within the station. However it is not only macro-level factors which influence the numbers of people using stations, and levels of congestion. More local factors such as changes to train service patterns, housing or employment developments, modernisation of stations and more besides are potential causes of increased congestion at many of London's 329 National Rail stations and 270 London Underground stations. The most significant challenge will arise in central London, where demand for travel in peak periods will rise substantially, placing considerable pressure on key destination and interchange stations.

Congestion within stations leads to delays as passengers move slowly through the station, are forced to wait to board trains, or are held outside the station as safety concerns force temporary closures.

As train and station crowding becomes worse, passenger journey times are increasingly affected. Figure 113 shows the top 21 locations in 2016 with the highest levels of passenger disbenefit from gateline closures. Many of the highlighted stations are National Rail interchanges where passengers are interchanging onto London Underground lines that are already crowded on their approaches to the station.

By 2041, planned station control measures may be required at 30 key stations, shown in Figure 114. This includes London Underground stations serving each of the six major National Rail termini. The closure of a London Underground station at a terminus – even for a short time – adds significant pressure to the wider network.

Figure 113 London Underground stations with greatest disbenefit from gateline closures, 2016



Source: City Planning

Figure 114 Stations expected to require planned station control by 2041



Source: City Planning

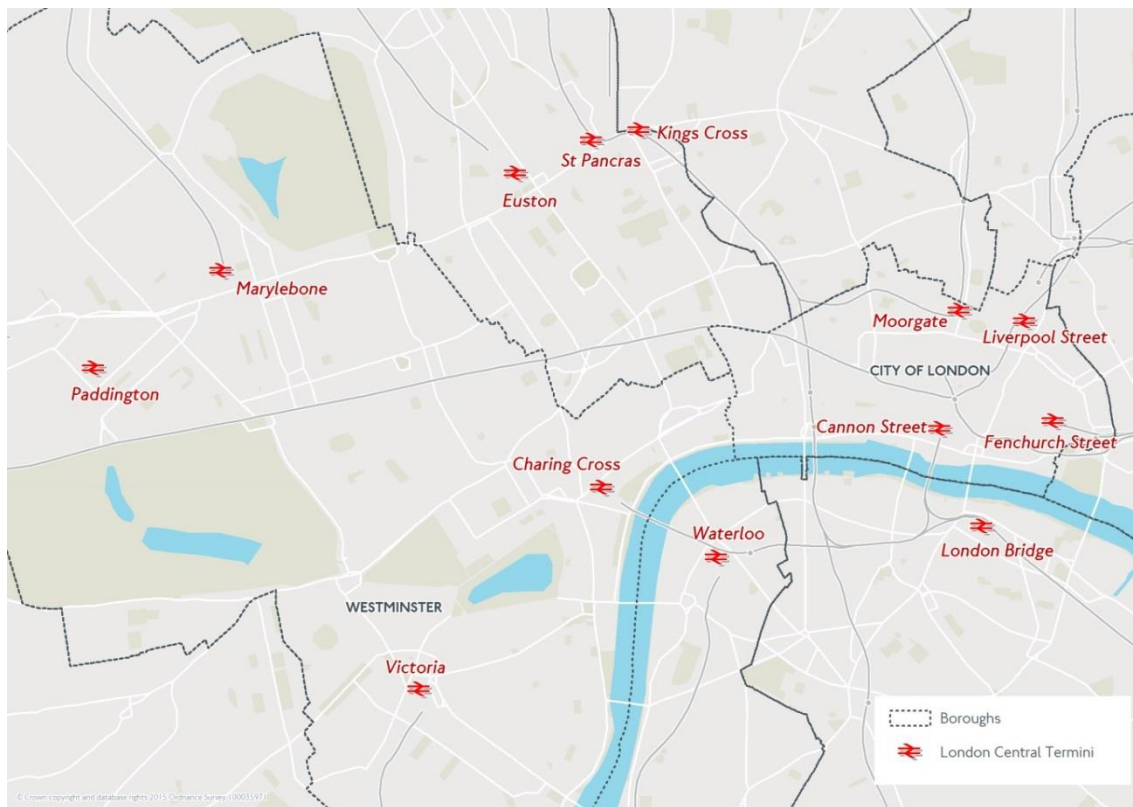
National Rail Termini

There are fourteen central London rail termini, shown in Figure 115. Passenger flows at some of central London's rail termini can significantly exceed those at London's Underground stations, and as well as catering for these vast rail passenger flows, most termini also house an Underground station – which are in many cases among London's busiest stations in their own right. As well as handling a large proportion of commuter traffic into central London, central London's rail termini are often vitally important gateways for business travel between central London and the UK's most economically active areas.

There are over half a million passenger travelling through the central London National Rail termini in the morning peak period (07:00-10:00) with over a quarter of a million passengers in the busiest hour (08:00-09:00). The termini are the points at which the majority of rail passengers reach central London, but although the termini are at the end of the rail line they are rarely the end of the journey; while some passengers are able to walk the last few minutes of their journey, thousands more depend on fast, reliable onward connections to reach their ultimate destination.

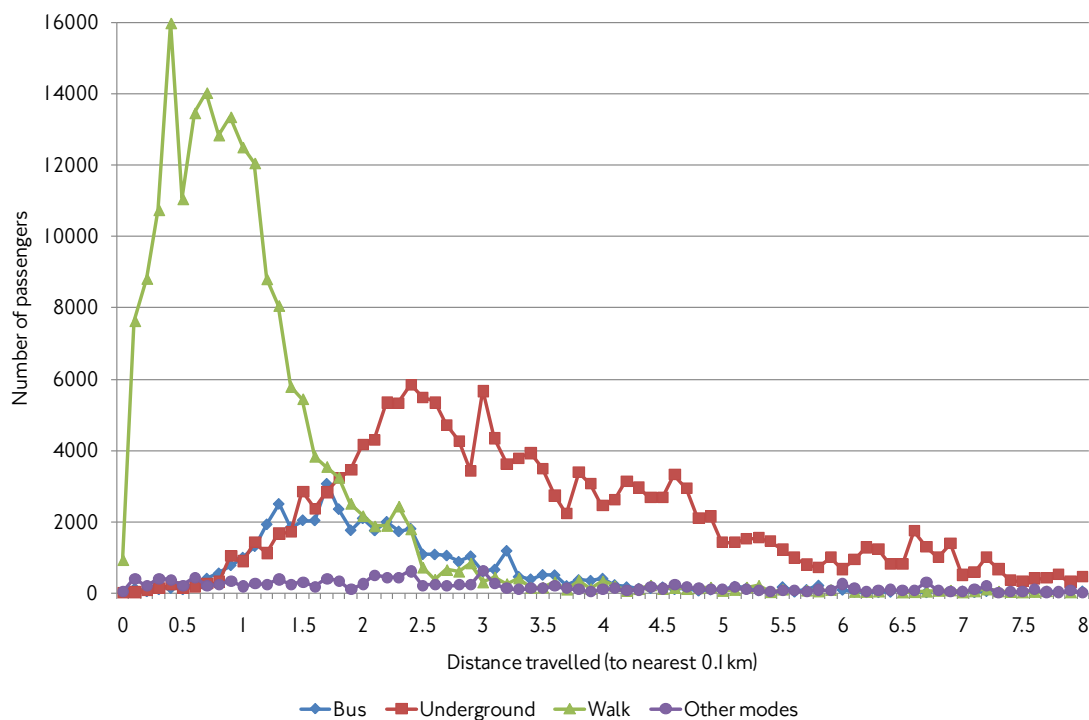
Most onward journeys to and from the central London termini are made either by Underground (40 per cent) or on foot (36 per cent), with the remainder made by bus (10 per cent), rail (9 per cent) and other modes. The use of different modes is closely correlated with the distances travelled, as shown in Figure 116.

Figure 115 Central London Rail Termini



Source: City Planning

Figure 116 Onward Journeys by mode and distance, central London rail termini, morning peak 2011



Source: Central London Rail Termini Report (TfL 2011)

With the number of rail passengers travelling into central London projected to rise considerably over the next twenty years, the need for efficient onward dispersal will become even greater. Demand increases will be driven by employment growth in central London, particularly in Opportunity Areas and Areas for Intensification, and facilitated by increased capacity on rail routes towards central London. The rail termini continue to see huge demand for office space in their vicinity, particularly within 500m of stations. Very tall buildings have been developed in the City of London and at London Bridge and are also expected in Paddington. Other mainline termini may similarly become hotspots of dense office space development. The land between King's Cross and St Pancras International is the largest redevelopment site in central London. The redevelopment of land near railway termini is likely to add to congestion and overcrowding at these stations.

Since responsibility for operations at each of central London's rail termini is typically shared between Network Rail, one or more Train Operating Companies, and Transport for London, these stakeholders must collaborate closely to manage large passenger flows and plan for growth. Major station works are highly disruptive for passengers and local communities and must be managed in such a way as to minimise inconvenience.

London Underground

On the London Underground network, rising demand is placing increasing pressure on stations. In recent years major station upgrades have been taking place at Victoria, Bond Street, Vauxhall and Tottenham Court Road. Work on a major upgrade has commenced at Bank and is due to complete in 2021. London Underground's Future Station Capacity Programme (FSCP) builds off of these upgrades and responds to rising passenger demand and forecast congestion at key stations across the network. By prioritising stations and developing designs for capacity upgrades, it seeks to support growth in demand, reduce in-station journey times, enhance the benefits of line upgrades such as on the Northern and Piccadilly lines, improve interchange and accessibility including step-free access, optimise third-party engagement and funding, and ensure stations support strategic growth in employment and housing. Other considerations such as ensuring stations can be safely evacuated in the event of a fire or other major incident also need to be addressed.

Holborn and Camden Town have been identified as the most urgent stations to upgrade in the future, with funding allocated to them in TfL's current business plan. These stations both regularly suffer overcrowding, with Camden Town already having to operate a one-way system on Saturday and as exit-only on Sunday afternoons to control crowding. As demand is expected to grow by as much as 50 per cent by the early 2030s, such measures may need to extend to other times during the week. At Holborn, large queues regularly build to enter the station in the evening peak with control measures being implemented. This is to prevent overcrowding inside the station which is triggered by entry, exit and interchange customers having to pass through the constrained space at the bottom of the main escalators. Interchange flows at Holborn are continuing to grow. The congestion will get increasingly severe with evening peak demand at Holborn projected to increase by 30 per cent by 2031.

Although the need for interventions is largest at network-critical stations, other stations will also require interventions to address the impacts of new development and to take advantage of opportunities with third-party developers. By working with developers and local authorities, significant capacity and accessibility improvements can be delivered to enable growth while lowering costs for TfL. Such opportunities are currently being pursued at Finsbury Park, Bromley-by-Bow and Tottenham Hale, and in the near future at stations such as South Kensington, Paddington (Bakerloo), Elephant & Castle (Northern) and Walthamstow Central.

Those stations in most need of upgrade works, either due to current conditions or because there is likely to be particularly high growth in the vicinity, have been identified, set out in Figure 117 below. This table also includes stations, marked with asterisks, where upgrades are planned or may need to take place earlier than 2041.

Figure 117 London Underground stations in need of upgrade works

Major interchanges with Network Rail	Critical central London interchanges	Key interchanges or local areas with high economic activity	Potential with complementary development
<i>Opportunity to develop collaborative masterplans for mutual benefit</i>	<i>Network-critical stations where interchange routes may experience severe congestion</i>	<i>Stations where interchange between modes or access to increasing number of jobs creates congestion</i>	<i>May be prioritised when complementary developments are identified</i>
Embankment	Camden Town*	Baker Street	Aldgate
Euston*	Green Park	Brixton	Canada Water
Euston Square*	Holborn*	Elephant & Castle (Northern)*	Chancery Lane
Liverpool Street	Leicester Square	London Bridge*	Covent Garden
Stratford*	Oxford Circus*	Moorgate*	Edgware Road (Circle)
Waterloo	Piccadilly Circus	Old Street*	High Street Kensington
		Paddington (Bakerloo)*	St. James's Park
		Russell Square	St. Paul's
		South Kensington*	
		Walthamstow Central*	
		Warren Street	

Source: London Underground

Note: stations marked with asterisks are where upgrades are planned or may need to take place earlier than 2041

6.8 Passenger safety on the public transport network

Londoners rightly expect their public transport services to be operated safely and to be managed and policed to ensure their personal security. After many years of safe operation, there was a major tram derailment at Sandilands Junction in November 2016 in which seven people lost their lives and over 50 people were injured. This tragedy serves as a reminder that safety is paramount.

Figures 118 and 119 show the trend in passenger injuries and fatalities on the principal public transport networks up to 2015/16. Note that this data is for the financial year ending March 2016 and thus does not include the Sandilands incident. In summary, the data shows that:

- On the Underground during 2015/16 there were 93 passenger injuries and three fatalities. This was slightly higher than the previous year, but it should be noted that the statistical definitions of this series changed in 2014/15.
- In 2015, 71 bus or coach occupants were injured in London, with one fatality. 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 chapter 3 of this report. There has been a consistent trend of improvement in bus or coach passenger injuries over the last decade.

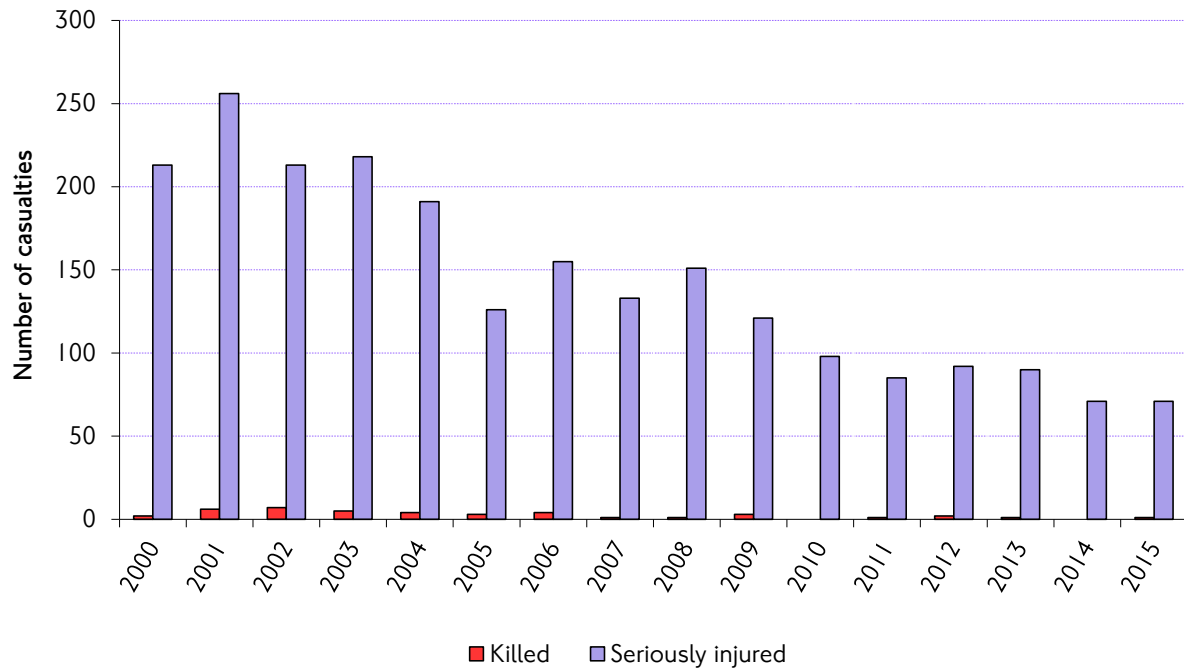
These trends should also be evaluated in the context of rising public transport patronage in London. The challenge remains to continue to improve passenger safety despite growing passenger volumes.

Figure 118 Number of people killed or seriously injured while travelling on London Underground, 1994 to 2016



Source: TfL Surface Transport

Figure 119 Number of bus or coach occupants killed or seriously injured in London, 2000 to 2015



Source: TfL Surface Transport

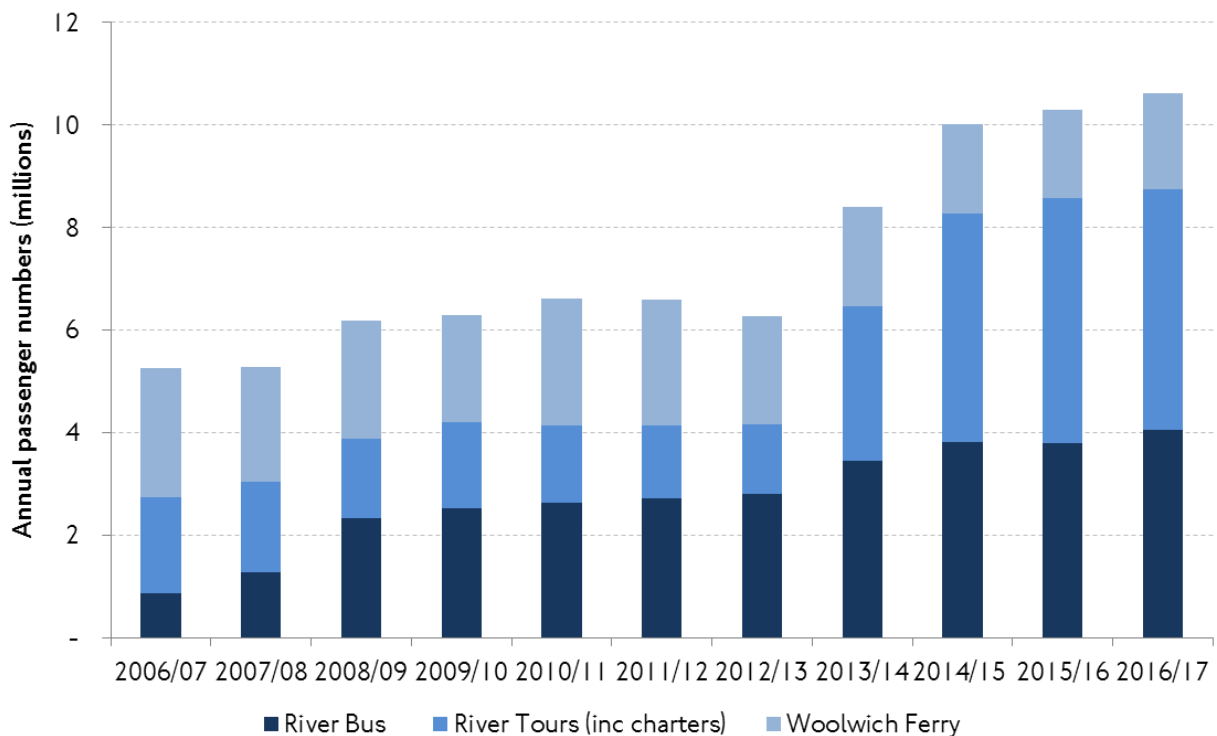
6.9 River services

Over the last ten years, river patronage has doubled (see Figure 120) with over 10.5 million people travelling on the river in 2016/17. TfL has worked in partnership with operators and developers to expand existing piers and services, improve integration with walking, cycling and public transport (e.g. rollout of contactless payment readers) and to introduce new developer led piers such as Plantation Wharf which have helped increase patronage. Between 2017 and 2021, up to seven new developer led piers including at Battersea and Royal Wharf will be introduced along the Thames and further opportunities are being investigated.

The Port of London Authority (PLA) Thames Vision has set a target to double annual river patronage to 20 million and underlying intra-port freight carried by water to over four million tonnes by 2035. To meet these targets, it will be necessary to:

- Maximise the finite space available on the river to safely carry both passengers and goods;
- Work with developers and commercial partners to introduce new and expand existing pier infrastructure, particularly in east London, at minimal cost to TfL;
- Improve visibility of river services and further integrate the river with walking, cycling and other public transport modes;
- Identify measures (e.g. engine filters) to minimise the impact of river services on the environment; and
- Address a skills shortage on the Thames, for example through the Thames Skills Academy.

Figure 120 River patronage growth, annual passenger numbers, 2006/07-2016/17



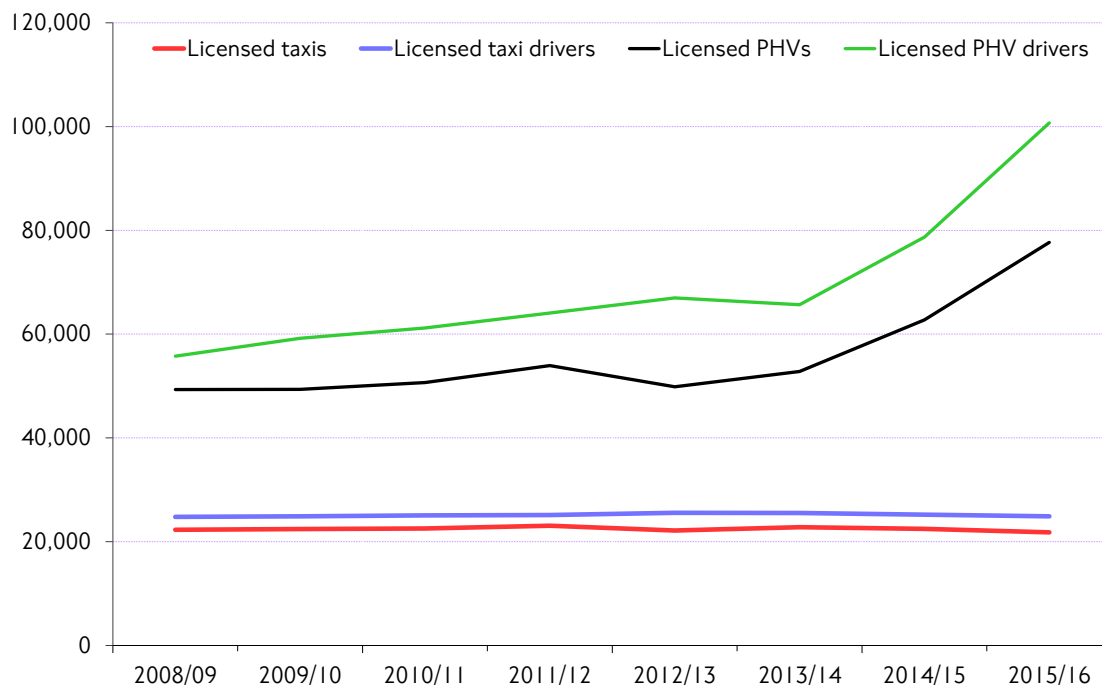
Source: TfL Surface Transport

6.10 Taxis and private hire vehicles

TfL is responsible for licensing taxi (black cab) and private hire services in London. The licensing of private hire operators started in 2001, with private hire driver and vehicle licensing following in 2003 and 2004 respectively. Prior to 2001 there was no regulation of private hire services in the capital.

The number of licensed taxi drivers and taxi vehicles has remained fairly constant since 2001 but in the past few years there has been a significant increase in the number of licensed private hire drivers and vehicles, shown in Figure 121. Since 2008/09, the number of private hire vehicles has increased by 58 per cent and the number of drivers by 81 per cent. At the same time the number of licensed private hire operators has decreased.

Figure 121 Recent trend of licensed London taxis and private hire vehicles



Source: TfL Surface Transport

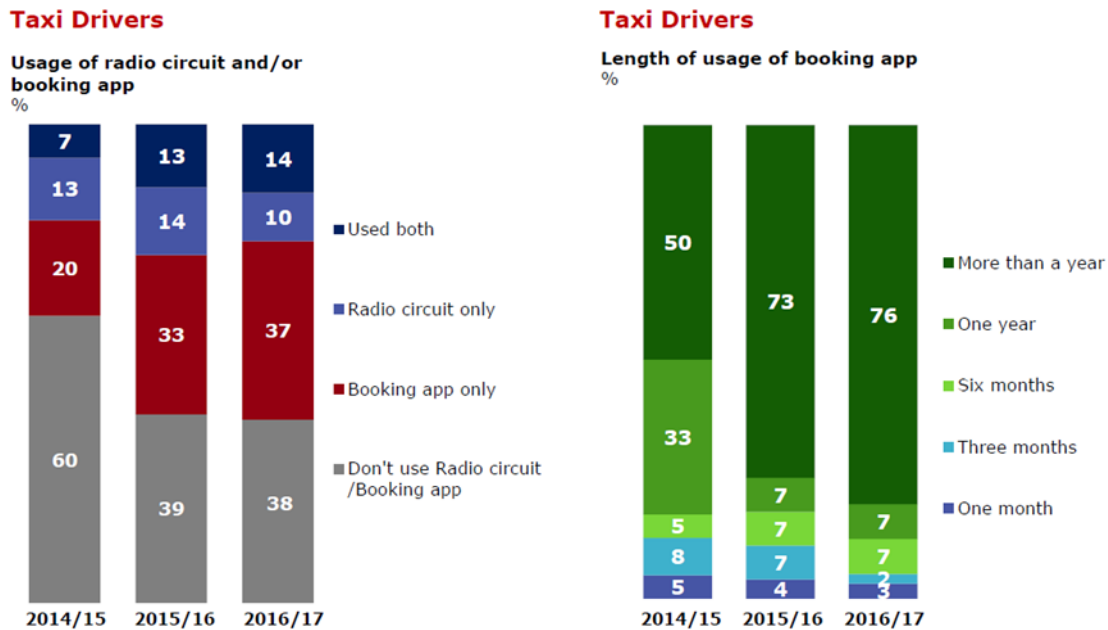
Monitoring the size of the taxi and private hire markets is difficult as operators and drivers are not required to provide journey information to TfL and there is no equivalent to the data received for bus and Tube journeys. Furthermore, private hire covers a wide range of different services. Research is underway to establish the size of the taxi, minicab and chauffeur markets and changes to these markets.

Separately, TfL now requires all licensed private hire operators to submit details of their booked journeys and the licensed drivers working for them on a weekly basis. This information provides a better understanding of the profile of the private hire industry whilst also assisting compliance and enforcement activity (for example monitoring drivers who may be working when unlicensed).

Impact of app-based services

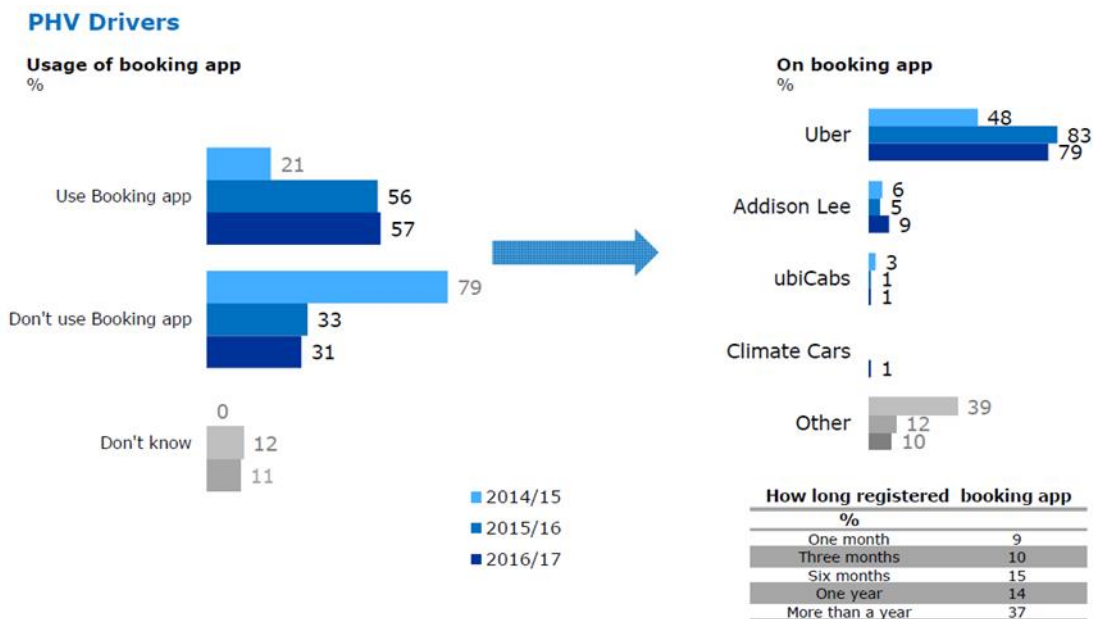
The introduction of apps which enable users to book a taxi or private hire vehicle (PHV) has had a major impact on both markets. An increasing number of drivers are using apps and the usage by passengers has grown significantly. Figure 122 shows the change in use of apps by taxi drivers between 2014/15 and 2016/17 and Figure 123 shows the use of apps by private hire drivers over the same period.

Figure 122 Change in use of apps by taxi drivers and length of time app used for, 2014/15 to 2016/17



Source: TfL Surface Transport

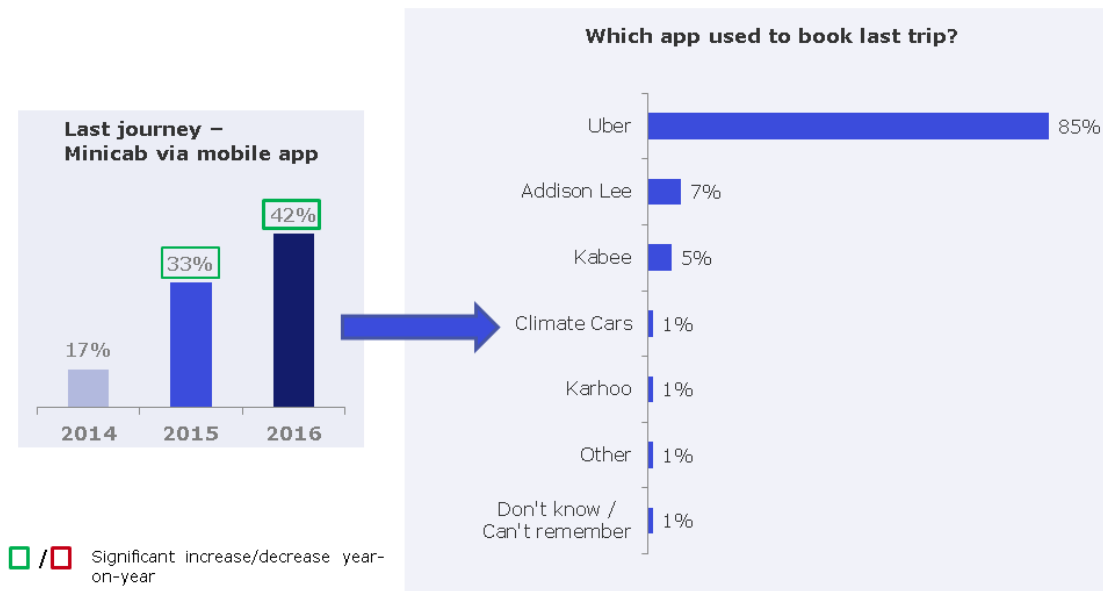
Figure 123 Change in use of apps by private hire drivers, 2014/15 to 2016/17



Source: TfL Surface Transport

Research carried out with users in 2014, 2015 and 2016 showed that amongst minicab users the number who had used an app to book their last minicab journey had risen from 17 per cent to 42 per cent, shown in Figure 124.

Figure 124 Change in use of apps by minicab passengers, 2014 to 2016



Source: TfL Surface Transport

There is increasing interest in the provision of ridesharing services. In 2016, just under a fifth of taxi and minicabs users had used a ridesharing service in London. While ridesharing presents opportunities there are also some potential risks including to passenger safety.

Challenges and opportunities for taxi and private hire services

Challenges and opportunities include:

- Ensuring that there is fair competition between the taxi and private hire markets and that services represent good value for money for passengers;
- Managing the increase in private hire driver and vehicle numbers and the impact on congestion, air quality and compliance;
- Phasing out diesel taxis and ensuring new vehicles are zero emission capable;
- Ensuring that the supply of taxi or private hire services meets customer needs;
- Ensuring that taxi ranks and space for taxis and private hire vehicles to pick up and drop off passengers are provided in suitable locations;
- Providing training to drivers to improve the customer experience, help minimise road danger and improve services for disabled passengers;
- Ensuring drivers are paid a fair wage and are not exploited; and
- Reviewing legislation to reflect the changing nature of the taxi and private hire market, including the need to bring pedicabs within the licensing framework.

6.11 Coach travel

14 million passengers a year travel by coach in and out of Victoria Coach Station, to 1,200 destinations in the UK and abroad. Coaches provide national and international connectivity at a low cost for many groups including commuters, students, people visiting family and friends, and holiday-makers. The greatest inbound flows are seen on the M1 and M4, with the M11 and M40 also key routes.

Victoria Coach Station currently operates at or close to capacity and is in need of substantial refurbishment. Major redevelopment in Victoria will place increased pressure on the road network, further damaging operations. Further, Grosvenor Estates are keen to redevelop the site and it is an identified construction site for Crossrail 2.

An assessment of policy and demand for coach services has demonstrated that a central hub in zone 1 needs to be maintained, with supporting hubs around London, and a feasibility study is underway looking at a new primary hub in the inner/central/west London area, which has land available and offers good road and onward transport links. Further work is also underway to clarify the role of coaches in London's transport offering, and to consider what role TfL should play in their provision.

6.12 Summary: a good public transport experience

London has become more unaffordable as housing and travel costs have risen faster than incomes

Whilst the economy of London has grown, not all Londoners have shared in the benefits. London is one of the most expensive places to live in the world and yet more than a fifth of working Londoners do not receive the London Living Wage. In the early years of TfL, average earnings rose faster than fares, particularly bus fares which were frozen or reduced each year between 2005 and 2008. However, between 2008 and 2015, single Tube and bus fares increased by around 60 per cent. While this allowed for significant investment in transport networks, those on the minimum wage saw their pay rise just 17 per cent, making travel costs a larger proportion of their spending. The Mayor has frozen fares to make travel more affordable. Travel costs becoming unaffordable could make it harder for Londoners to make the journeys they need and want to by public transport.

A good customer experience means consistently getting the basics right and being innovative

A good customer experience means consistently getting the basics right and being innovative. Customers should be able to trust their transport providers to provide a good experience across the network, but overstretched services may struggle to deliver what customers want. Customers will expect services to respond to emerging technology and reflect cultural change - as expectations rise, it will become increasingly difficult to deliver the basics consistently in a crowded and congested environment. In particular, customers expect and deserve a consistent experience and yet satisfaction varies considerably between different rail operators, with customers on Southern and Thameslink services the least satisfied.

An inclusive, accessible, affordable transport network benefits all Londoners. But despite significant improvements, 41 per cent of the public transport network is still not accessible

Journey times are longer on the step-free network and a number of barriers to travel remain. In particular, whilst everyone finds travelling on crowded services unpleasant, for those with accessibility needs crowded services can act as a total barrier to travel. With a fast growing population with accessibility needs - 1.8 million people by 2041 - and more intensely crowded rail services, accessibility risks becoming a more acute challenge as time moves on.

Buses are a space-efficient and affordable mode of transport but falling speeds worsen the experience for users

London's bus services provide the most extensive public transport network in the capital, offering low cost, accessible travel across London's residential outer areas as well as a dense network of services in inner and central London. Investment in new services, increased frequencies, bus priority and improved customer experience meant that demand for bus travel grew by 71 per cent between 2000 and 2015 and 3.9 million bus journeys are made in London every day.

However, passenger volumes have started to fall in recent years, largely as result of slowing bus speeds and also reflecting changes to travel patterns. It is vital that the huge achievements of the past 15 years are not lost and London does not see a return to car travel. In fact, there is enormous potential to deliver mode shift from car to bus, with around three million journeys that could feasibly be made by bus. Modelling suggests that increasing bus connectivity in outer London in particular could deliver this mode shift; emerging forms of demand responsive bus services could provide a cost effective solution in some cases. To realise this potential, buses will need to provide connectivity and convenience to compete with the car, and bus speeds will need to improve once again.

Despite tube and rail upgrades and the opening of the Elizabeth line, demand will increase faster than supply by 2041, exacerbating crowding

In the next five years, London will experience the opening of the first entirely new rail line in a generation and the completion of significant upgrades to the London Underground network. As a result, by 2021, the rail network will be less crowded on average than today, although many lines will still experience very crowded trains. But by 2031, the funded programme will have drawn to a close, and population growth will be placing renewed pressure on the rail network. By 2041, demand will have outstripped supply and in the absence of new rail capacity we can expect to see severe crowding across almost all of the Tube and rail network as it approaches central London, and spreading much further in many cases. Crowding will increase by 50 per cent on London Underground and 90 per cent on national rail services by 2041.

Crowding in stations causes delays and frustration and will become more common as London grows

The same demographic and economic factors that lead to busier trains will result in increased passenger numbers at stations across the network. The most significant challenge will arise in central London, where demand for travel at peak periods will rise substantially, placing pressure on key destination stations and interchanges. Congestion within stations leads to delays as passengers move slowly through the station, are forced to wait to board trains, or are held outside the station as safety concerns force temporary closures. By 2041, planned station control measures may be required at 30 key stations, including London Underground stations serving each of the six major National Rail termini. The closure of a London Underground station at a terminus, even for a short time, adds significant pressure to the wider network.

Passenger safety should always be a top priority

In recent years, the number of people killed or seriously injured on the London Underground has remained broadly stable, set against growing passenger numbers, and the safety of bus and coach passengers has improved considerably. After many years of safe operation, there was a major tram derailment at Sandilands Junction in November 2016 in which seven people lost their lives and over 50 people were injured. This tragedy serves as a reminder that safety is paramount and that it is vital to work to continuously improve passenger safety despite growing demand for services.

The Thames Vision sets a goal of doubling river patronage

Over the last ten years, river patronage has doubled with over 10.5 million people travelling on the river in 2016/17 and the Port of London Authority (PLA) Thames Vision has set a target to double annual river patronage to 20 million and underlying intra-port freight carried by water to over four million tonnes by 2035.

In recent years, there has been an unprecedented rise in the number of licensed private hire drivers and vehicles, leading to concerns around congestion, air quality and compliance

Whilst the number of licensed taxis and licensed taxi drivers in London has remained stable for many years, the number of private hire vehicles (PHVs) has increased by 58 per cent since 2008/09 with the number of licensed drivers increasing by 81 per cent over the same period.

Coaches provide affordable long distance transport options; Victoria Coach Station currently operates at or close to capacity and is in need of substantial refurbishment.

Coaches provide affordable long distance transport options; however, TfL does not operate services directly but has historically provided the London terminus at Victoria Coach Station. 14 million passengers a year travel by coach in and out of Victoria Coach Station, to 1,200 destinations in the UK and abroad. A study has concluded that a central hub in zone 1 needs to be maintained, with supporting hubs around London. The role that the public sector should play in future coach provision is yet to be decided.

7 New Homes and Jobs

The number of people living in London is rising fast, with the population expected to reach 10.5 million by 2041, accompanied by 6.8 million jobs. As described in the previous chapters, without further action the growth in travel demand will lead to overcrowded public transport services, congested and traffic clogged streets, and poor air quality. We also face a public health crisis, and the transport network can play a vital role in helping people be more active. Fundamentally, people will choose the easiest and most convenient travel options; it is therefore vital that the design of new developments makes travelling sustainably the best choice. This chapter describes the role of transport in unlocking development and explores the relationship between different factors and sustainable travel choices.

New Homes and Jobs: key findings

- London accounts for one fifth of the UK economy and holds a unique role as an internationally competitive centre for global business services. Central London accommodates 30 per cent of London's jobs in just 2 per cent of its area.
- All of London's key employment centres are in locations which can be reached by more than two million people within 45 minutes and this is where the most growth is expected, with three quarters of a million additional people expected to be working in central London and the Isle of Dogs by 2041. Transport capacity constraints can limit this connectivity and may lead to lost economic potential if crowding starts to deter people from working in the centre.
- The 'effective connectivity' of the transport system will be insufficient to meet London's labour supply requirements from the early 2030s as demand starts to outstrip supply. New rail capacity will be required to meet this demand and ensure London's economy can continue to thrive.
- Beyond the centre, travel is more car dependent but town centres could become sustainable travel hubs. Currently, Londoners make 1.5 million car trips every day to or from one of London's town centres.
- 50,000 new homes are needed every year, equivalent to a new home every 11 minutes, 24 hours a day for the next 25 years, but only around half this have been delivered in recent years.
- A constrained housing supply means people are paying more to live in worse conditions. In the long term, a constrained housing market will deter people from living and working in London and threaten economic growth.
- Transport has a key role in unlocking housing development – homes in the best connected areas command a price premium and a disproportionate amount of development has taken place in very well connected areas.
- Conversely, many of the areas with the greatest capacity for development have poor transport connectivity and this has directly limited private sector investment in housing.

- Investing in new public transport capacity could unlock the delivery of hundreds of thousands of homes that may not otherwise come forward for development. TfL is the owner of 5,700 acres of public land in London and sites have been identified that could potentially deliver 10,000 homes over the next five years.
- Where people live to a large extent determines their travel patterns: car ownership and use is higher in places where access to jobs, shops and services depends on the car. People living in more densely populated areas, with good access to town centres and public transport services, are more likely to travel by public transport, cycling and walking and less likely to travel by car.
- Better cycling facilities, such as safe and appealing routes, and secure parking at stations, can expand the effective connectivity provided by the public transport network as people living further away can access rail services within the same amount of time.
- In outer London particularly, car ownership levels are higher where there is better parking provision, based on the assumption that off-street parking is better than on-street, and that unpermitted parking is better than permitted. In inner London, there is some evidence that the cost of parking is deterring people from owning and running a car.
- Research conducted with residents of new developments found that for all groups and in all areas residents of developments with more parking available owned more cars than people living in developments with less parking.
- In summary, it is clear that the situation and design of new housing will determine the travel patterns of its residents. Higher density, well connected housing, offering a good quality environment for walking and cycling, and limited parking provision, will encourage people to travel sustainably. Equally, in order to prevent rising car travel, new employment should be well connected by public transport and active modes to the potential workforce, with limited parking, to deter commuting by car.

7.1 Unlocking new jobs

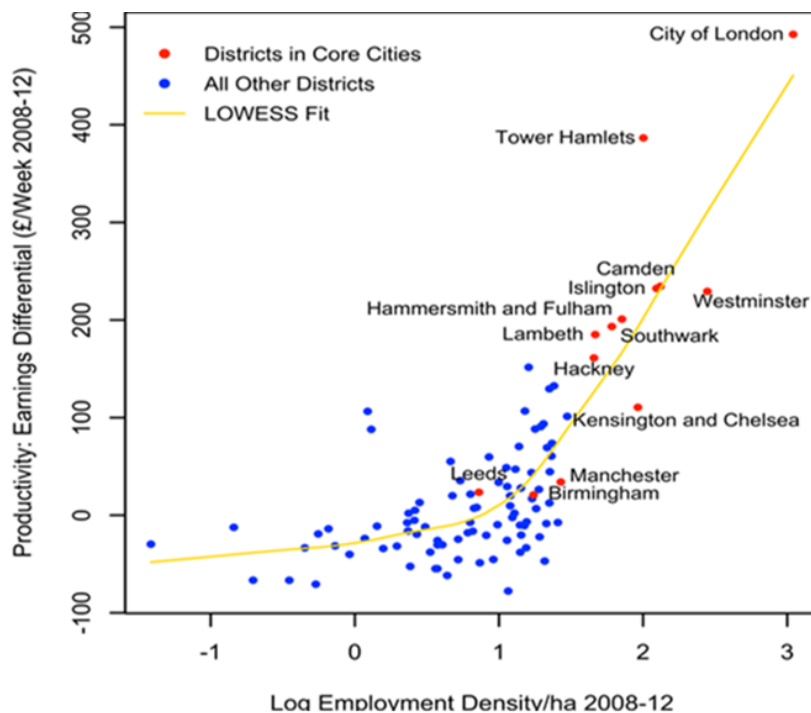
This section describes the challenges and opportunities facing London's economy and the role of transport in delivering economic growth.

London's economy and the role of transport

London is vital to economic growth across the UK – it is the most productive region and the UK's only global centre. London's position as an internationally competitive centre for global business services brings trade not just to London but to the UK as a whole. In 2014, London accounted for around 23 per cent of the UK's economic output, a rise from around 19 per cent in 1997. 45 per cent of GVA was generated in just six central Boroughs, making this the most productive part of the UK. It hosts a cluster of globally competitive sectors in its centre, which accommodates over 30 per cent of the city's jobs and 60 per cent of office jobs in just 2 per cent of its area. There is considerable scope to further increase employment density in London's global employment core but this will depend on expanding the available labour supply.

Figure 125 shows the clear relationship between employment density and productivity in the 100 largest employment centres, with the exceptionally high density City of London and Tower Hamlets (containing Canary Wharf) the most productive zones by quite some way. An important economic challenge facing London over the next few decades is to maintain and extend this role.

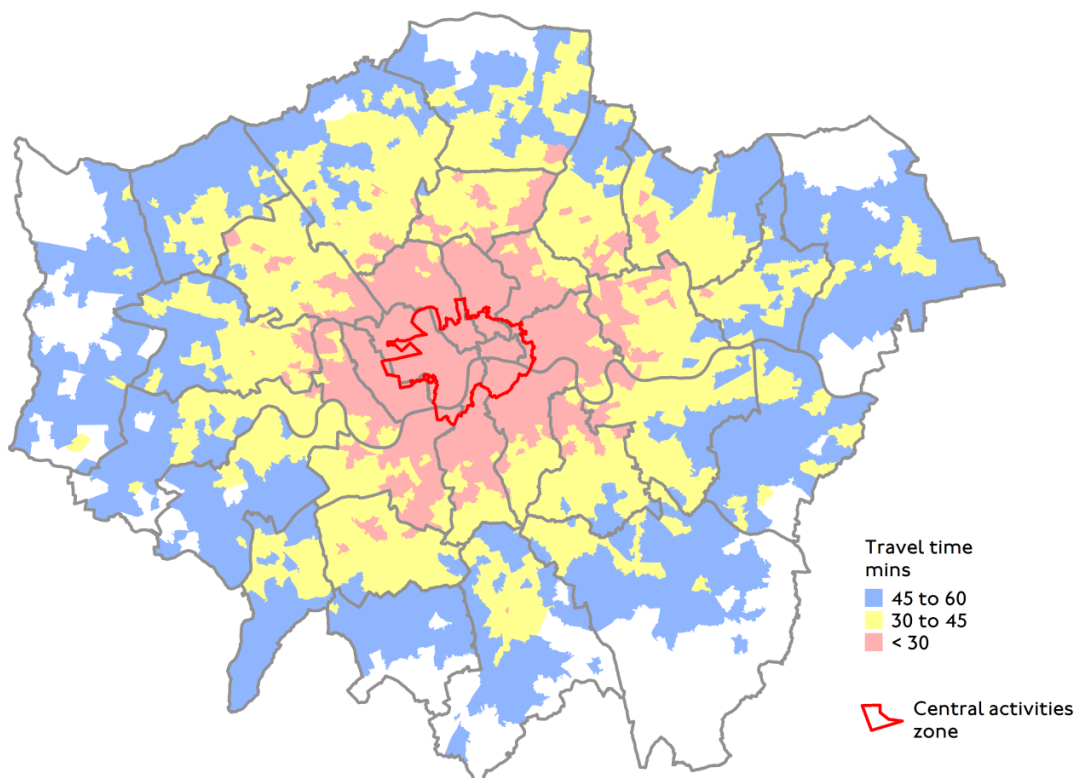
Figure 125 The relationship between employment density and productivity in the 100 largest employment centres



Source: Volterra

Ready access to a very large population catchment, supplied by the rail network, is fundamental to London's ability to act as a global employment centre. Businesses depend on the system being able to deliver people reliably from where they live to where they work at times they are prepared to travel. This means that in addition to the connectivity of the transport system, its capacity and performance are critical. These factors together determine its 'effective connectivity'. Figure 126 shows the working age population able to access each zone within 45 minutes travel time. By 2041, with the funded programme, 7.6 million working age people will be able to access central London in 45 minutes travel time. All of London's key employment centres are in locations which can be reached by at least two million people within 45 minutes. This is also where the most growth is expected, with three quarters of a million additional people expected to be working in central London and the Isle of Dogs by 2041. Eight in ten of those working in central London arrive by rail and so this growth will depend on the effective connectivity provided by a high capacity radial rail network.

Figure 126 Travel time to the Central Activities Zone, funded programme, 2041



Source: TfL City Planning

Impact of public transport crowding on economic growth

Transport capacity constraints can limit the effective connectivity of the transport system, and will constrain growth in labour supply if not addressed. Persistent levels of excessive crowding on the transport system and associated impacts on system performance can be seen as a 'warning sign' that labour supply constraints are starting to emerge. The impacts may be felt before the point is reached at which passengers cannot physically board trains as some travel will be deterred by the prospect of severe overcrowding. They are also likely to be accompanied by deteriorating system performance.

If experienced on a daily basis this will reduce some people's willingness to commute resulting in them withdrawing from labour markets in which they would otherwise be willing to participate. If the situation is sufficiently widespread it will impact on people's perception of the quality of life available in the city and fewer people willing to live and work in it, reducing the effective supply of labour that is available. As labour supply becomes constrained, employers' costs will increase as they have to pay higher wages and they will become less competitive. Eventually the city will become less attractive as a business location and agglomeration benefits will decrease leading to a further loss of competitiveness and so on.

If the central London economy was to be constrained as a result of transport problems, estimates suggest that this could result in an annual loss to national output of approximately £70 billion or 5.4 per cent of GDP.

The rail capacity challenge to 2041 and need for new rail capacity

As outlined earlier in this report, with currently committed and planned investment the 'effective connectivity' of the transport system will be insufficient to meet London's labour supply requirements from the early 2030s as demand starts to outstrip supply.

There is strong evidence that the heart of the transport network will be severely constrained by the early 2030s. The central area of the Underground network within the Circle Line, together with links to Canary Wharf, Stratford and Battersea, represent the heart of the network critical to delivering the 'hyper-connectivity' enabling key employment centres to share a vast shared labour market. This part of the network offers a dense array of interchange possibilities between Underground lines and also with the ring of national rail stations that enables dispersal of arriving national rail commuters to their employment locations.

The greatest challenges on the London Underground network will arise on:

- the Victoria line northbound, north of Victoria; and southbound, south of Finsbury Park;
- the Northern Line northbound and southbound on both the Charing Cross and Bank branches (inbound from Waterloo, London Bridge, Euston and King's Cross St Pancras);
- the Jubilee Line eastbound, east of Waterloo; and
- the Waterloo and City line northbound.

Furthermore, the radial rail network is expected to experience severe crowding, with particular capacity challenges in the following locations:

- North east (Victoria, Piccadilly, Central and Northern lines) to south west (Northern, District and rail lines to Waterloo) corridor;
- DLR (Canary Wharf); and
- Trams east of Croydon.

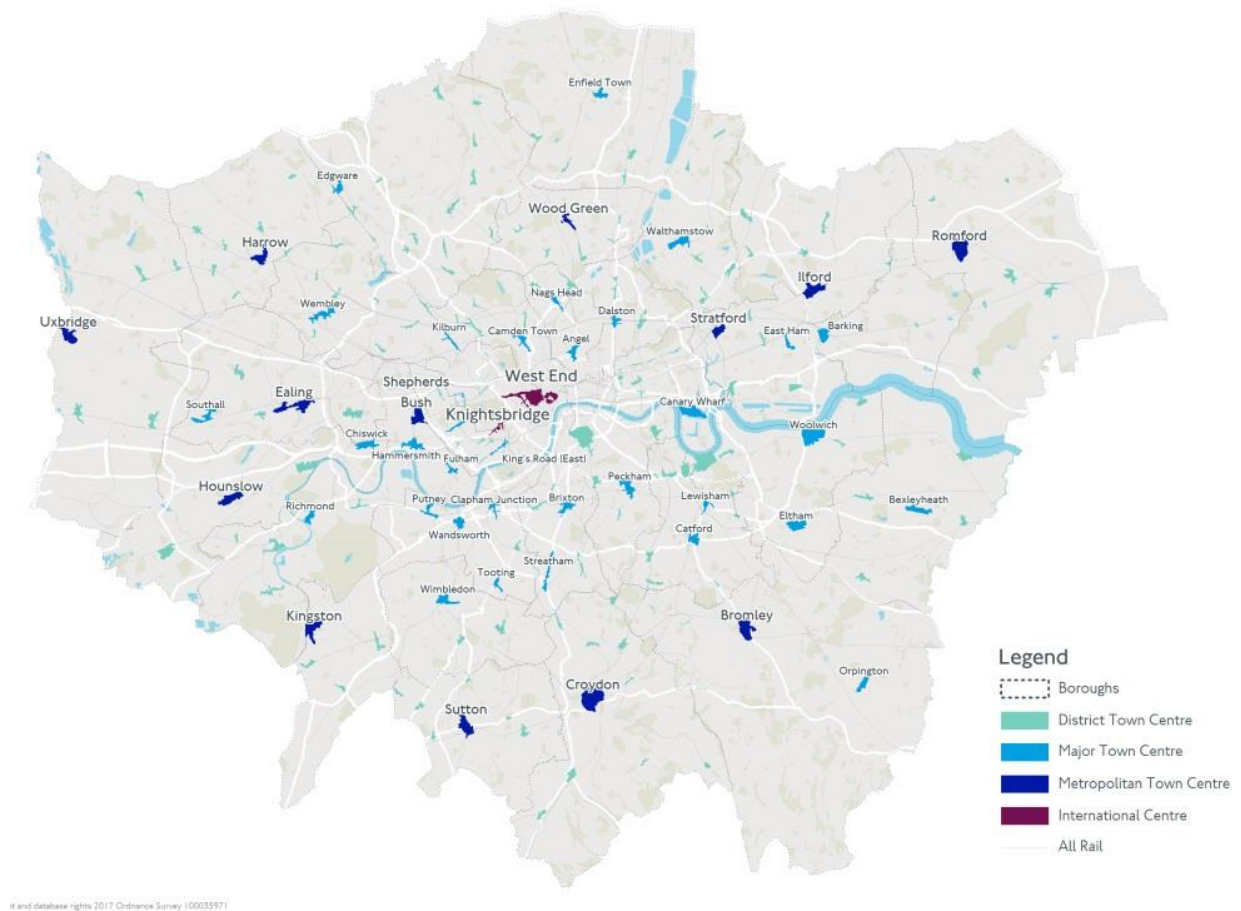
The solution is for additional capacity to be created through appropriate investment in the transport system. The Jubilee Line Extension demonstrates the benefits of investing in new rail capacity. The line has enabled large scale development in a series of locations along its route, most notably at Canary Wharf, which now accommodates over 100,000 high value jobs. This is only possible because of the line's function (along with the DLR and Crossrail from 2019) in integrating the area into the wider transport network that serves Central London. Canary Wharf is therefore able to draw on a largely similar labour pool to the City of London and the rest of Central London.

Role of town centres

Beyond the centre, travel is more car dependent but town centres could become sustainable travel hubs. London contains twelve metropolitan town centres – many similar in size to the centres of major cities across the UK – as well as 35 major centres and 147 district centres. These are shown in Figure 127. At least four in ten journeys made by London residents start or end in a town centre, primarily for shopping but also to work, access services and for leisure purposes. On an average day, London residents make 1.5 million car trips to a town centre.

As our shopping habits change, the role of town centres is changing accordingly. Retail is consolidating in larger centres, meaning that smaller centres are becoming less viable over time. In general, we can see that the denser the area in 2011 in terms of retail units, the greater the increase in density since. Conversely, town centres have an increasing role as leisure destinations and residential locations, resulting in more evening travel.

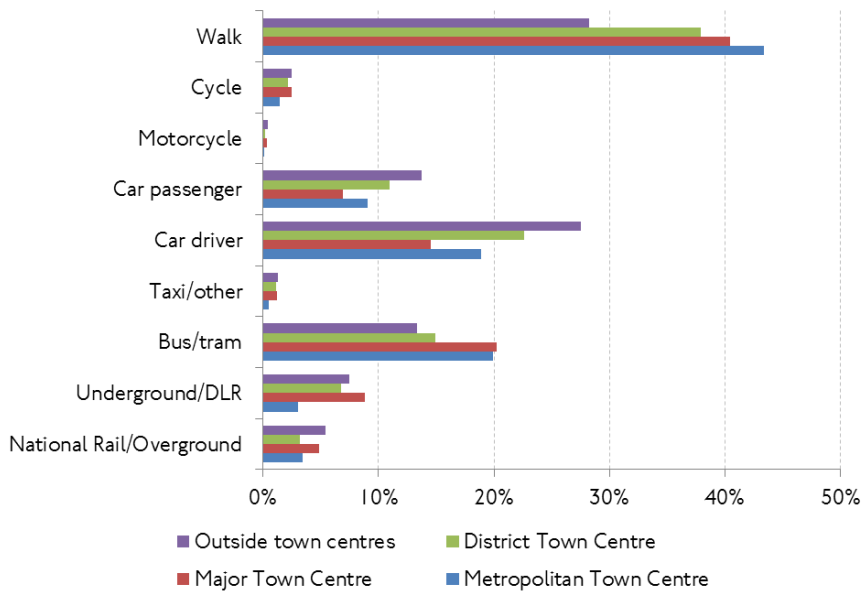
Figure 127 Map of London's town centres



Source: TfL City Planning

Town centres typically also act as transport hubs, with larger town centres all served by Tube or rail services and multiple bus routes. Whilst London residents are less likely to drive to town centres than other destinations, nevertheless, three in ten trips to a town centre is made by car. Non-Londoners also visit London's town centres, often by car, so this is likely to underestimate the overall car mode share. Research has found that people accessing town centres by active modes and bus spend more per month than car users. The mode share of trips to town centres by London residents is shown in Figure 128.

Figure 128 Mode share of trips to town centres, London residents



Source: TfL City Planning

7.2 Unlocking new homes

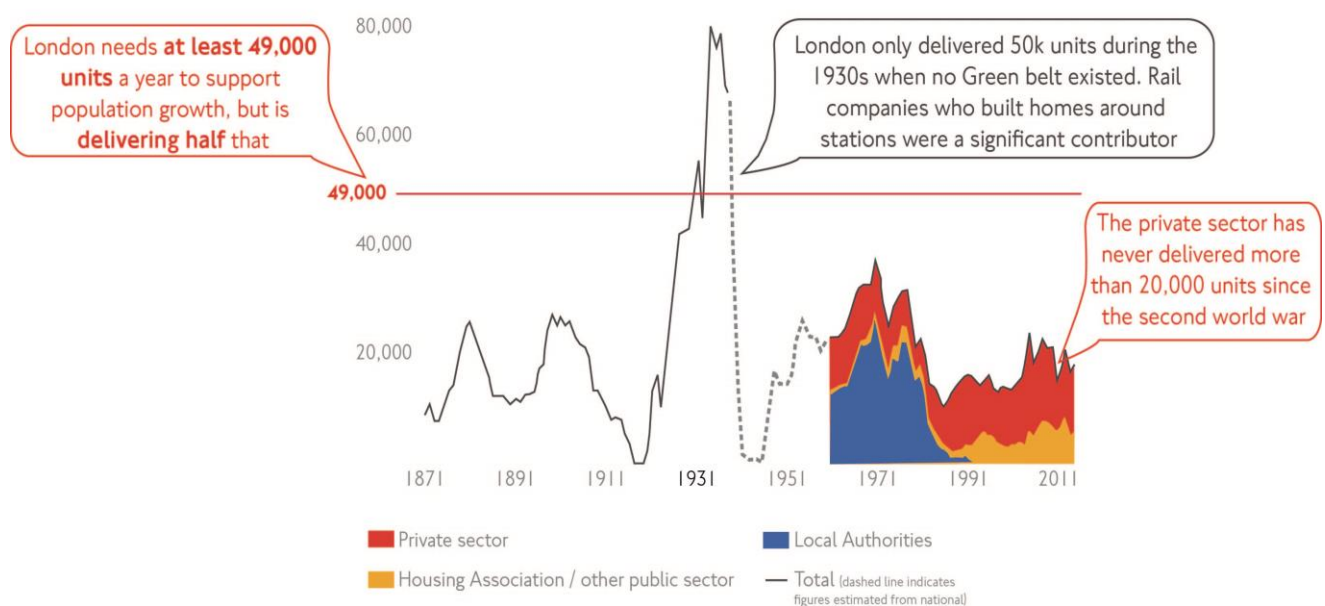
This section describes the challenges and opportunities facing housing in London and the role of transport in unlocking the development of new homes.

London's housing challenge

Building enough new homes and catering to the needs of all Londoners is extremely challenging. To accommodate population growth and tackle the existing housing shortage, 50,000 new homes are needed every year. This is equivalent to a new home every 11 minutes, 24 hours a day for the next 25 years. Some 270,000 homes in London have been granted planning permission but have not yet been built - last year alone nearly 70,000 new homes were approved - and only around half the homes that Londoners need have actually been delivered in recent years. Figure 129 shows the profile of housing delivery over the past 150 years. This shows that London has only once and for a very short period seen the levels of housebuilding now required – in the early 1930s.

Figure 129 New homes built in Greater London, 1871 to 2014

New homes built in Greater London, 1871 to 2014



Source: TfL City Planning

A shortage of housing raises living costs and reduces quality of life, with people having to live in overcrowded or unsuitable homes, far from home, friends and family. Overcrowding is rising in London, but falling nationally. The biggest supply gap is in the lower market value (less than £450 per square foot), with the least gap in the upper mainstream market (£700-1,000 per square foot). 90 per cent of new residential units in London are flats.

As well as damaging quality of life and increasing the cost of living, housing supply constraints can deter people from living and working in London, meaning a

constrained housing supply also signifies lost economic potential. Three quarters of businesses consider housing a threat to the economy.

Analysis suggests that if London's housing needs were not met, the consequences might be:

- Prices rise;
- Some people who would have lived in London live elsewhere;
- Housing is only delivered in places with the highest land values and elsewhere, properties are sub-divided;
- People are forced to live further away from where they work and in areas with poorer transport accessibility; and
- Overcrowding rises and the amount of space per person falls.

The role of transport in unlocking housing

The role of transport in unlocking housing development is multi-faceted:

- Unlocking new development opportunities through investment in new rail infrastructure or substantial improvements to current services, for example increasing service frequency and quality on the National Rail network.
- Maximising the impact of planned new infrastructure and upgrades through complementary investment to create high quality places.
- TfL is a major land owner and could also partner with developers to bring forward National Rail sites for housing.

Transport brings about investment in housing both by improving the viability of developments and creating new markets. Homes in the best connected areas command a price premium - currently 2.5 per cent for Crossrail 1 above surrounding areas - and a disproportionate amount of development has taken place in very well connected areas. Since 2005 over half of residential development has come forward in areas of PTAL 4 and above, shown in Figure 130.

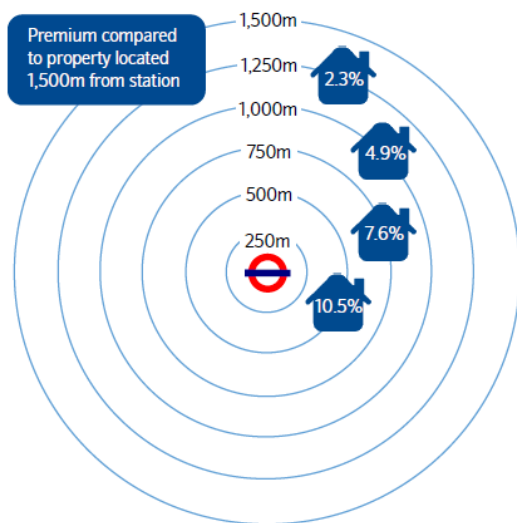
Figure 130 Housing completions by public transport access of local area, 2005 to 2016



Source: TfL City Planning

It is estimated that an additional 1,000 new homes delivers 250 new jobs created, with access to central London and good rail services a key determinant. Research by Nationwide found that London homebuyers are willing to pay a £42,000 premium for a property 500m from the nearest station, compared to a similar one 1.5km away, shown in Figure 131. Better railways are fundamental to building more homes and the greatest benefits are accrued where infrastructure provides new or significantly enhanced rail connectivity to central London.

Figure 131 Property price premium compared to property located 1,500m from a station

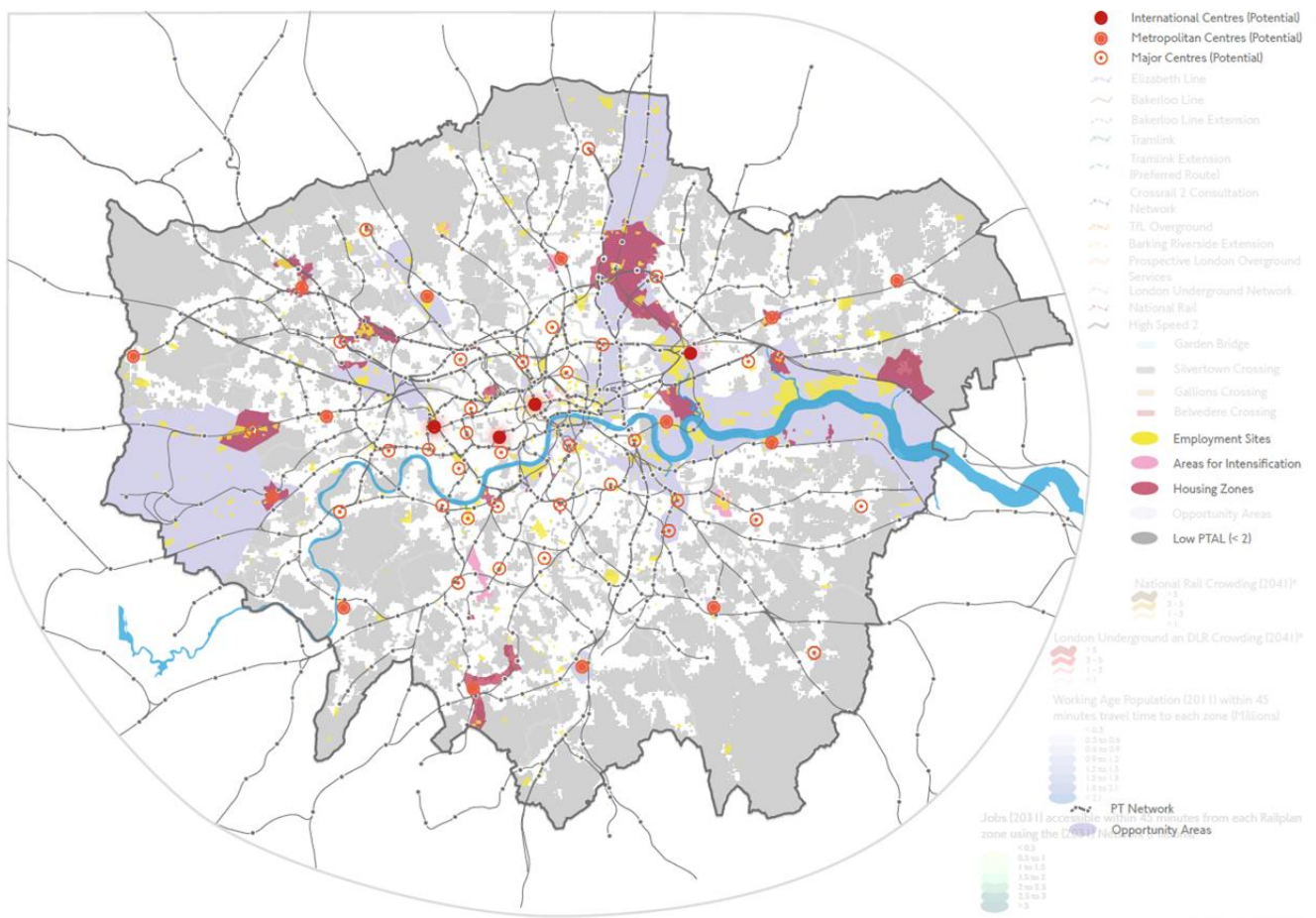


Source: Nationwide

Over recent years, a disproportionate amount of population growth has taken place in inner London, as that area densified through new development and also the splitting of houses into flats. Whilst further potential for densification remains, there are limits to the residential capacity of the areas that are well connected by public transport.

Lack of transport provision can damage the viability of sites for development. Opportunity Areas are London’s largest reservoir of brownfield land, but many of the areas with the greatest capacity for development have poor transport connectivity and this has directly limited private sector investment in housing. Figure 132 shows Employment Zones, Areas for Intensification and Housing Zones mapped alongside public transport access levels – showing the overlap between development opportunities and poor connectivity, particularly in the Upper Lea Valley.

Figure 132 Comparison of growth areas and public transport access

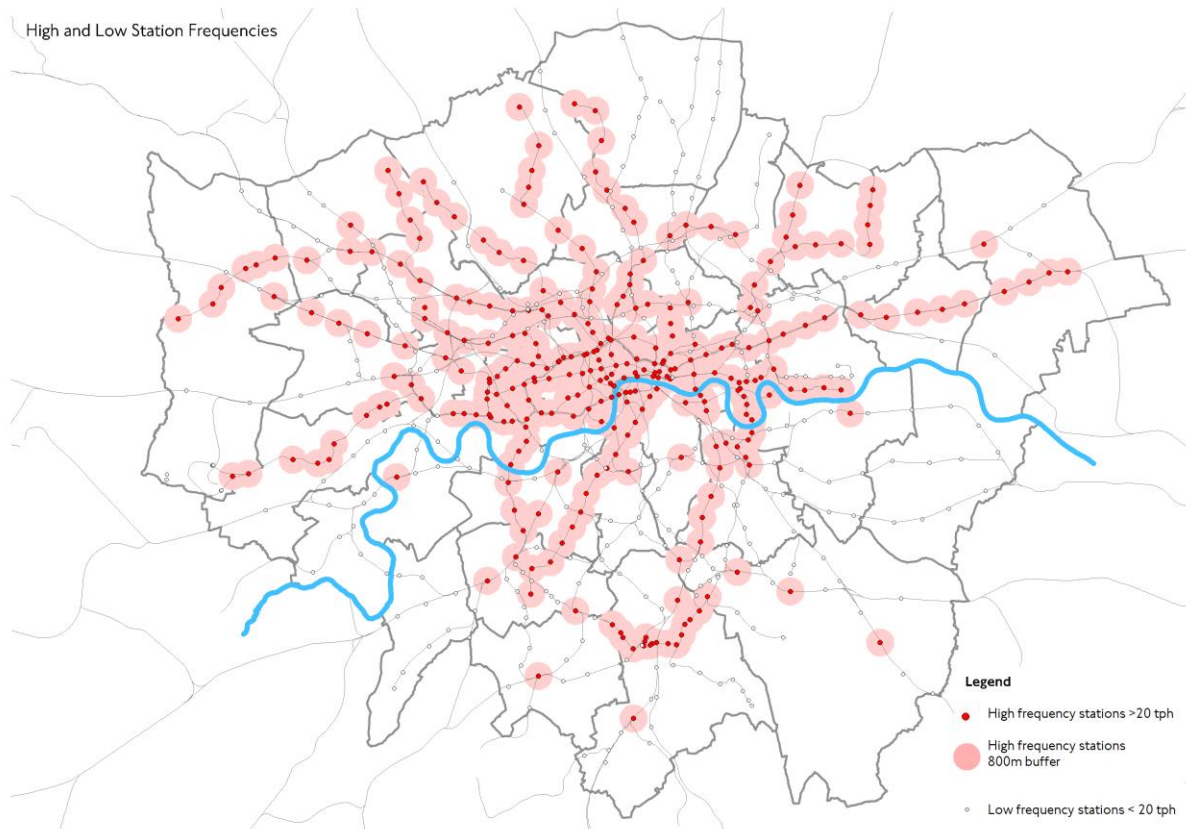


Source: TfL City Planning

Beyond these growth areas, densification and development is constrained in parts of London with poorer access to the rail network, and in particular in South London where the connectivity provided by the National Rail Network is considerably poorer than in other regions. Figure 133 maps all the stations offering a high frequency service – the paucity of coverage in South London is clearly evident. ‘Metro-isation’

of the service to enhance frequency and therefore capacity, by upgrading signalling, track and stations, has the potential to unlock new homes and increase densification of the existing housing stock.

Figure 133 High frequency stations and buffer areas of 800m



Source: TfL City Planning

Investing in new public transport capacity could unlock the delivery of thousands of homes that may not otherwise come forward for development. For example:

- Crossrail 2 will support 200,000 new homes and 200,000 jobs along its route. Early upgrades of the West Anglia Main Line in advance of Crossrail 2 could accelerate the delivery of this growth.
- The Bakerloo Line extension will enable more than 25,000 new homes and 5,000 jobs in the Old Kent Road Opportunity Area.
- An extension of the DLR to Thamesmead could enable up to 17,000 new homes and around 3,000 new jobs.
- TfL's planned extension of the London Overground to Barking Riverside will support the delivery of 11,000 new homes that would otherwise not have been viable. An extension of the Elizabeth line could support the delivery of a further 55,000 homes and 50,000 jobs in Bexley and north Kent.

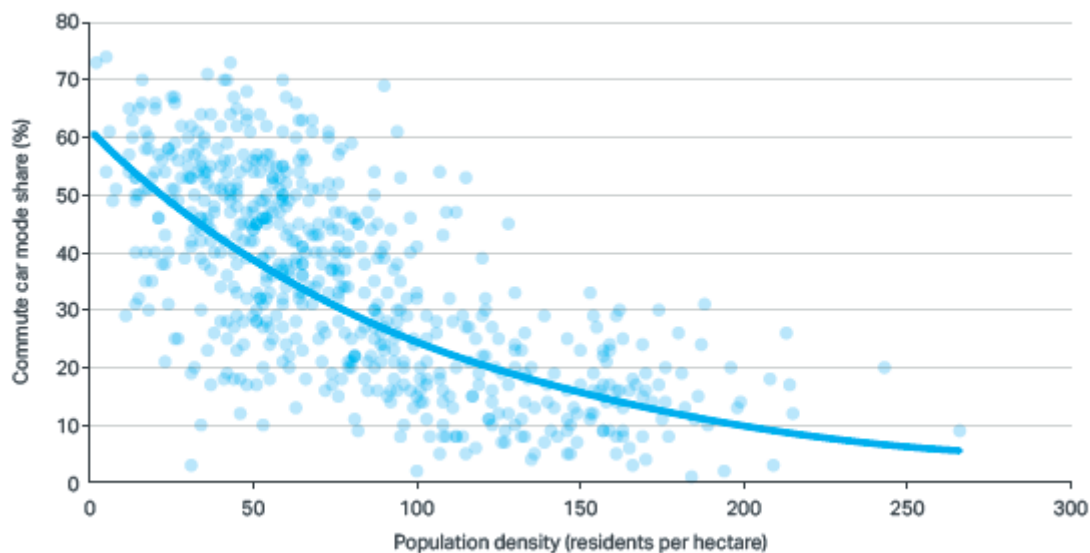
- A Tram extension to Sutton could support the delivery of at least 10,000 new homes and improve public transport accessibility to Sutton town centre and St Helier Hospital.

TfL is the owner of 5,700 acres of public land in London and sites have been identified that could potentially deliver 10,000 homes over the next five years.

7.3 Relationship between housing density and sustainable travel

Where you live to a large extent determines your travel choices. Where people live in dense communities, with shops and services within an easily walkable distance, they are more likely to choose to walk, cycle and use public transport and less likely to own a car. Figure 134 shows the relationship between population density and the share of journeys to work made by car – it is absolutely clear that as population density rises, the proportion of people driving to work falls, so that in the most densely populated areas less than 10 per cent of people travel to work by car, compared to more than 70 per cent in the least densely populated areas.

Figure 134 Car mode share for travel to work by population density, London residents 2011

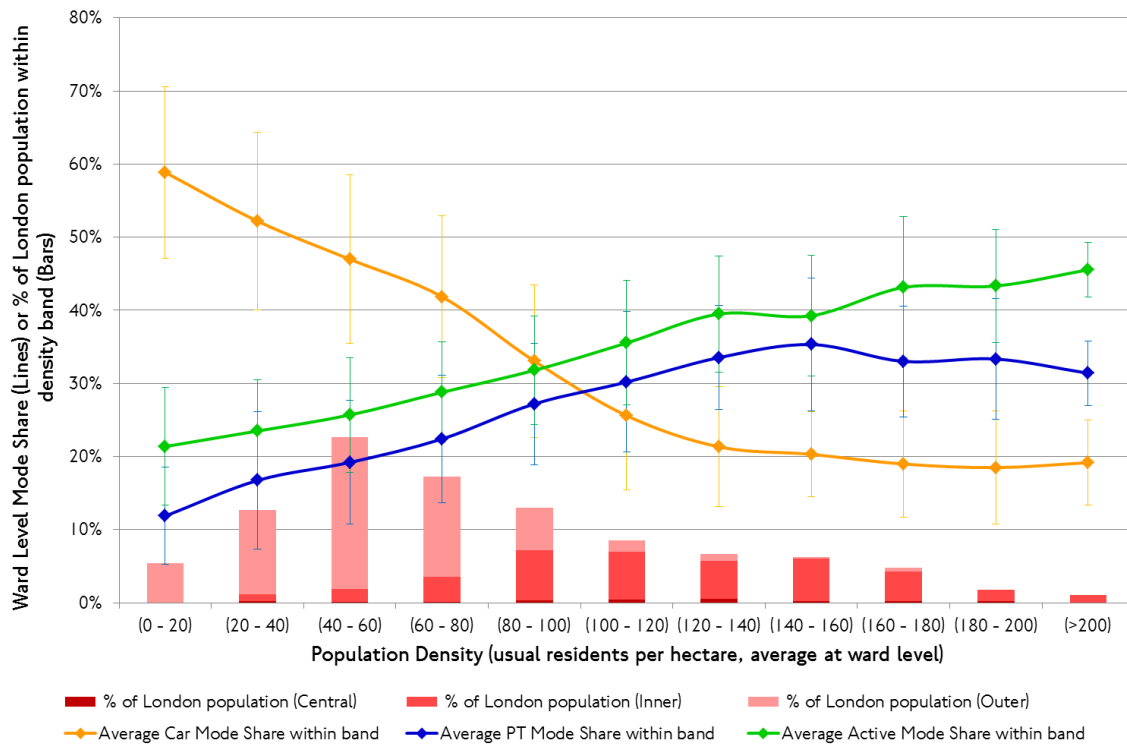


Source: City Planning

Higher densities can influence travel in a number of ways: people living in densely populated areas typically need to travel shorter distances to access opportunities and services; densely populated areas tend to be better connected by public transport, particularly buses; and the car is less attractive due to increased competition for road space and parking. As London's population has grown, population densities have increased. Population growth has disproportionately taken place in inner London, so that a higher proportion of the population now lives in more densely populated areas. This has contributed to the rise in sustainable travel in recent years.

Figure 135 highlights the relationship between density and car mode share – as density rises (moving left to right on the X axis), the car mode share (shown in yellow) falls and the sustainable mode share (shown in green and blue) rises. The stacked bars show the proportion of London's population living at each level of population density. This shows that the highest proportion of Londoners live in areas with between 20 and 100 people per hectare, mostly in outer London, where the car mode share averages between 50 and 30 per cent. Inner London is more densely populated and has a higher sustainable mode share.

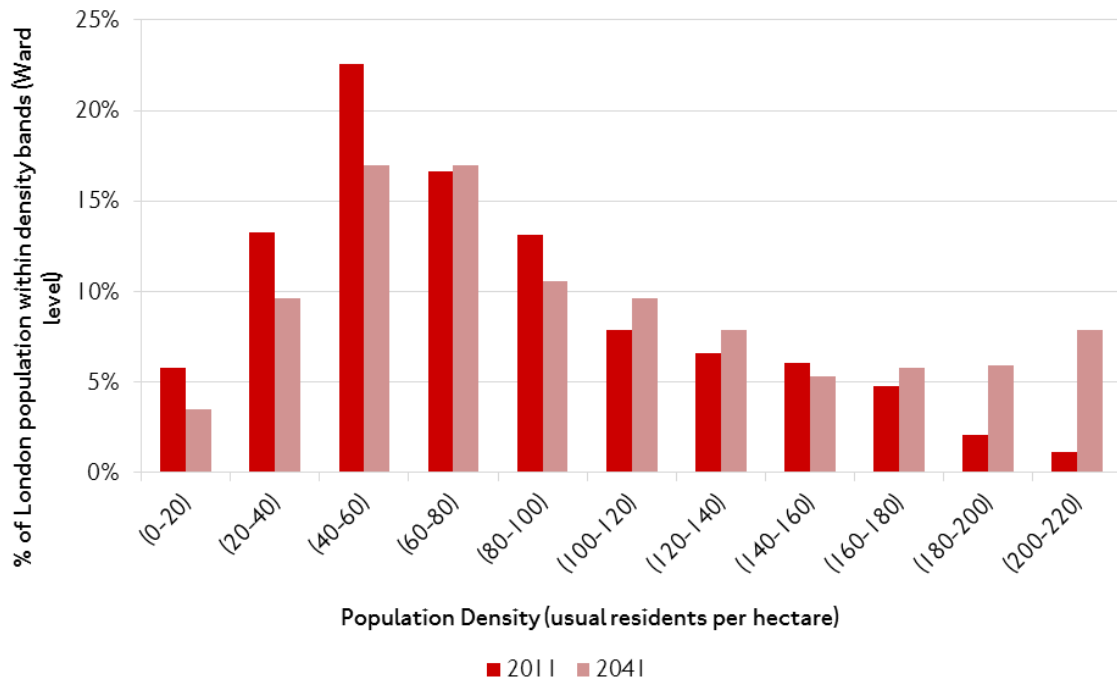
Figure 135 All journey mode share by public transport access of home area, London residents, 2011



Source: City Planning

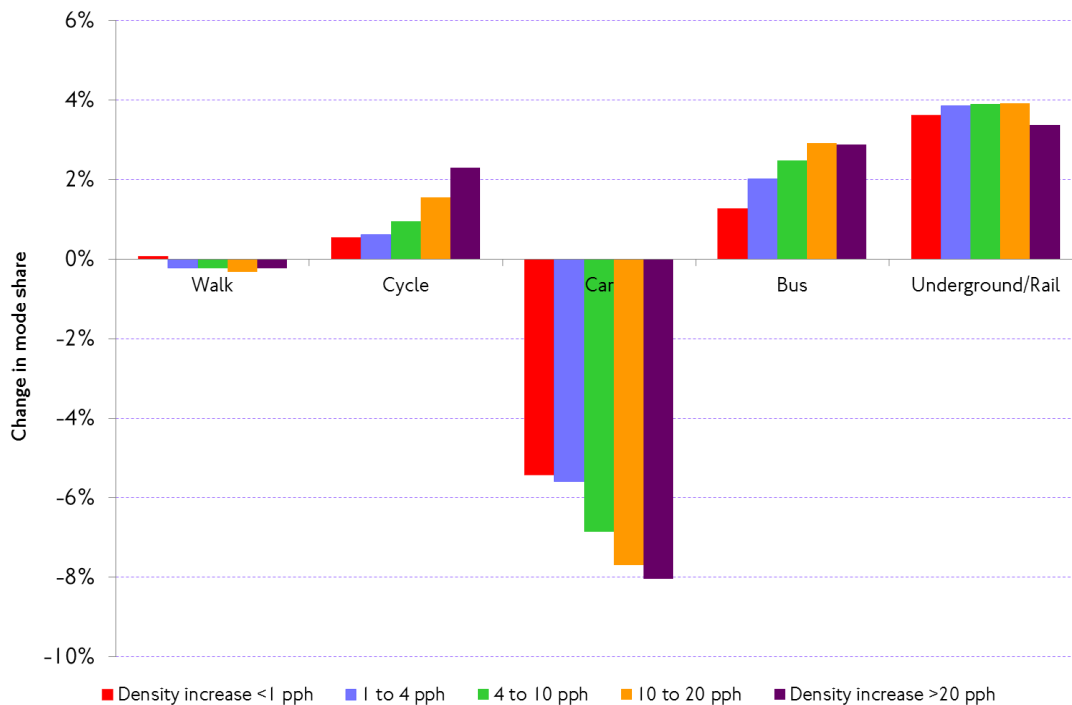
As London's population continues to grow, density across the city will increase. Areas that have a population density of more than 100 residents per hectare have an average car mode share of 25 per cent or less. The proportion of the population living in areas at least as densely populated as this is projected to increase from around 30 per cent at the time of the 2011 Census to over 40 per cent in 2041 (see Figure 136). Nevertheless, the majority of the population is still expected to live in places with fewer than 100 residents per hectare, where the car accounts for at least 30 per cent of all trips, rising to nearly 60 per cent of trips made by residents of the least densely populated parts of London. Rising population densities are likely to lead to falling car travel; as shown in Figure 137, car travel has fallen the most where there have been the greatest increases in population density.

Figure 136 Proportion of population by density of local area, actual and forecast, 2011 and 2041



Source: City Planning

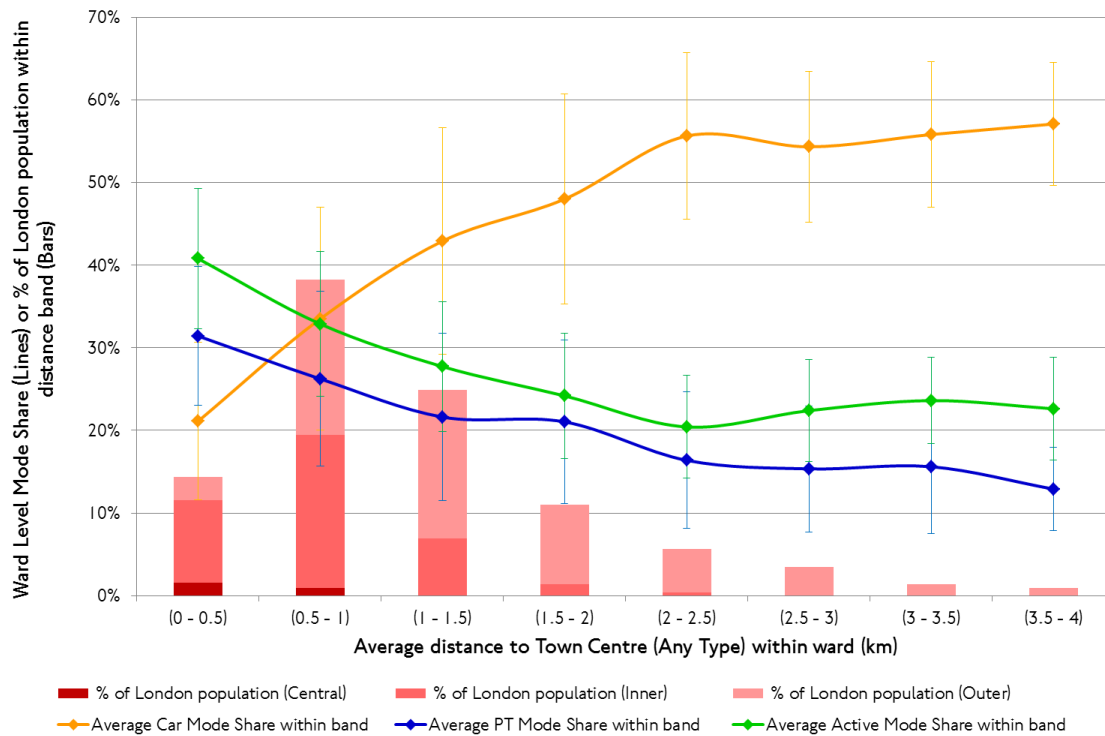
Figure 137 Change in mode share by density of local area, 2001 to 2011



Source: City Planning

One reason that people are more likely to travel sustainably when they live in more densely populated areas is that it is easier for them to access shops and services on foot or by travelling a short distance. As evidence of this, there is a strong correlation between the use of sustainable modes and the distance people live from a town centre, so that people who live close to a town centre are more likely to travel by public transport, walking and cycling than those who live further away. Figure 138 illustrates this relationship.

Figure 138 Average mode share for all journeys by proximity to a town centre, London residents 2011



Source: City Planning

7.4 Relationship between public transport connectivity and sustainable travel

Public transport connectivity of workplaces

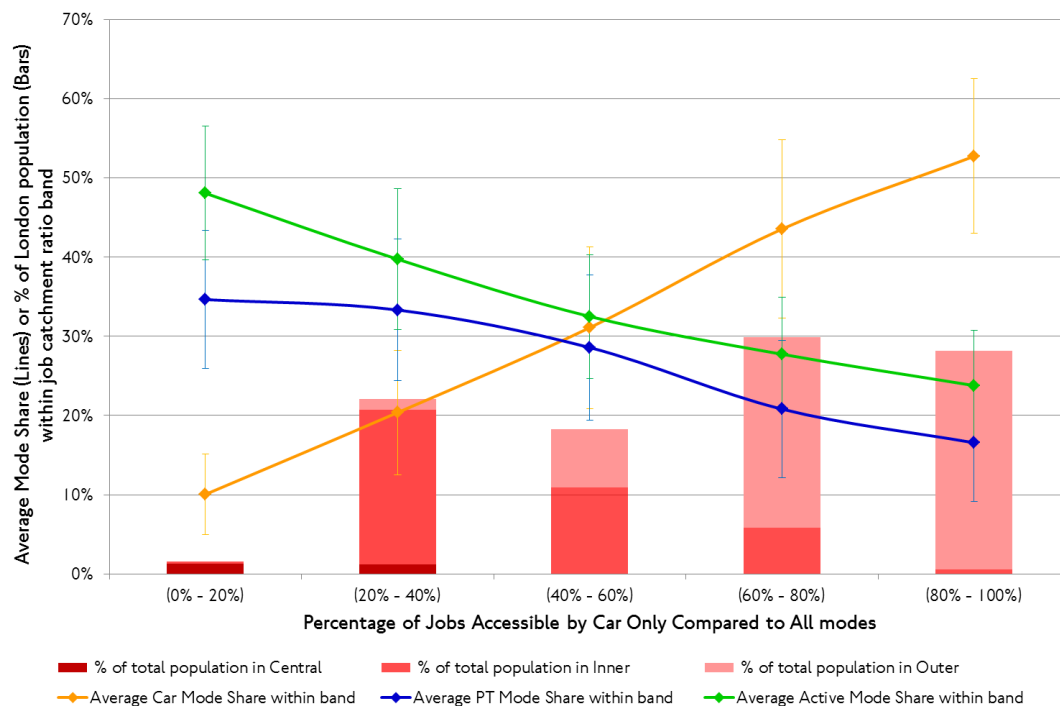
People are more likely to drive and less likely to use public transport if their place of work is located in an area:

- with low PT provision
- with low employment density
- further from Central London
- further from rail stations
- further from town centres

The average distance travelled to commute is 8km, compared to 5.5km for journeys for other purposes. As a result, just 19 per cent of commute journeys are walked, with the vast majority made by public transport or car.

Furthermore, people are more likely to drive for all journey purposes in areas where a high proportion of jobs can only be accessed by car than in areas where jobs can be easily accessed by public transport, shown in Figure 139. This suggests that once a car oriented pattern is established, in this case due to the need to drive to work, people are more likely to use the car for other journey purposes as well, highlighting the importance of locating employment growth in areas accessible by public transport and limiting the need to drive to work.

Figure 139 Average mode share for all journeys by the proportion of the total jobs available to residents of that area which are only accessible by car, London residents 2011



Source: City Planning

Public transport connectivity of residential areas

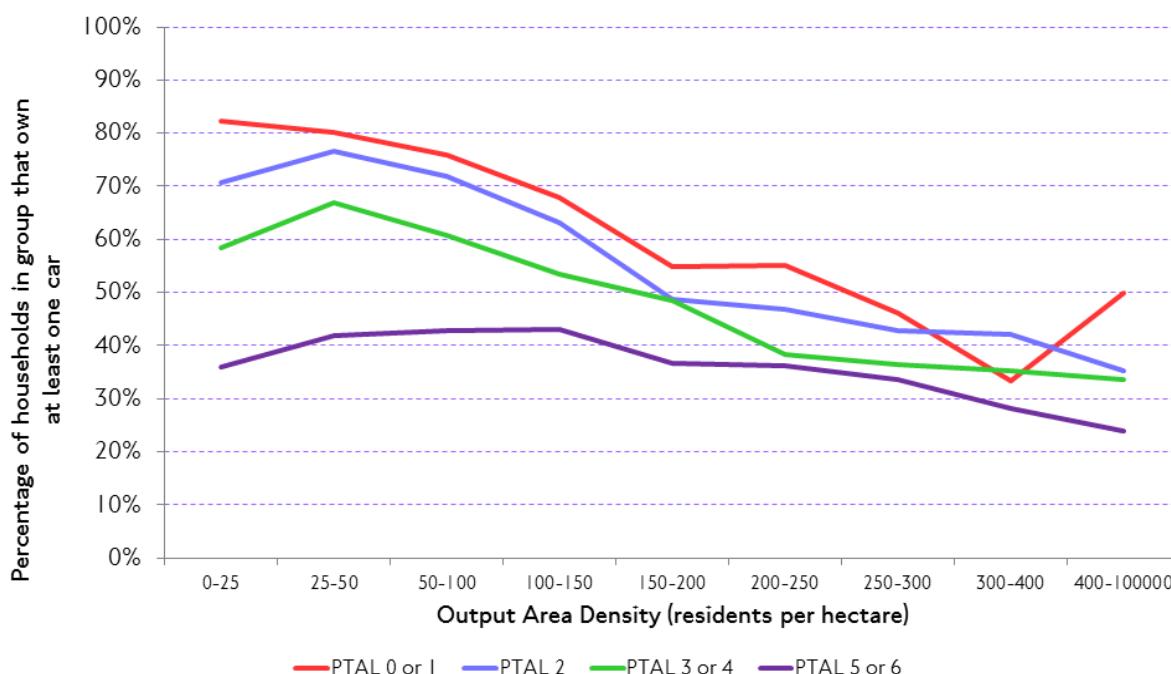
Car ownership is higher in parts of London with less access to public transport and lower where public transport options are very good – shown in Figure 140. Likewise, the share of journeys made by car is higher in areas with less good access to public transport. Public transport access level and population density have a compounding impact, so that car ownership is highest in parts of London with the lowest density population and the least good access to public transport – shown in Figure 141.

Figure 140 Household car ownership by Public Transport Access Level (PTAL), London residents 2011

Public Transport Access Level	% of households that own at least one vehicle
0 – 1 (least good)	75%
2	67%
3-4	53%
5-6 (best)	38%

Source: City Planning

Figure 141 Household car ownership by Public Transport Access Level (PTAL) and population density, London residents 2011



Source: City Planning

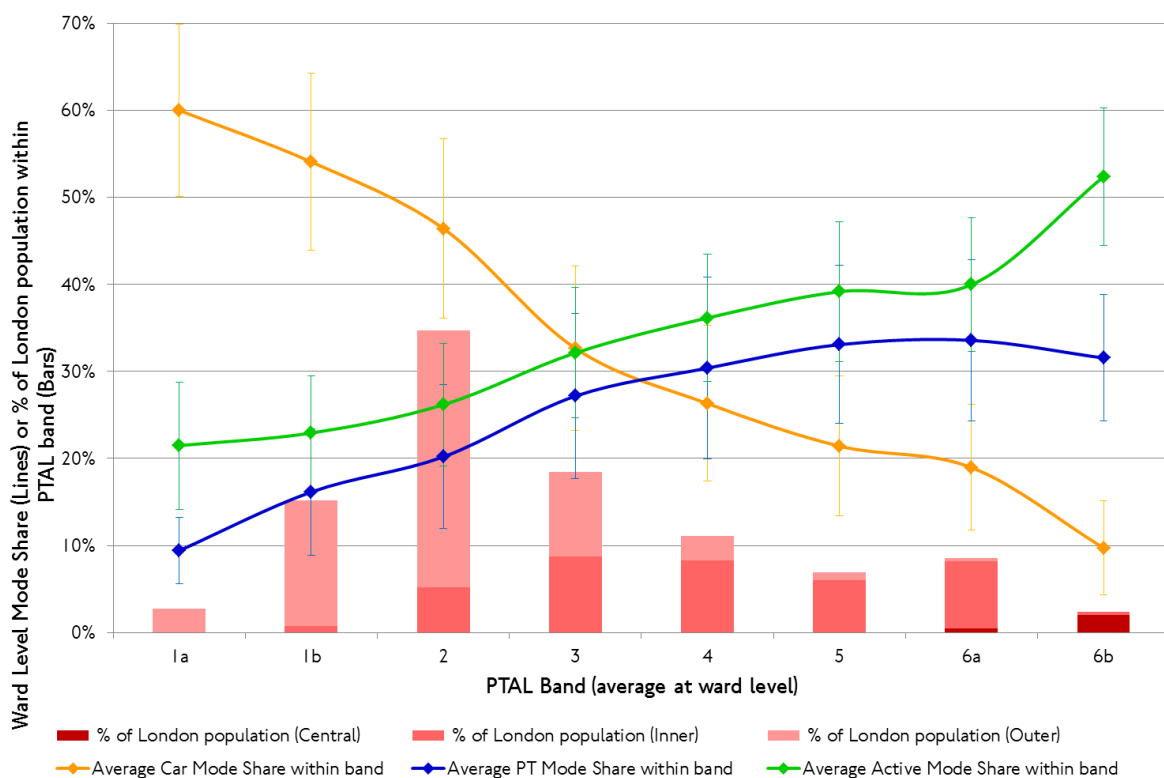
So there is a clear link between the necessity of owning a car and levels of car ownership. This is somewhat a cyclical relationship – in some locations, the options available make car ownership more or less appealing, and for some people, location

will be more or less appealing as a place to live based upon the transport choices available. So for some, the ability to live without a car will be appealing aspects of an area, whilst for others, the availability of car parking and low congestion is attractive when choosing somewhere to live.

As Figure 142 indicates, more than 50 per cent of London’s population live in areas of PTAL 2 or less and are therefore likely to be more car dependent. For some, the choice to live in an area with less good access to public transport will have been driven by the affordability of homes. Access to a tube station can increase property prices by 8 per cent. This means that less affluent people might not be able to afford areas that are well connected by public transport and might find it more difficult to reduce their dependency on a car.

Looking to the future, unless further action is taken, the distribution of London’s population by their access to public transport is not expected to change dramatically. More than half of London’s population will continue living in PTAL 2, and around 14 per cent in the areas with the best public transport, PTAL areas 6a and 6b.

Figure 142 Average mode share for all journeys by Public Transport Access Level, London residents, 2011

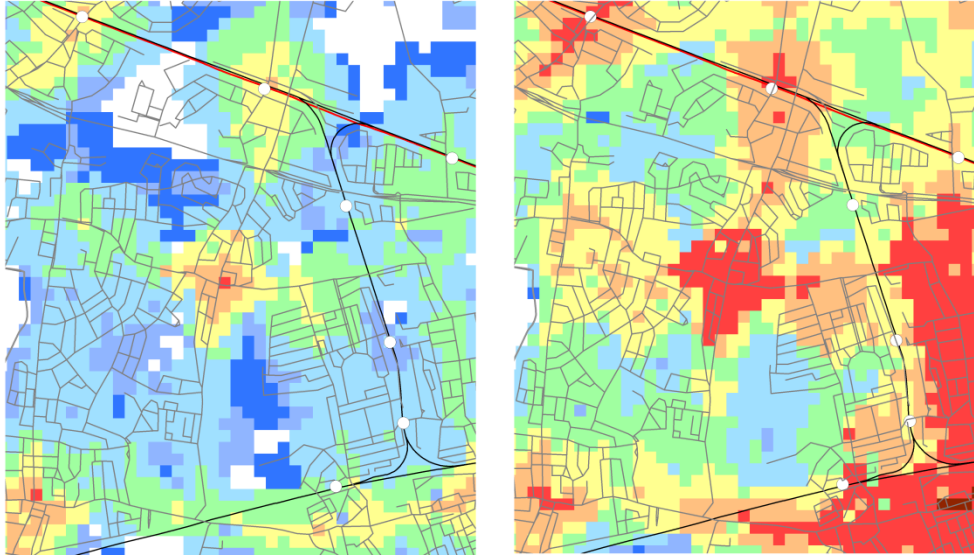


Source: City Planning

Public Transport Access Levels are calculated based upon the time it would take to walk to public transport services. With better cycling facilities – safe and appealing routes, and safe and secure parking at stations – the effective connectivity provided by the public transport network is expanded as people living further away can access rail services within the same amount of time. Figure 143 illustrates the improvement to public transport accessibility that could be delivered by facilitating cycling. As well

as benefitting existing residents, investing in cycling to rail stations could help unlock higher density development.

Figure 143 Example improvement in public transport accessibility delivered by facilitating cycling to rail stations



Source: City Planning

7.5 Relationship between parking and sustainable travel

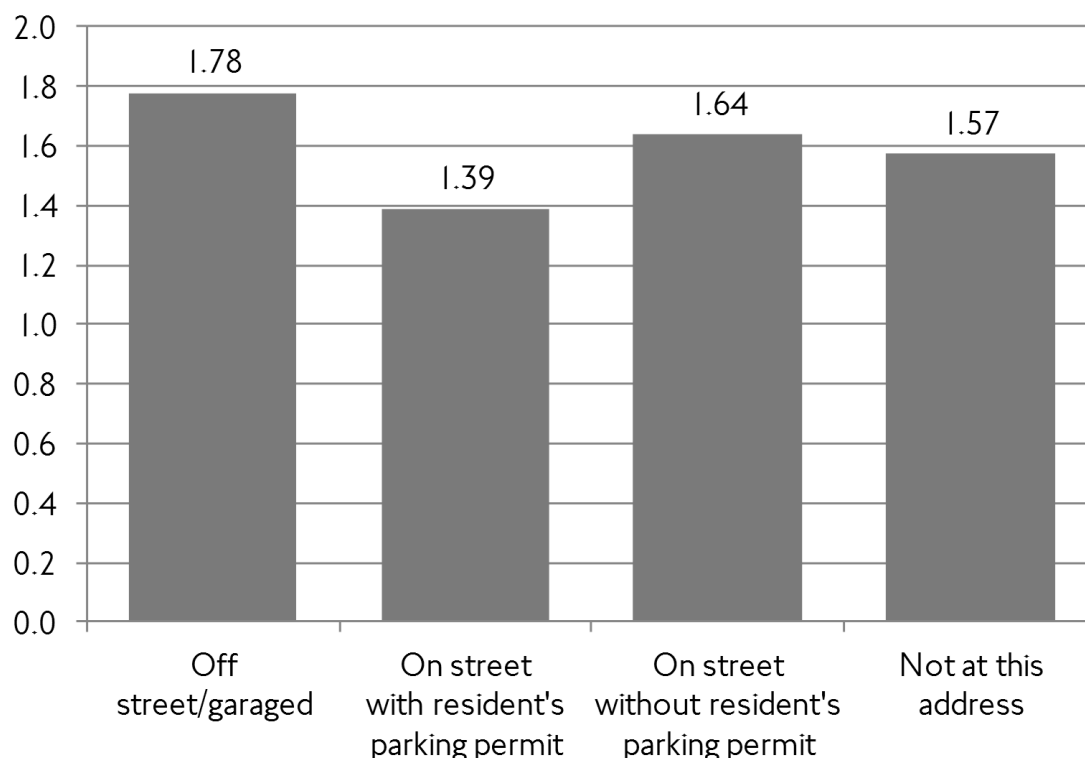
There are 2.6 million cars registered in London and more than half of London households have at least one car. Londoners are more likely to own a car if they live in Outer London, live in an area with poor access to public transport, have a higher income, have a child in the house, and are of Western European nationality. There is a strong positive relationship between household car ownership and average car trip rate by borough. If people own a car they tend to use it.

London is less car dependent compared to other cities partly because of the increasing costs and inconvenience of car use. The difficulty in finding parking spaces, the cost of parking and the cost of driving within the Congestion Charging Zone have all made car travel comparatively less attractive. In addition, traffic congestion has increased the time and stress of travelling by car and made predicting journey times more difficult. The key reasons London households choose not to own a car are:

- the costs of owning and running a car – around a quarter of those without a car say that they would buy one if they could afford to;
- the stress of owning and driving a car in London; and
- a car is unnecessary given the proximity of local services and the availability of public transport.

One key factor is the availability and cost of residential parking. The majority (59 per cent) of vehicles across Greater London are kept in some form of off-street parking overnight, 24 per cent are parked on street without a permit and 16 per cent are parked on-street with a residents' permit. The quality of parking varies greatly by region - less than 30 per cent of vehicles in inner London are parked off-street, compared to 65 per cent of outer London vehicles. Overall, there is some evidence that quality of parking available influences the level of car ownership, particularly in Outer London. Figure 144 demonstrates that across Greater London car ownership levels are higher where there is better parking provision (this is based on the assumption that off-street parking is better than on-street, and that unpermitted parking is better than permitted).

Figure 144 Average car ownership by quality of parking, London car-owning households, 2009/10-2011/12



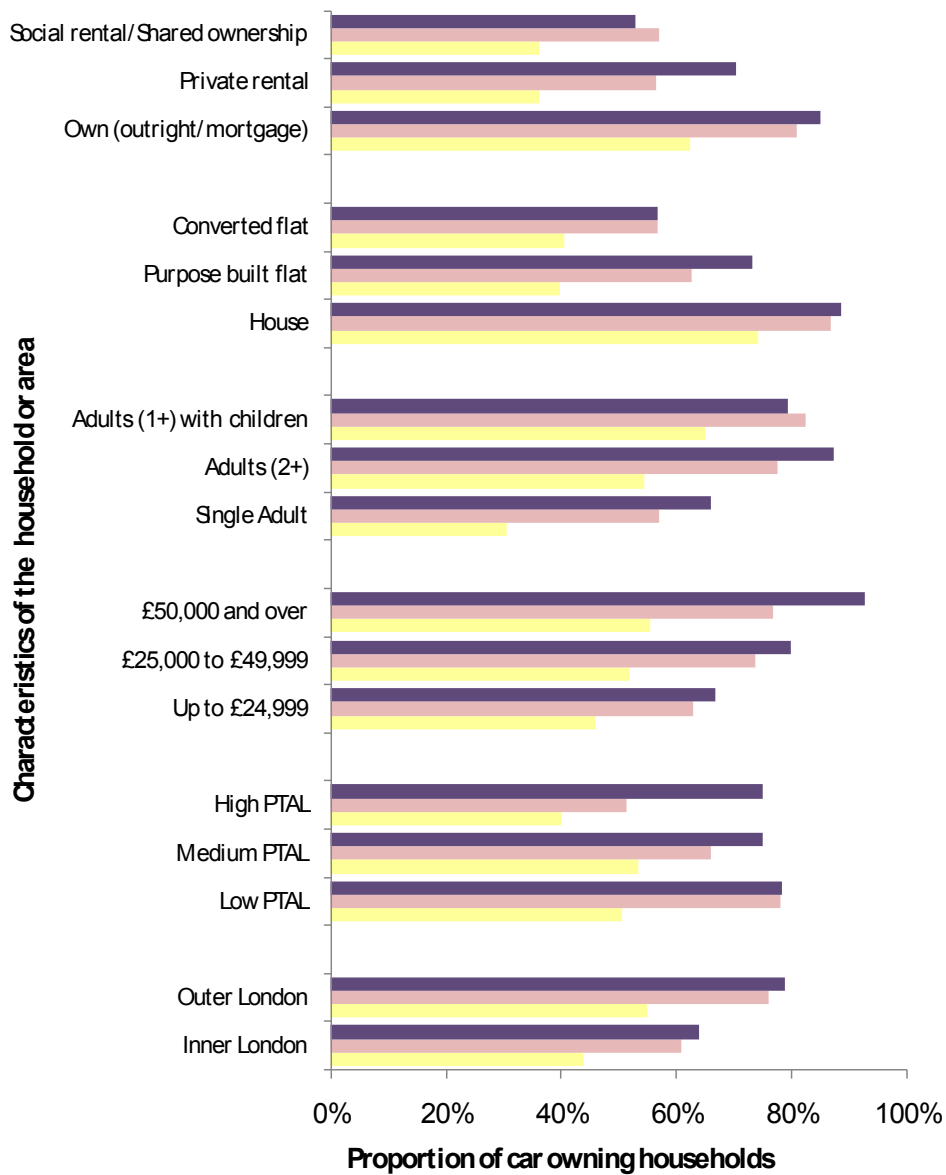
Source: City Planning

Note: Includes car owning households only, and thus the lowest possible level is 1.

Research conducted with London residents in 2013 found that the cost of car parking is substantially more in inner London, at almost £240 per year, compared to an average of just under £85 for outer London households, and less than £20 for residents of external boroughs within the M25. Whilst very few of those surveyed said that a lack of parking prevented them from owning a car, the cost of buying and running a car was one of the main reasons inner Londoners chose not to own a car – and the cost of parking both at home and at likely destinations could reasonably be supposed to contribute to this.

Research conducted with residents of new developments found that for all groups, and in all areas, people living in developments with more parking available had higher levels of car ownership than people living in developments with less parking. For example, income is a key determinant of car ownership. Nevertheless, 83 per cent of people with a high income in developments with over 0.5 spaces per unit have a car compared to 56 per cent of the same income group with less parking available. Figure 145 shows the relationship between parking availability and car ownership.

Figure 145 Car ownership by parking provision and other key factors, residents of new developments, 2012



Key: Parking provision in the development

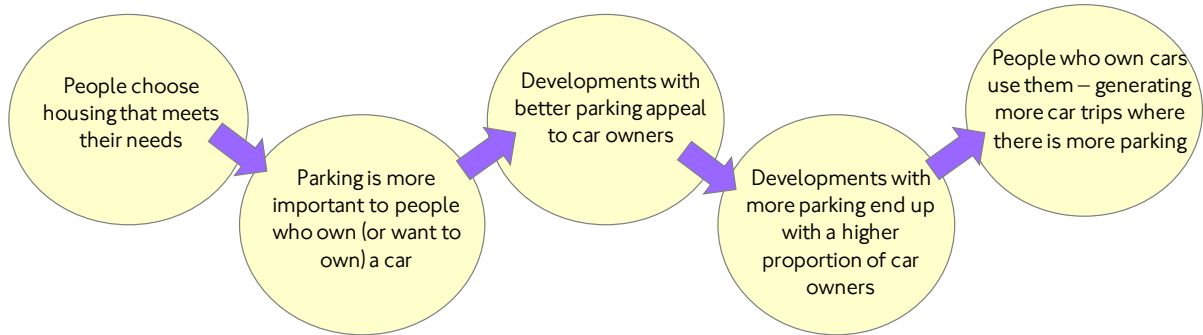
- More than 1 parking space per unit
- 0.51 to 1 parking spaces per unit
- Up to 0.5 parking spaces per unit

Source: Residential Parking Provision in New Developments (TfL 2012)

People choose a home that meets their needs; there is a close relationship between the importance attached to parking by residents and their satisfaction with the quality of parking in the local area. People who have cars use them: in both Inner and Outer London, car owners use their cars frequently at all times of day, including during the busiest peak periods. Therefore, overall, developments with more parking contain

more car owners and generate more car journeys than developments with less parking provided. This was true for all groups and in all areas studied. The level of car parking provided in new developments therefore has a substantial impact on the level of car use generated by that development. Figure 146 summarises how parking provision leads to car ownership and use.

Figure 146 How parking provision leads to car ownership and use



Source: Residential Parking Provision in New Developments (TfL 2012)

7.6 How the design and location of new developments influences sustainable travel

Integrating land use planning and transport will have a key role to play in shaping London and in delivering social, economic and environmental sustainability. Land use and transport are intrinsically linked because

- Growth and spatial distribution of different land uses (such as housing, employment, retail, etc.) generates travel demand. The scale of distribution of homes is a key determinant of infrastructure requirements across London.
- Dwelling typology, household size, and tenure mix has implications for trip generation, while geographic location has implications for sustainable and active travel patterns as well as parking requirements.
- Transport infrastructure plays an important role in unlocking development potential of regeneration areas and providing access to the wider region. Affordability of transport fares becomes an issue as rising housing costs lead to more low income workers living in Outer London. This may have implications for Central London labour supply.

The evidence shows that if it is easier to travel by public transport and active modes, people will do so, but where it is more convenient to travel by car – because origins and destinations are spread out, public transport connectivity is poor or parking is readily available – people will choose the car. The situation and design of new housing will determine the travel patterns of its residents. Higher density, well connected housing, offering a good quality environment for walking and cycling, and limited parking provision, will encourage people to travel sustainably. New employment should similarly be well connected by public transport and active modes to the potential workforce, with limited parking, to deter commuting by car.

7.7 Summary: new homes and jobs

London is vital to economic growth across the UK – it is the most productive region and is the UK’s only global centre

London sits at the heart of the UK economy, accounting for just under a quarter of national economic output. It plays a unique role as a global employment hub, one of a small number of very large cities around the world. The centre hosts a cluster of globally competitive sectors, and accommodates a third of London’s jobs in just 2 per cent of its area. 45 per cent of GVA was generated in just six central Boroughs, making this the most productive part of the UK. Central London has grown more than elsewhere, yet compared to other similar cities there remains scope to increase its density and productivity.

Jobs in central London depend on rail capacity; by 2041 demand will outstrip supply, possibly limiting growth

All of London’s key employment centres are in locations which can be reached by more than two million people within 45 minutes and this is where the most growth is expected, with three quarters of a million additional people expected to be working in central London and the Isle of Dogs by 2041.

Transport capacity constraints can limit this connectivity and may lead to lost economic potential if crowding starts to deter people from working in the centre. A crowded network, with the frustrations and inefficiencies this brings will eventually act to constrain the available labour market and encourage businesses to look elsewhere to invest. New rail capacity will be required to meet demand and ensure London’s economy can continue to thrive.

Beyond the centre, travel is more car dependent but town centres could become sustainable travel hubs

At least four in ten journeys made by London residents start or end in a town centre and town centres also act as transport hubs, with larger town centres all served by Tube or rail services and multiple bus routes. Whilst London residents are less likely to drive to town centres than other destinations, nevertheless, on an average day, there are 1.5 million car trips to town centres. As our shopping habits change, the role of town centres is changing, with retail consolidating in larger centres.

London needs 50,000 new homes a year but is delivering half that - transport investment can unlock development

To meet the needs of London’s current and future population, 50,000 new homes are needed every year, equivalent to a new home every 11 minutes, 24 hours a day for the next 25 years, but only around half this have been delivered in recent years. A constrained housing supply means people are paying more to live in worse conditions. In the long term, a constrained housing market will deter people from living and working in London and threaten economic growth.

Transport has a key role in unlocking housing development. Homes in the best connected areas command a price premium, currently 2.5 per cent for Crossrail 1 above surrounding areas, and a disproportionate amount of development has taken place in very well connected areas.

Many of the areas with the greatest capacity for development have poor transport connectivity, hampering development

London's Opportunity Areas are the largest reservoir of developable land, but many suffer from poor transport connectivity at present. Investing in new public transport capacity could unlock the delivery of hundreds of thousands of homes that may not otherwise come forward for development. In particular, it is estimated that Crossrail 2 alone could support 200,000 new homes and 200,000 jobs along its route. TfL as a landowner can contribute directly to the supply of housing; TfL is the owner of 5,700 acres of public land in London and sites have been identified that could potentially deliver 10,000 homes over the next five years.

London's low density sprawl has contributed to high car use, new developments should make it easy to travel sustainably

Where people live to a large extent determines their travel patterns: car ownership and use is higher in places where access to jobs, shops and services depends on the car. People living in more densely populated areas, close to shops and services, and with access to good public transport services are more likely to travel by public transport, cycling and walking and less likely to travel by car. The car mode share for those living the furthest from a town centre is nearly three times that of those living very close to a town centre. Similarly, commute patterns are determined by how well served workplaces are by public transport. How people commute is particularly important because people who need a car for work are far more likely to drive all their other journeys as well.

Car ownership and use also tends to be higher where there is better parking provision, based on the assumption that off-street parking is better than on-street, and that unpermitted parking is better than permitted. In inner London, there is some evidence that the cost of parking is deterring people from owning and running a car. In new developments, there is clear evidence that more parking means more car use than would be seen otherwise.

In summary, it is clear that the situation and design of new housing will determine the travel patterns of its residents. Higher density, well connected housing, offering a good quality environment for walking and cycling, and with limited parking provision, will encourage people to travel sustainably. Equally, in order to prevent rising car travel, new employment should be well connected by public transport and active modes to the potential workforce, with limited parking, to deter commuting by car.