

Commission for Travel Demand Submission from Transport for London March 2017

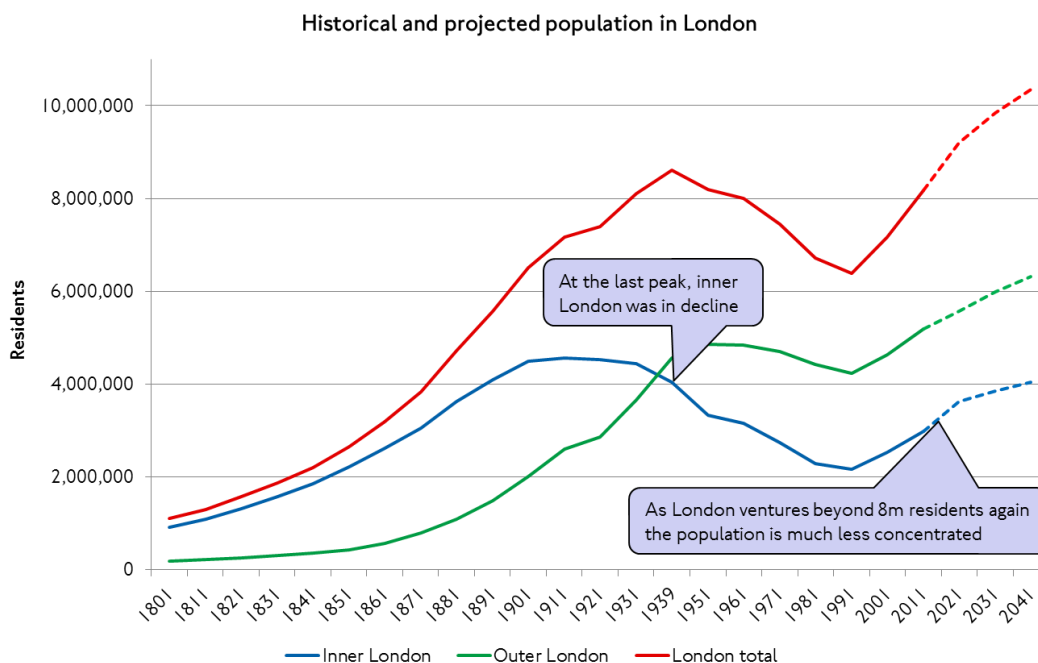
Introduction

TfL is the strategic transport authority for London, governed by the Mayor of London and responsible for delivering the Mayor's Transport Strategy and managing those services across the capital for which the Mayor is responsible, including the London Underground, Overground, DLR and Tram networks, London Buses and the public transport network, the strategic highway network and for delivering active travel services.

Changes in travel demand: the decline of the car

London has changed radically over the past two decades. Following a long period of population decline, population growth returned to London in the 1990s and the capital city is now the biggest it's ever been. 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. These 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.

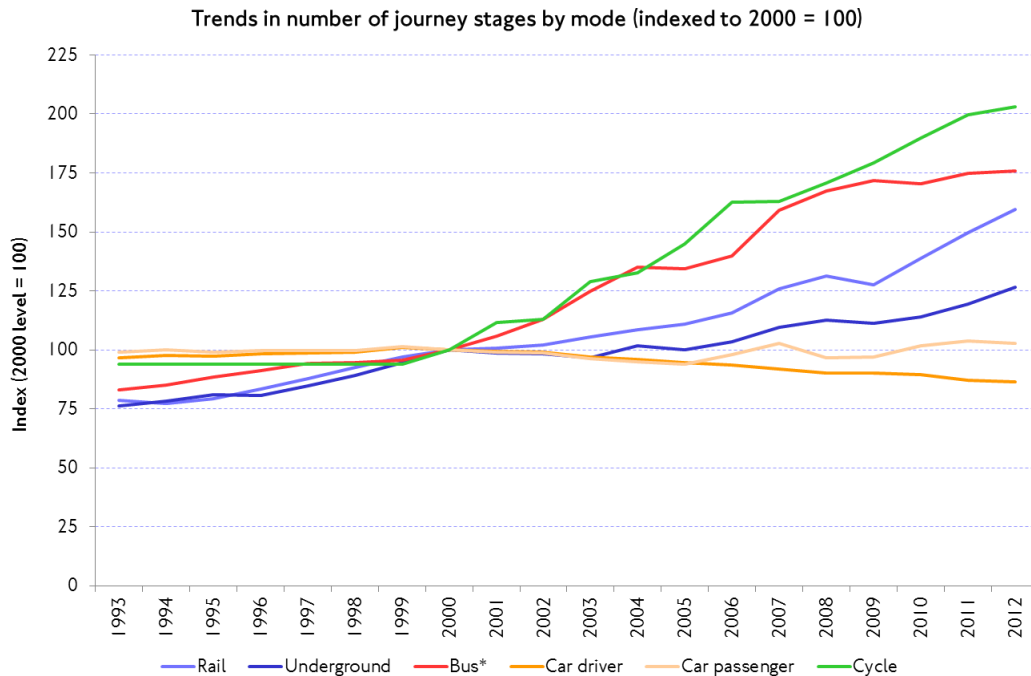
Figure 1: Historical and forecast population in London, 1801 to 2041



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

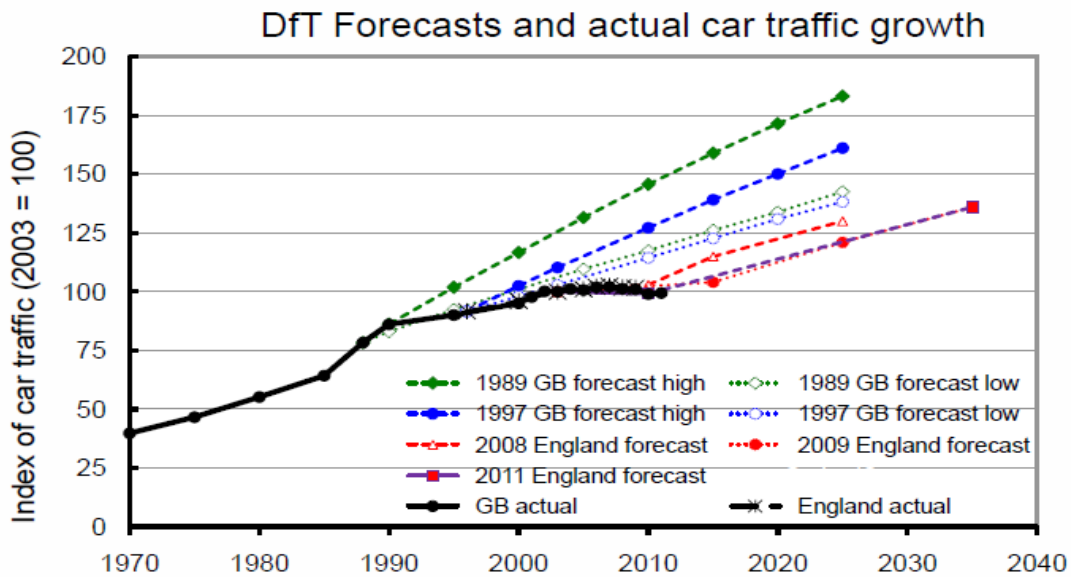
onwards demand for car travel began to fall. Since 2000, the car mode share has fallen by 11 percentage points from 48% to 37%, with fewer kilometres travelled by car. Compared to the rest of the UK, car ownership is less common even amongst the highest income households, especially in inner London.

Figure 2: Trends in journey stages by mode 1993 to 2012



By the 2010s, it had become clear that traditional demand models were not satisfactorily forecasting travel demand, with models continuing to predict rising car travel as shown in Figure 3. TfL launched a series of studies to better understand the characteristics and drivers of travel demand, and a programme of model development to enable transport models to better reflect real-world conditions and trends. Significant improvements have already been made to the existing demand model to improve the credibility of our forecasts, and the next generation demand model will launch in 2017. TfL continues to study the drivers of demand, with a particular focus on understanding how new and emerging technology might change the way we travel.

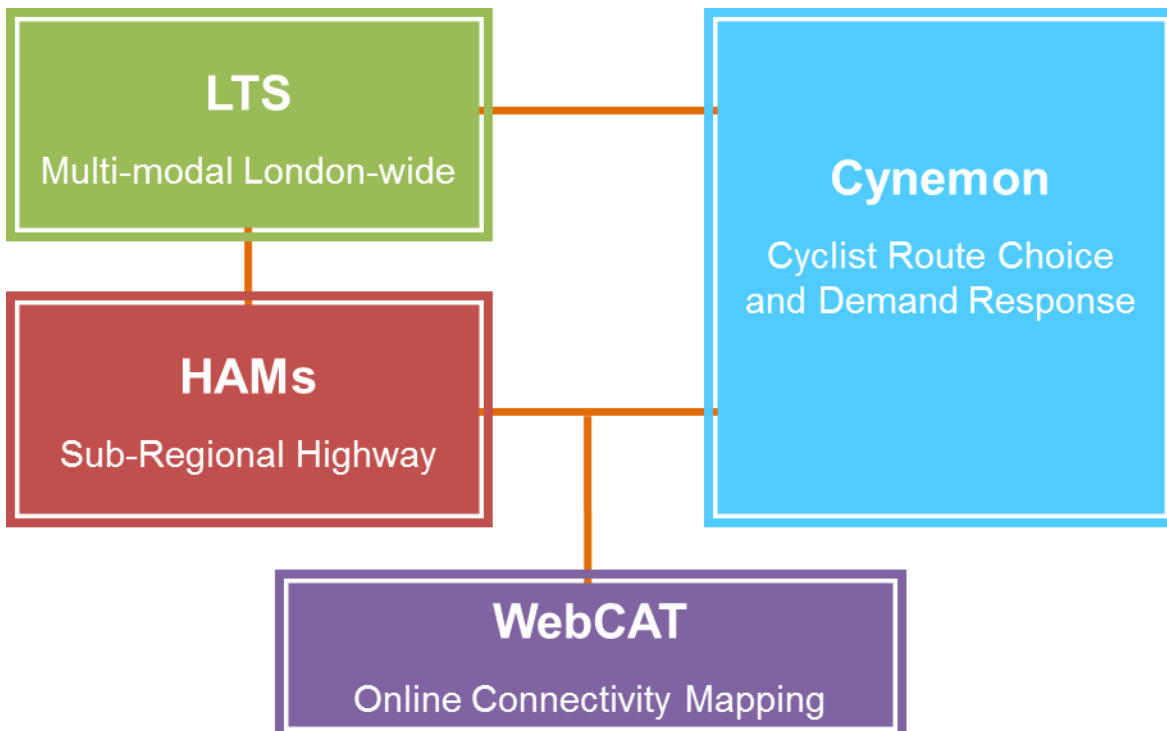
Figure 3: Comparison of DfT forecasts and actual car traffic growth



Changes in travel demand: the rise of cycling

Smaller in volume, but of great interest, is the rise in cycle travel that took place over the same period. Between 2000 and 2016, cycle travel in London grew by 118%. TfL's demand and assignment models were not well equipped to reflect the emergence of cycling as a popular option. An extensive programme of analysis, research and model development is now nearing completion, so that by 2018 cycling will be integrated in TfL's mainstream models, supported by bespoke tools supporting policy development.

Figure 4: TfL's suite of modelling tools



Understanding the drivers of demand

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:

1. **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.

There have also been increases in public transport fares during the period of interest. In isolation, these fare increases would be expected to cause a reduction in the quantity of travel by public transport, but with the cost of travel by car increasing similarly while the balance of capacity and service quality has shifted, public transport ridership has continued to increase.

2. **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 increasing 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.

3. **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 was the case amongst previous cohorts.

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

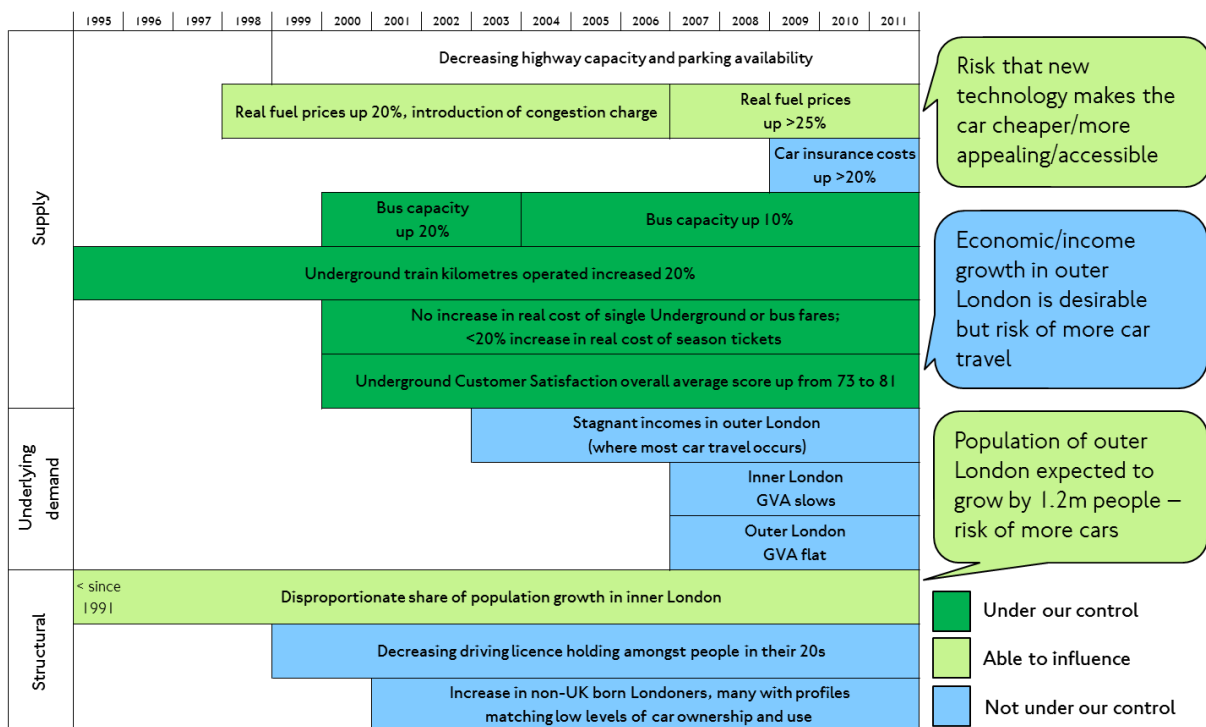
once linked to travel characteristics no longer appearing relevant. Working arrangements have also evolved, with a higher proportion of the population now working part-time – a characteristic often associated with higher rates of travel.

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 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 5 summarises the findings and challenge ahead.

Figure 5: Drivers of demand

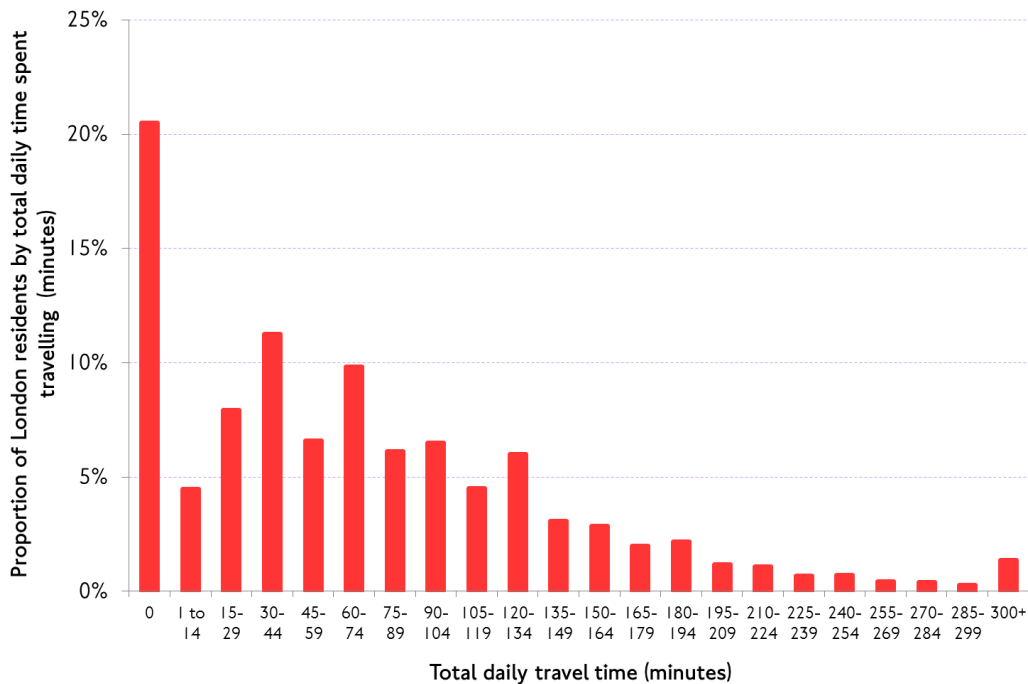


Emerging trends: decline in the amount of travel

Whilst travel demand per person has remained stable for a very long period, evidence is emerging that trip rates are starting to fall and that the amount of time people spend travelling is also falling. Within the transport industry, concepts of a 'travel time budget' or constant have been popular, suggesting that although forms of urban planning and transport may change, and although some live in villages and others in cities, people gradually adjust their lives to their conditions such that the average travel time stays approximately constant. However, TfL now considers that using a one hour travel time budget is not a useful touchstone for the planning of the nation's infrastructure needs in the long term.

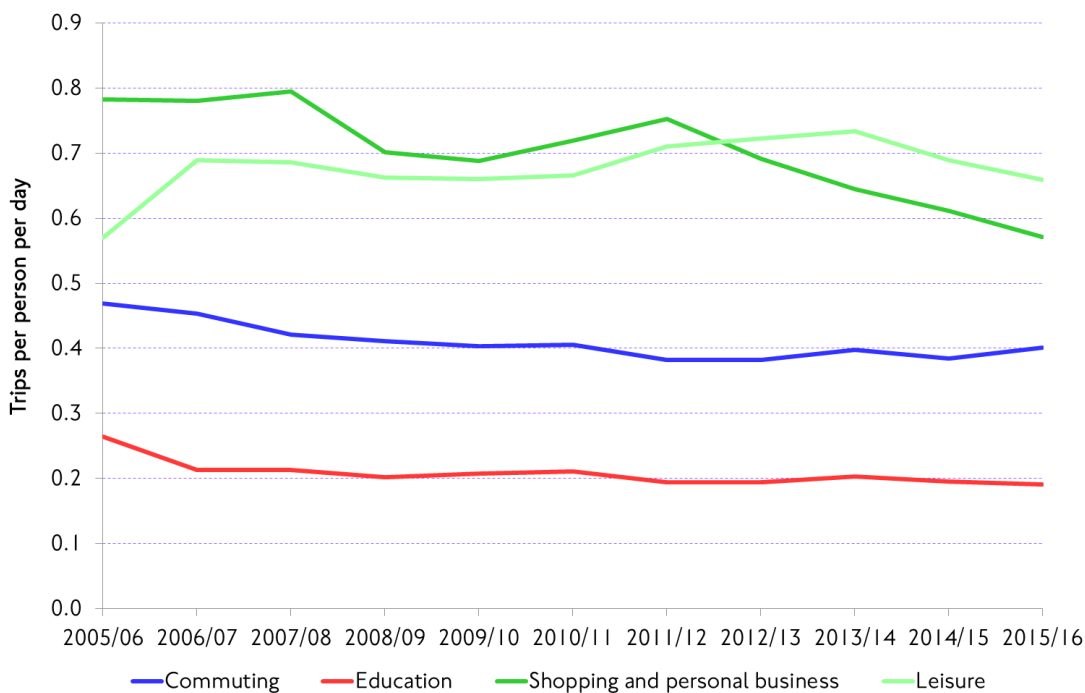
Between 2006/07 and 2015/16, the amount of time the average London resident spent travelling had fallen from 73 to 66 minutes per day, a drop of more than 10 per cent. In particular, there has been a rise in non-travel, in other words, people staying at home all day and not making any trips. On any given day, around 20% of Londoners do not make any journeys. At the other end of the scale, 22% of the London population spend more than two hours travelling per day. The average amount of time spent travelling per day differs for individuals with different characteristics, with full time workers, people aged between 25 and 59, and people living in households with incomes over £35,000 all travelling more than average.

Figure 6: Total time spent travelling in minutes on an average day, London residents



We do not currently have a good explanation for the reduction in time spent travelling, given continued economic growth, and a study is underway to better understand this. One clear trend however is of a decline in travel for shopping, as shown in the figure below. There appeared to be initial evidence that this was being replaced with travel for leisure purposes but the latest results have showed leisure travel returning to the previous level. London has seen significantly more van traffic in recent years, suggesting that at least part of this reduction in shopping travel is explained by increased online shopping.

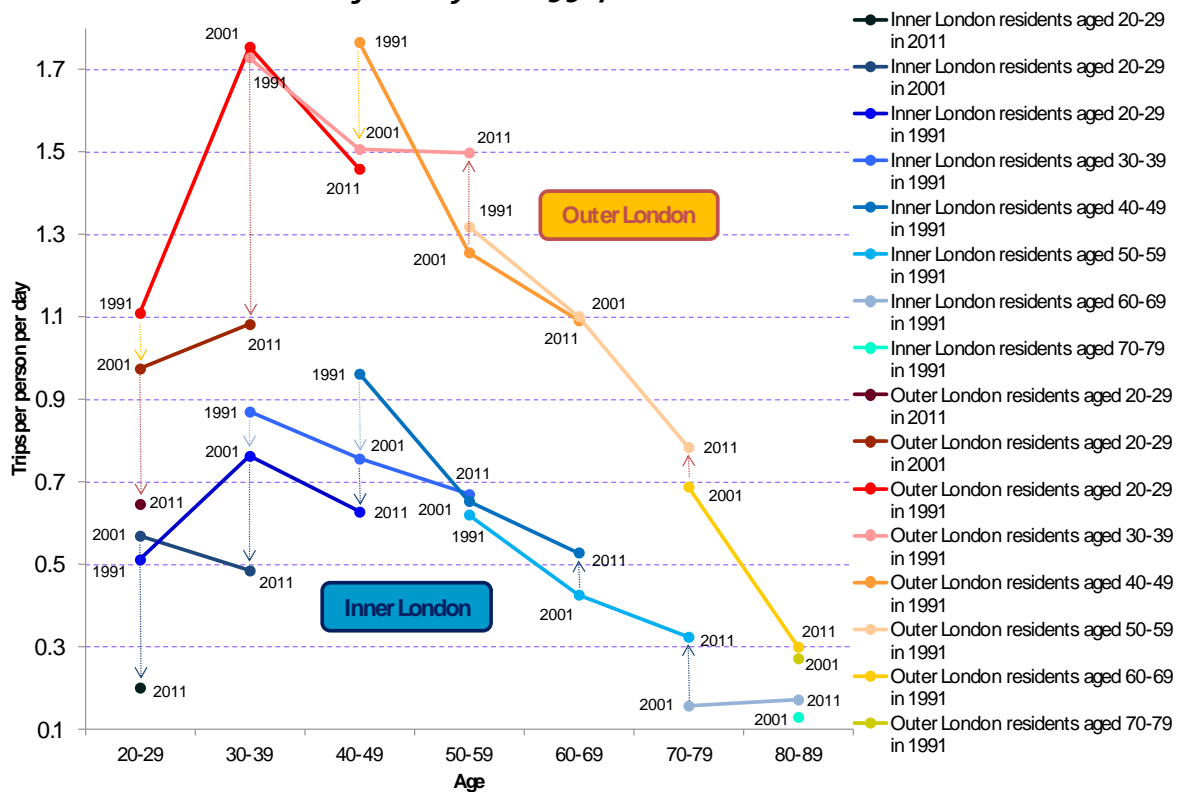
Figure 7: Travel by journey purpose, London residents, 2005/06 – 2015/16



Emerging trends: cohort effects starting to emerge

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



Emerging trends: the introduction of 'new modes' of travel

The evolution of new technology has already spurred new approaches to transport services in London and this is only set to continue. There is a risk that new ways of accessing cars could reverse mode shift by making cars cheaper, more accessible and more appealing. For example, the decline in license holding amongst young people has contributed to the decline in car travel, but new technology that opened up car travel to more people, or removed the cost burden of ownership, could reverse that trend. Nevertheless, the same innovations, managed well, could deliver further mode shift from the private car – shared car services could feasibly reduce car ownership and thus the amount of induced car travel, whilst new demand responsive higher-occupancy services could expand the reach of the public transport network in lower density areas where it is more difficult to provide efficient conventional public transport services.

Better reflecting uncertainty in demand modelling

There are several areas of uncertainty in future travel demand:

- Growth forecasts including:
 - economic growth;
 - the relative success of London and its place in the world; and
 - population and employment location.
- Changes in behaviour/preferences such as the rise of cycling, the health agenda and declines in urban car ownership
- External technological change, including disruptive and transformational influences such as Uber and the '*Internet of Things*'

The economy, population and employment location have a direct impact on travel demand. The number of people and jobs in London drives total travel demand. There have been periods over the past 50 years of rapid decline and growth in population. The current projections assume strong growth but they assume a continuation of trends in London's success. The location of population and employment is important for mode share as people who live and work in inner London make far fewer car trips than those in the suburbs. The trends in population movement have varied significantly over past decades. Demographics are also important. Projections assume a rise in older adults in London and declines in birth rates over time. These have been predicted in the past but haven't come to pass.

Changes in aggregate travel behaviour do not necessarily reflect genuine changes in preferences. Transport forecasts are being developed for urban areas where the context is substantial travel demand change over the past 15 years. As Drivers of Demand has shown, some of the changes we have seen contrast with conventional relationships in transport planning which assume rising incomes mean more car use. If people travelled today as they did in 1991 there would be almost 2 million more car trips a day in London and over 2 million fewer public transport trips. However, most of this change is attributable to changing land use, population demographics and financial costs of travel and not fundamentally different travel behaviour. There has been a rise in some 'lifestyle choices' such as the growth of cycling to work which may reflect preference change. There is great uncertainty about long term trends in these elements.

Technology has the ability to radically change travel demand. Most mainstream travel forecasts used for appraisal do not consider a significant change in travel behaviour as a result of autonomous vehicles. There is great uncertainty about how this technology could develop and whether it would lead to more or less shared mobility and more or less everyday car use. There is also uncertainty about the speed of adoption with some experts predicting significant uptake by 2025. Technology could also influence overall travel demand – will past predictions about telecommuting and home working come to fruition with reduced commuting? Will technology negate the need to travel completely? These are impossible questions to answer but are important to consider when designing schemes in the long term.

Improving the representation of uncertainty – Sensitivity testing

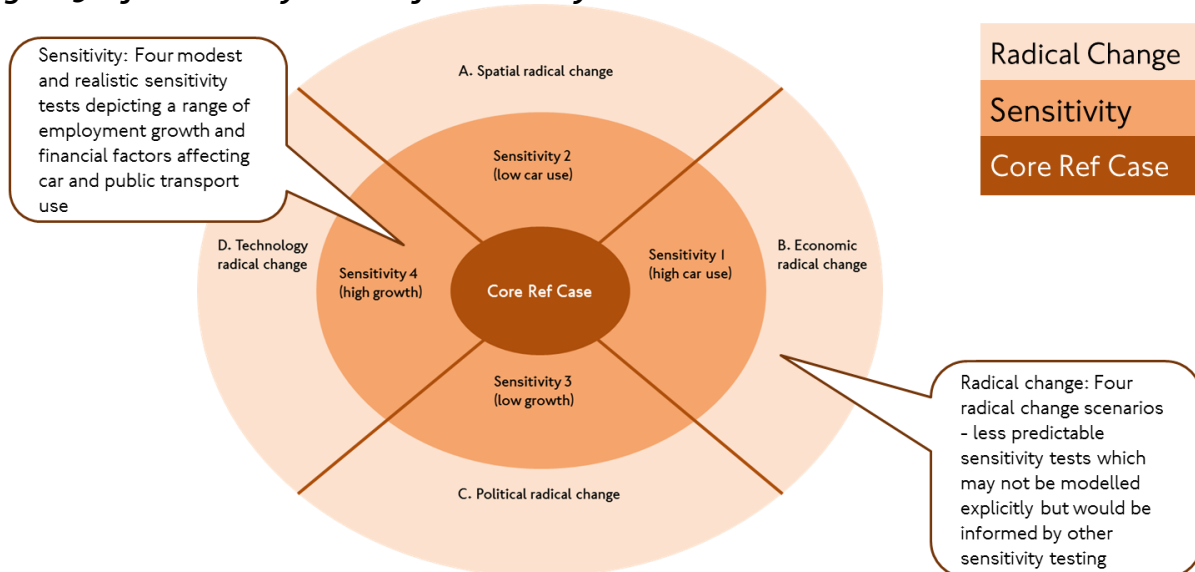
TfL has developed an approach which recognises the inherent uncertainty in forecasting. Robust assessment involves understanding how changes in the assumptions that form our future reference cases could influence schemes and policies as well as the core challenge. Our analysis

approach is to vary input assumptions in our modelling rather than changing the modelled relationships. This will identify if proposals have a better or worse case under alternative assumptions. For example:

- Does the necessity for Crossrail 2 depend on the highest projection of population and employment growth or is it required in all likely futures?
- What effect might sustained low fuel prices have on mode share and will this mean that a demand management proposal will not achieve the desired reduction in congestion?

TfL has developed a series of sensitivities to the core assumptions to reflect the inevitable uncertainty about the future and to understand how different possible futures might affect the nature of the transport challenges faced by London. These sensitivities are expressed as a series of modelled and hypothesised tests shown in Figure 9 and described as a 'wheel of uncertainty'.

Figure 9: TfL sensitivity 'wheel of uncertainty'



Note: Only changes to population or employment will affect total trip making by all modes

These sensitivities vary modelling inputs in order to stress test conclusions. The inner ring shows a series of modelled sensitivity tests. These modelled scenarios change input assumptions to reflect changes that could be considered reasonably likely, such as somewhat lower or higher population or economic growth than is forecast, or differences in the costs of travelling by car or public transport reflecting political changes to fares policy, fuel prices and so on. They provide a useful range of likely outcomes from which to assess schemes - the best schemes will hold their own in all of the 'inner ring' scenarios. The 'outer ring' represents changes that cannot reasonably be modelled, but which should be considered when thinking about the longer term. These include the changes to our way of life that technological developments could bring – some, such as automated vehicles, are already under development, others may be completely unforeseen at present. Major political or economic changes could have a similar impact – would forecasts in the 1970s have predicted the shift from a manufacturing to service economy, or in the 1980s have predicted the rise of inner London, or the success of Canary Wharf?

There is an expectation that where strategic modelling is required by a scheme/strategy, there will be an assessment against the most relevant sensitivities, with the results presented within the

economic case for the scheme/strategy alongside the core modelling and supported by a discussion of the potential impacts of more radical changes as represented in the 'outer ring'. For example, this is the approach currently being adopted in the development of the Crossrail 2 scheme.

Improving the representation of uncertainty – Model development

TfL continues to develop its model suite and is in the process of developing a new demand model to replace the LTS tool. The new demand model will include the representation of more modes, in greater detail and have a much more granular representation of individuals and their characteristics. A behavioural model like this poses challenges for accurate forecasting but is an excellent tool to assess 'what if?' scenarios and test uncertainty in how the city might develop. It will give TfL much greater flexibility to expand the 'wheel of uncertainty' and test variable behavioural responses to our schemes and policies.

All the model development work TfL does is predicated on ongoing analysis to understand trends and relationships, to facilitate continuous improvements in modelling capability.