



Mayor's Transport Strategy: Supporting Evidence Outcomes and Appraisal

July 2017



Introduction

This is part of the evidence base underpinning the draft Mayor's Transport Strategy



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.

The analytical work presented here describes the quantified outcomes of the strategy, assessing the benefits of the strategy in terms of the Mayor's aims and compared to the current funded plan.

The key conclusion is that with the actions identified in this strategy, a sustainable mode share of 80% can be achieved, meaning that eight in ten journeys made in London will be made on foot, by bicycle or by public transport and just two in ten by car, taxi, private hire vehicle or motorcycle.

This will deliver benefits to London's health and wellbeing, helping Londoners be more physically active, cleaning up our air and freeing up space to deliver Healthy Streets. Furthermore, the significant increases in rail capacity recommended by the strategy will reduce crowding on public transport and unlock thousands of new homes and jobs.

Contents

This report presents an appraisal of the key outcomes of the draft Mayor’s Transport Strategy. It is structured as follows:

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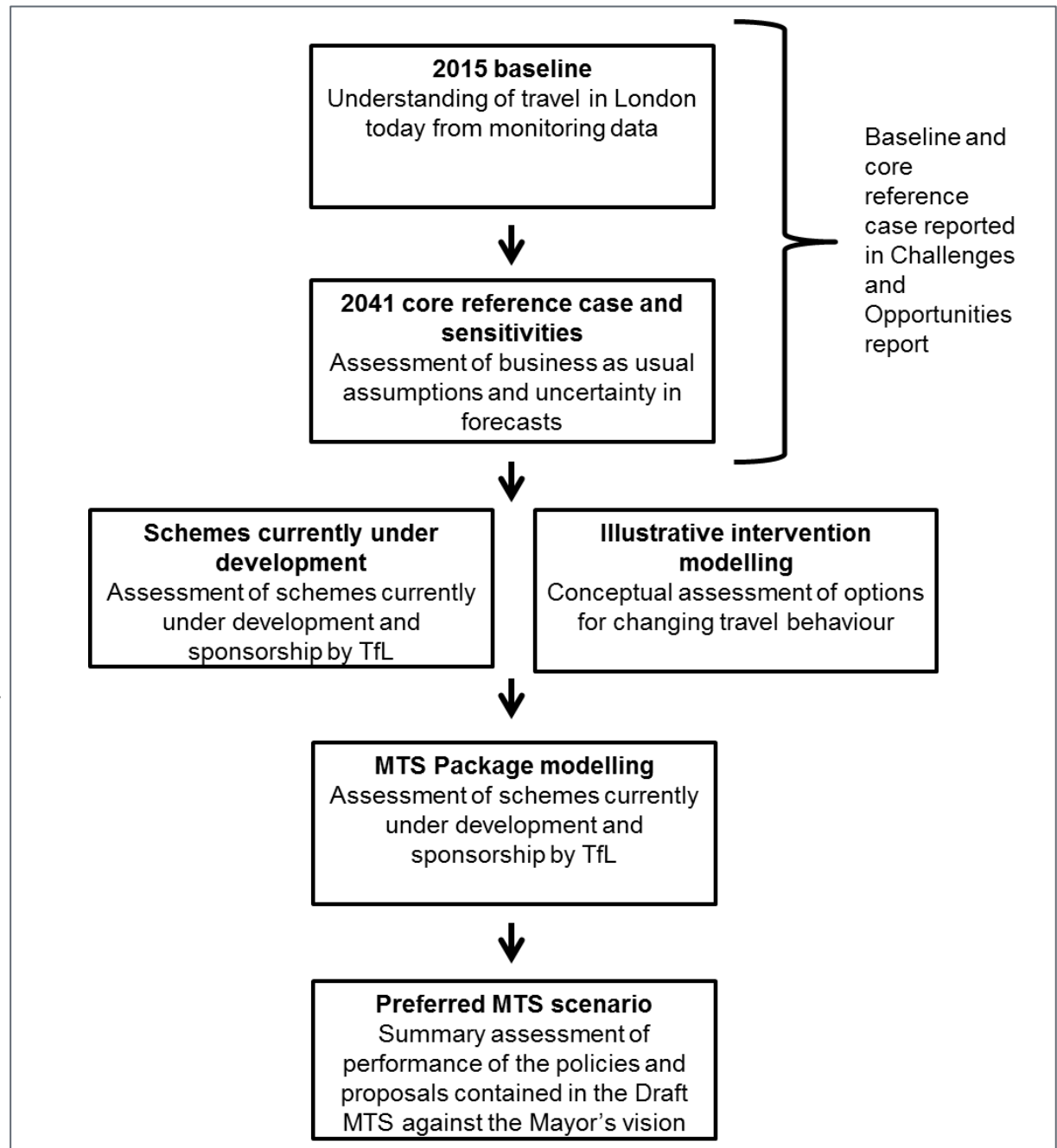
Approach to evaluating the impact of the draft MTS

TfL has assessed the outcomes and effectiveness of the draft Mayor's Transport Strategy

The MTS is an evidence-based policy document that builds on TfL's empirical understanding of how Londoners travel today, and may travel in the future. Analysis has been undertaken to inform strategy development and assess the effectiveness of various policies and schemes (interventions). This analysis includes a programme of modelling, using TfL's suite of strategic models and supporting analytical tools. TfL's overall approach to forecasting future travel demand is through developing a Core Reference Case, which includes current funded proposals for London.

A series of alternative policies and schemes have been assessed that could help to meet the challenges set out in the Challenges and Opportunities report. Various 'packages' have been developed from these alternative policies and schemes and an assessment of their relative effectiveness carried out against the Mayor's vision for travel in London.

Finally, an assessment has been made of the expected outcomes for London from implementing the MTS policies and proposals.



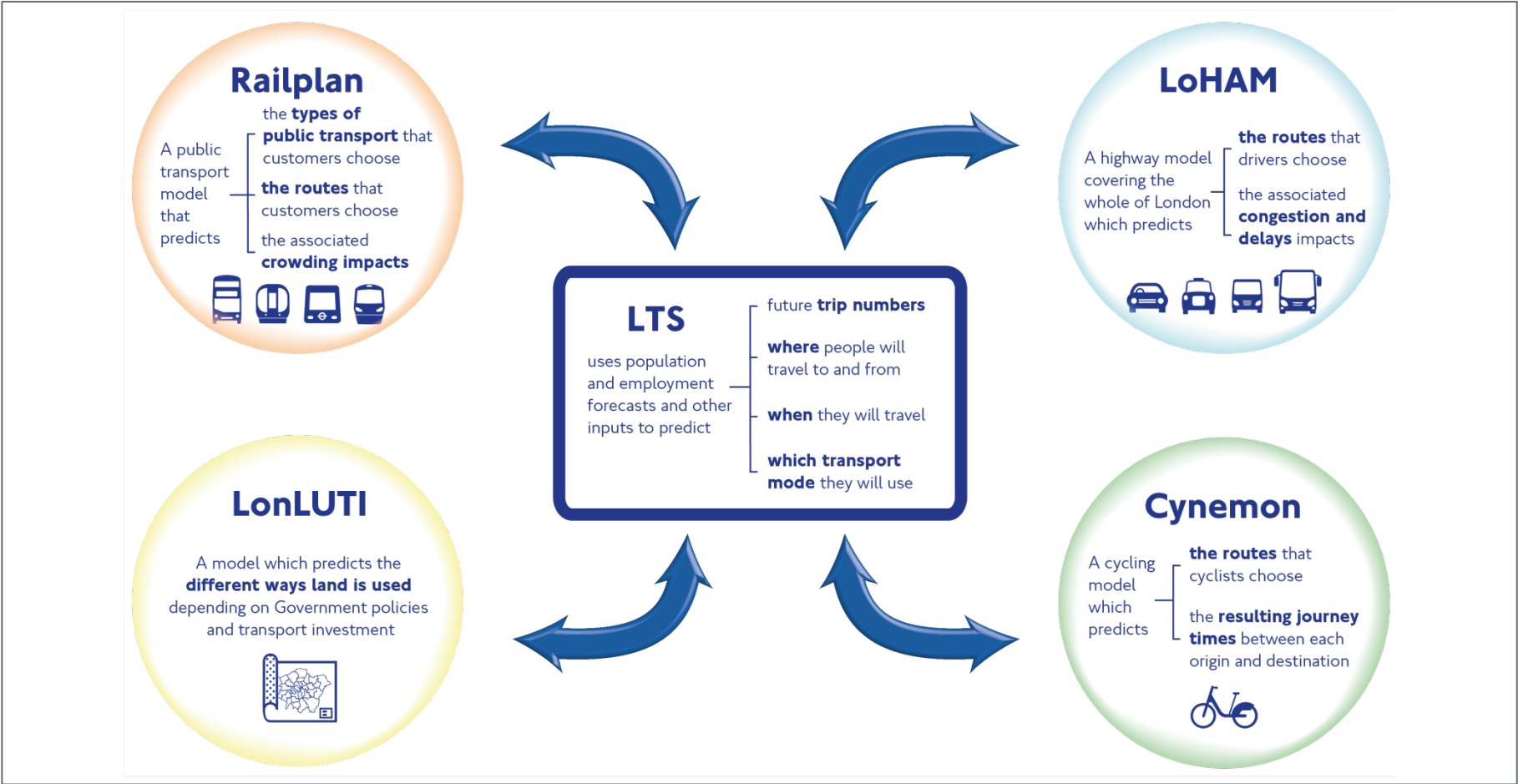
TfL's suite of strategic models has been used to assess the impacts of proposals contained in the MTS

TfL's strategic models have been widely used for forecasting the impacts of transport and land use decisions in London. This has included assessment of previous Mayor's Transport Strategies and London Plans. The role of the forecasting work for the Draft MTS is threefold:

1. To establish the transport baseline or reference case impact of our current plans, alongside other changes that are expected in

travel behaviour and transport network performance in London.

2. To inform the policy making process by assessing different interventions and their impacts.
3. To support a strategic assessment of the plans and policies included within the new MTS, and to assess the expected outcomes from these in the future.



The Reference Case assesses what could happen based on growth forecasts, trends and the funded programme

The MTS relies upon an understanding of what could happen in the future *without* the measures proposed in the draft strategy. A Reference Case has been produced to build on our understanding of current travel and present possible future travel volumes, distribution and mode share. This has formed the basis of analysis identifying the challenges and opportunities facing London and its transport network over the period to 2041.

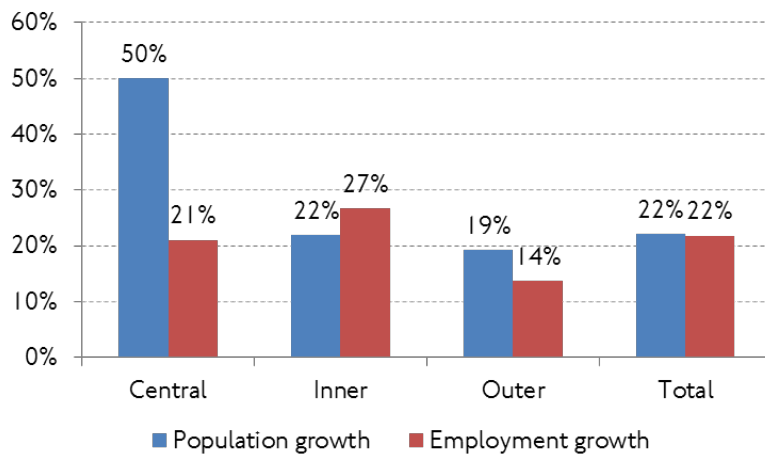
The Reference Case is based upon:

1. GLA population and employment projections
2. The funded programme of investment from TfL and other transport providers
3. Wider assumptions about policies relating to aspects such as fares, fuel costs and car parking, including an assumption that ongoing investment will facilitate continued growth in cycle travel.






Population and employment growth forecasts

	Population		Employment	
	2015 (m)	2041 (m)	2015 (m)	2041 (m)
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	6.7

Population and employment growth 2015 to 2041



The funded programme includes the following major schemes:

-  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
-  Capacity and frequency enhancements
-  Delivery of HS2, the HLOS and Thameslink upgrade schemes

Key assumptions determining future travel patterns:

- The economy is expected to grow and the value of time increases.
- 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 increase active travel and public transport use.
- The cost of car use is expected to fall over time, as technology improves vehicle efficiency, but parking costs are expected to increase.



To ensure the forecasting assumptions underlying the strategy are robust, analysis has looked at different future scenarios

All forecasting must accept that the future is inherently uncertain, and this uncertainty increases as we look further into the future. Robust assessment involves understanding how different trends or circumstances could alter the challenges facing London, and the schemes and policies designed to tackle these challenges.

There are many sources of uncertainty:

Population and the economy: for example, in the past, London has experienced periods of decline and growth, and the structure of the economy has changed in ways that might not have been predicted 30 or 40 years ago.

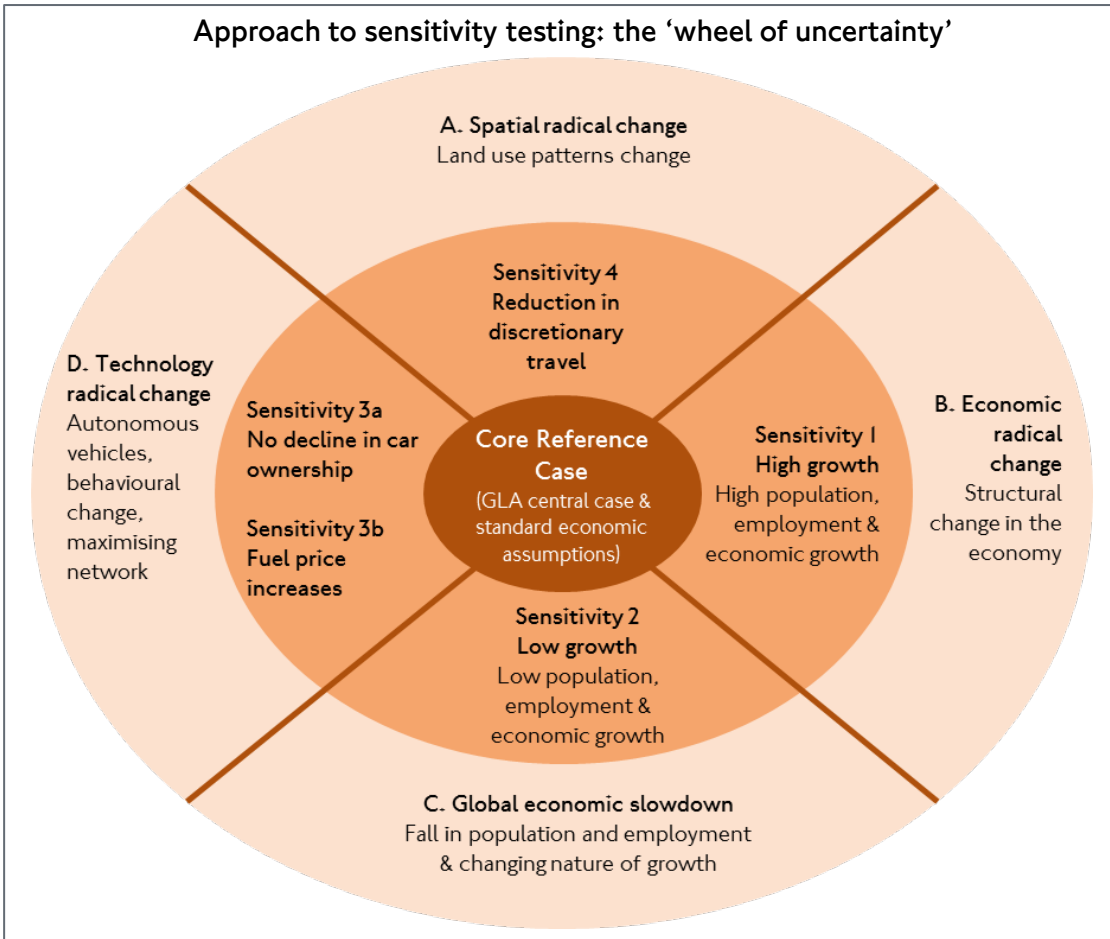
People's changing behaviour and preferences: for example, many young Londoners no longer consider obtaining a driver's license as a 'rite of passage'. It is very hard to predict such trends.

As London changes, its population will change: people's behaviour is a product of the environment they live in. Relationships between different factors are not always linear, making it hard to predict the longer term impact of measures to change the nature of our city.

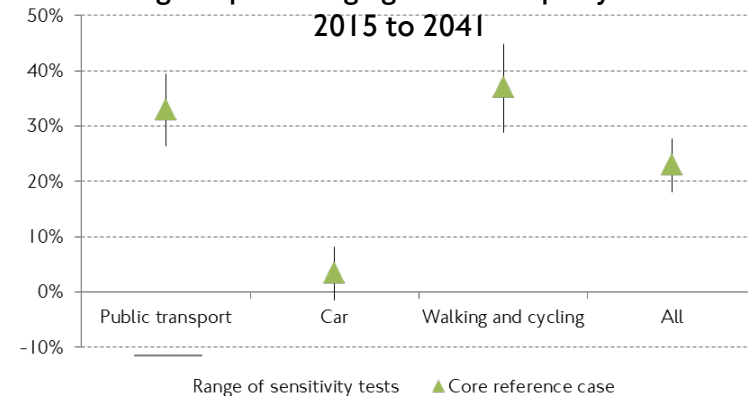
Technological advancement and adoption: in recent years, smartphones have brought extraordinary lifestyle change. In future, connected, autonomous vehicles could transform travel, but there is much we do not know about how this technology could develop.

Sensitivity tests suggest that the reference case is a robust basis on which to plan, with relatively little variation between tests in terms of the challenges.

Approach to sensitivity testing: the 'wheel of uncertainty'



Range of percentage growth in trips by mode 2015 to 2041



Note: the lines indicate the highest and lowest values emerging from the sensitivity tests; the green arrow is the core reference case.



Major schemes underwent thorough modelling; this was complemented with testing of 'illustrative interventions'

Traditionally, transport models are used to test the impacts of rail and road schemes - schemes delivering new infrastructure or capacity. They are less often used to test the impact of schemes at a more conceptual stage, that could be delivered in a number of ways, or schemes designed to deliver mode shift. Therefore, in order to reflect the Healthy Streets goals of the strategy, a new approach

was developed allowing the creation and testing of a series of 'illustrative interventions', typically radical examples of possible policies. Each test was carried out separately on the 2015 and 2041 Reference Case bases. We learned from the illustrative tests and used our improved knowledge to inform the development of 'packages' of interventions for the draft MTS.

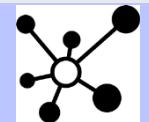
Illustrative interventions modelled as part of the development of the MTS



Testing to what extent might bus priority, frequency and quality improvements deliver increased bus use, with expected benefits to mode share, connectivity and congestion levels



Testing how an increase in cycling could contribute to relieving public transport pressure on central London and highway congestion.



Testing to what extent congestion and traffic growth might be mitigated by reducing car parking and car ownership, and improving public transport access in opportunity areas and town centres.



Testing to what extent a London wide charge might achieve vehicle kilometres reductions, mode shift, crowding relief and environmental benefits.

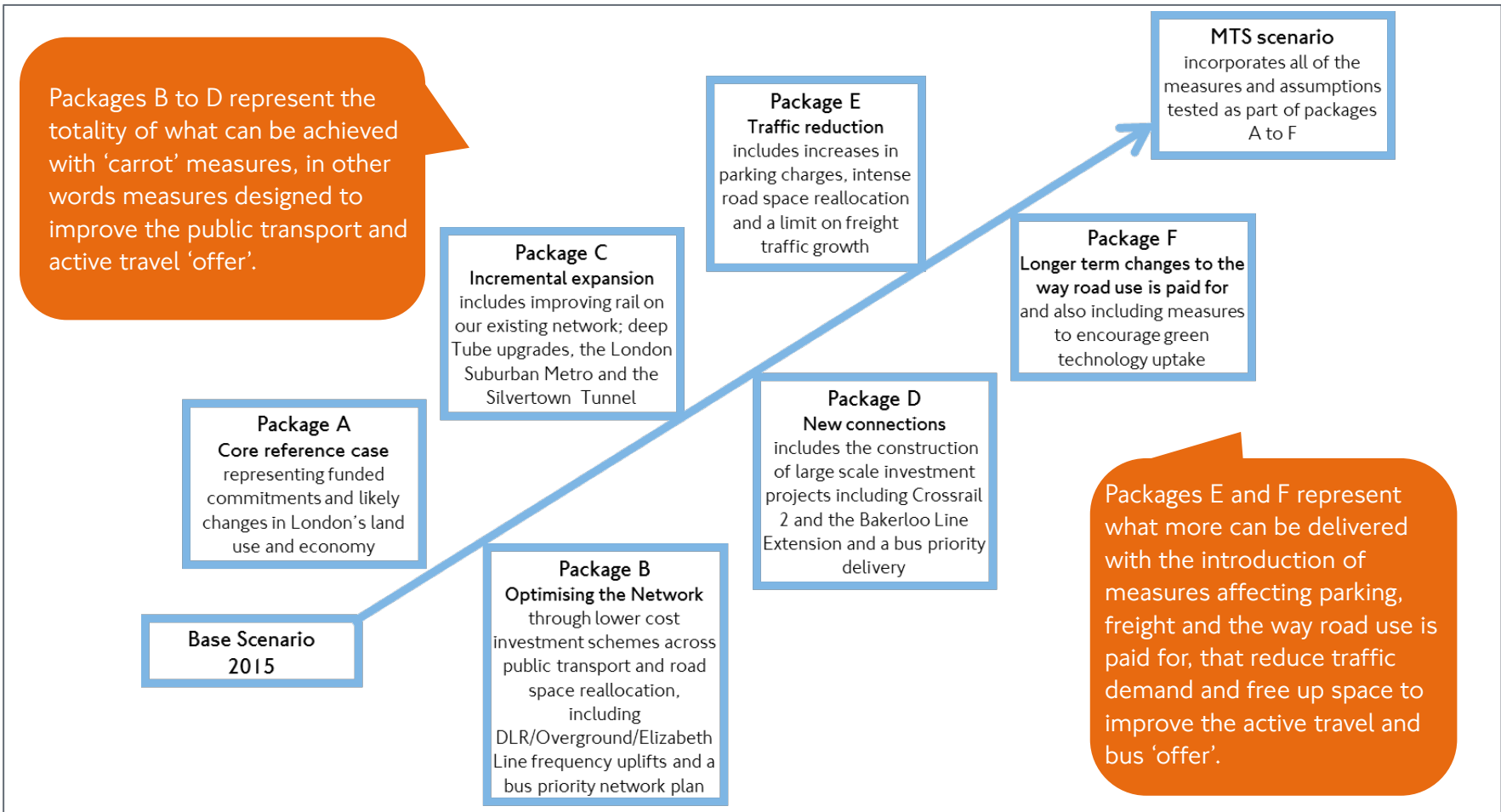


Testing to what extent integrating housing land use and public transport accessibility/access to local services can impact mode share, achieve vehicle kilometres reductions and reduce congestion.

Testing brought together modelling of major schemes & illustrative interventions into a series of cumulative 'packages'

In order to understand the impact and effectiveness of the policies and proposals contained in the Mayor's Transport Strategy, TfL developed a series of cumulative 'packages' to be tested in the strategic modelling suite. The packages drew on existing modelling of major rail and road schemes and on lessons learned from the testing of illustrative interventions. These packages are designed to pull together

measures of a similar type, and represent measures to be implemented in the short, medium and long term. They get progressively more ambitious – starting with optimising the existing network, then expanding it, then adding new connections, and then introducing measures to reduce traffic and tackle car use. The modelling of policies and proposals concerned with the latter years of the strategy is inevitably more illustrative.



Finally, analysis identified the impact of the policies and proposals in the MTS, identifying ten core outcomes

In total, the 'MTS package' includes all the measures assessed as part of packages A (the reference case or funded programme) to F. This is a representation of all of the quantifiable transport policies and proposals included in the MTS. Ten outcomes have been identified, reflecting the Mayor's aims, and each incorporating several quantified measures.

The ten outcomes are presented below and described in turn in the final section of this report.

The MTS outcomes will form the basis of future monitoring and evaluation of the MTS and will also be used to guide decision making in TfL and London's boroughs.

Outcomes of the Mayor's Transport Strategy

Healthy Streets and healthy people	A good public transport experience	New homes and jobs
1. 80% of journeys will be made by sustainable modes – public transport, walking and cycling – by 2041, compared to 64% today		
2. London's streets will be healthy & more Londoners will travel actively	6. More people will travel on an expanded public transport network	9. Sustainable travel will be the best option in new developments
3. London's transport system will be safe & secure	7. Public transport will be affordable and accessible to all	10. Transport investment will unlock the delivery of new homes & jobs
4. London's streets will be used more efficiently & have less traffic on them	8. Journeys by public transport will be pleasant, fast and reliable	
5. London's streets will be clean and green		

TfL's modelling and analysis demonstrates that, with the range of measures proposed by the MTS, it is possible to achieve an 80% sustainable mode share in London by 2041.



Forecasting growth

London is growing rapidly, with the population expected to reach 10.5m by 2041

London is bigger than it has ever been and growing rapidly with the population expected to reach 10.5m by 2041. This is 28% higher than in 2011 and is equivalent to adding the combined populations of Birmingham and Glasgow during this time.

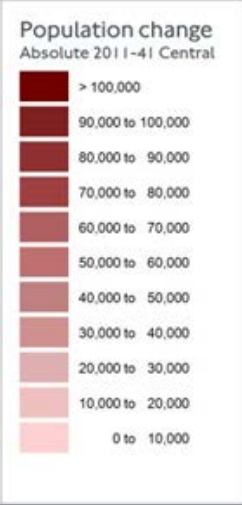
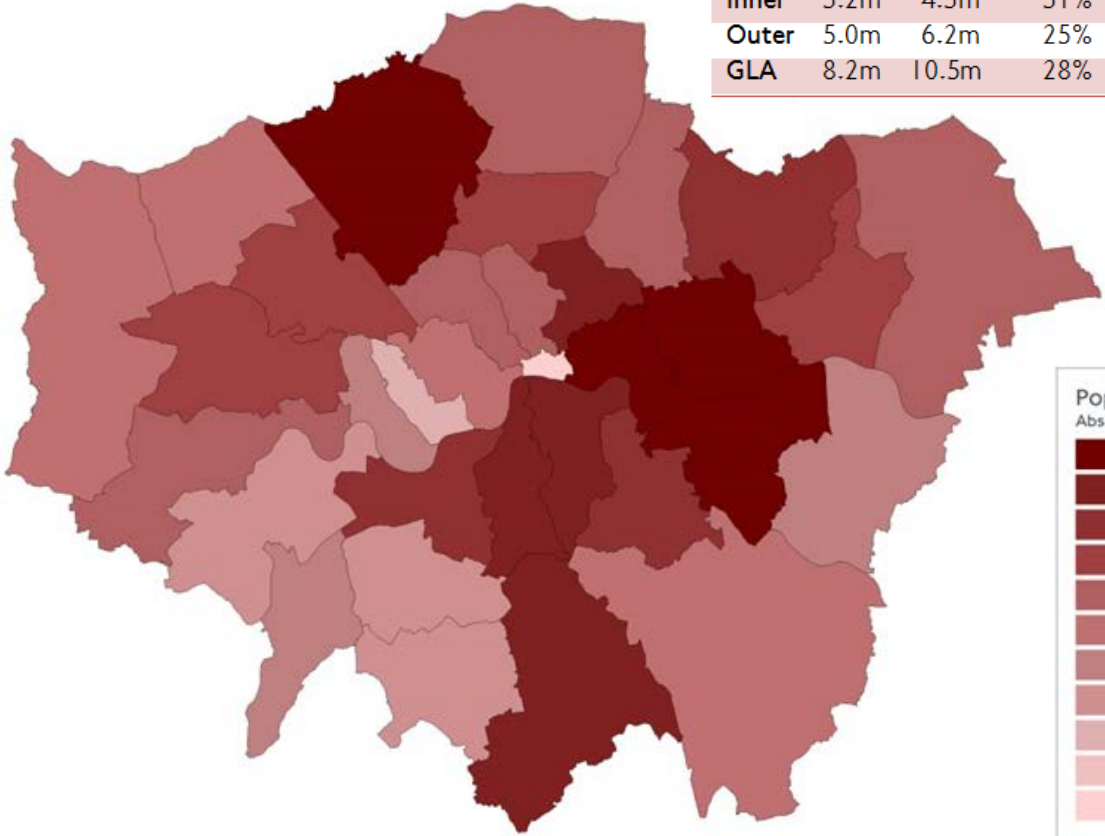
The composition of London's population is also expected to change, altering the emphasis of future demand pressures on the

transport networks. In particular, there will be an increase in the numbers of older people – particularly focused in outer London – leading to increased demand for accessible services.

40% of the growth will be in east London, with much of the growth taking place within Opportunity and Growth Areas.

Population growth 2011 to 2041

Popn	2011	2041	Change
Inner	3.2m	4.3m	31%
Outer	5.0m	6.2m	25%
GLA	8.2m	10.5m	28%



The recent 'baby boom' will stabilise, giving net natural change of +80,000 per year.



By 2041, the number of Londoners over 70 will have grown by 85%.



More people will leave London than arrive, with net out-migration of 20,000 per year.



Employment is expected to grow by more than a million additional jobs by 2041, concentrated in the Central Activities Zone

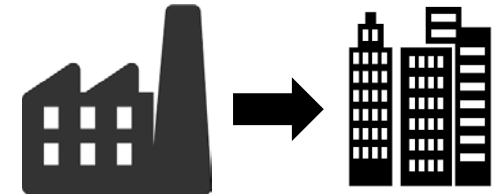
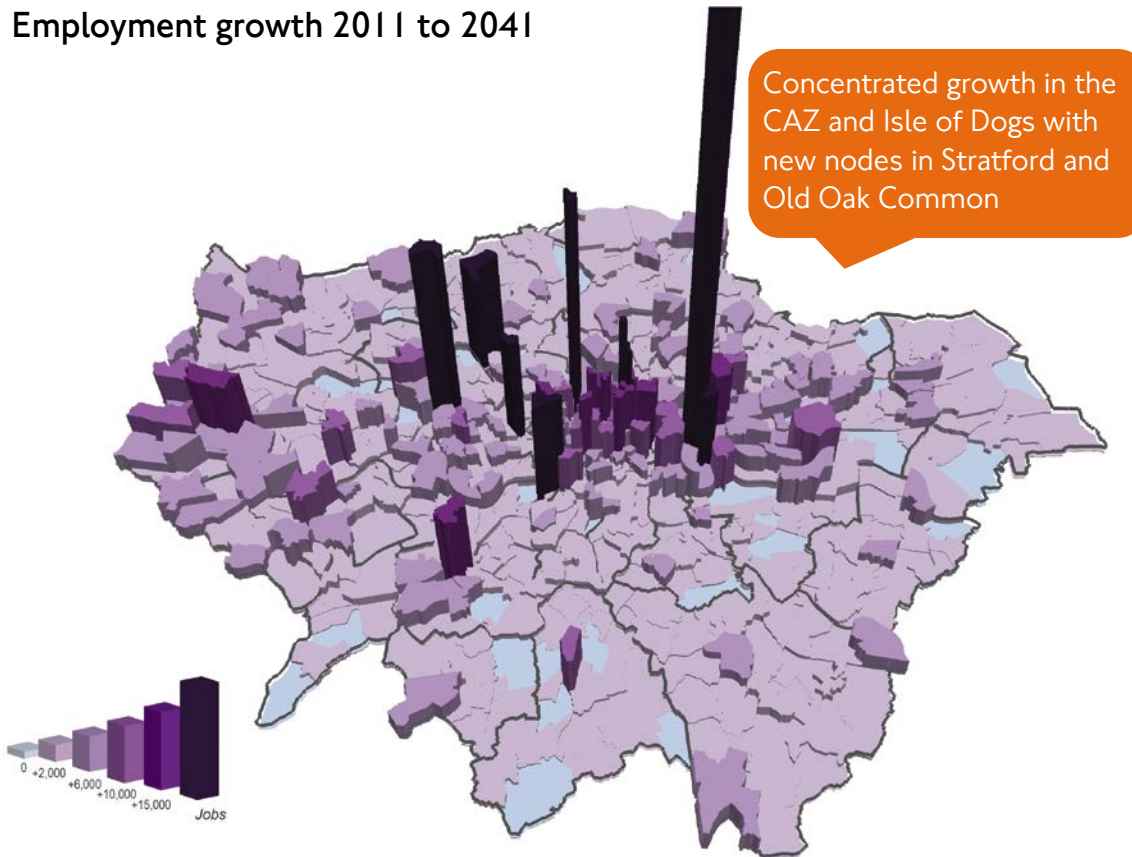
London's employment has grown from 4.6 million jobs in 2000 to 5.6 million in March 2016 and is projected to grow to 6.25 million by 2031 and 6.75 million by 2041.

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 Common also have the potential to become major hubs.

The Opportunity Areas will also play a key role in supporting London's growth, with the potential capacity to support nearly 600,000 jobs.

Employment growth 2011 to 2041



Over the past 15 years manufacturing has been declining and jobs in professional services have been increasing – this is expected to continue. The switch from lower to higher density employment is expected to lead to an increase in commuting by public transport and a fall in commuting by car.



Nevertheless, a third of jobs are in outer London, with a 56% car mode share for commuting. As London grows, we need to ensure more sustainable commuter patterns for travel beyond the centre.

By 2041, without the MTS, growth in travel demand will lead to congested and car dominated streets

Travel demand is expected to increase to around 32 million trips on an average day in 2041, 5 million more than today.

With the committed programme of investment but without the interventions proposed in the MTS, the sustainable mode share is expected to rise from 64% to 70%.

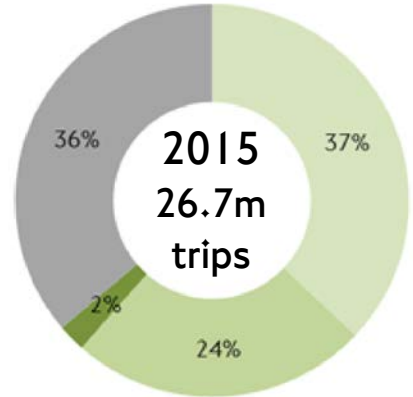
Despite a falling car mode share, vehicle kilometres will rise by around 8% in the morning

peak. 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%, will lead to an overall rise in traffic on the network if left unchecked.

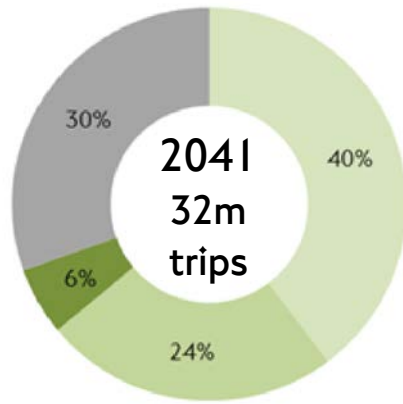
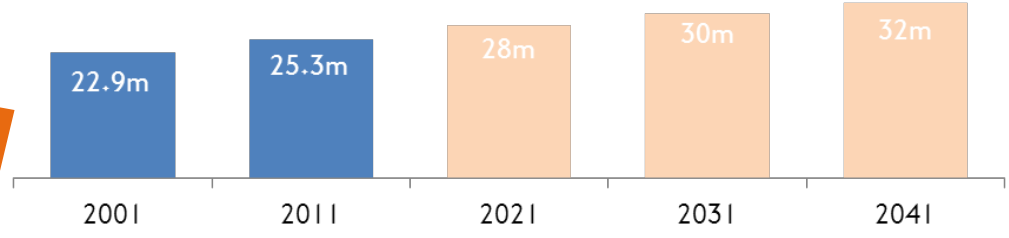
The interventions proposed in the MTS are intended to deliver mode shift from the car and increase the share of trips made by sustainable modes.

Mode share of travel in London, without the MTS

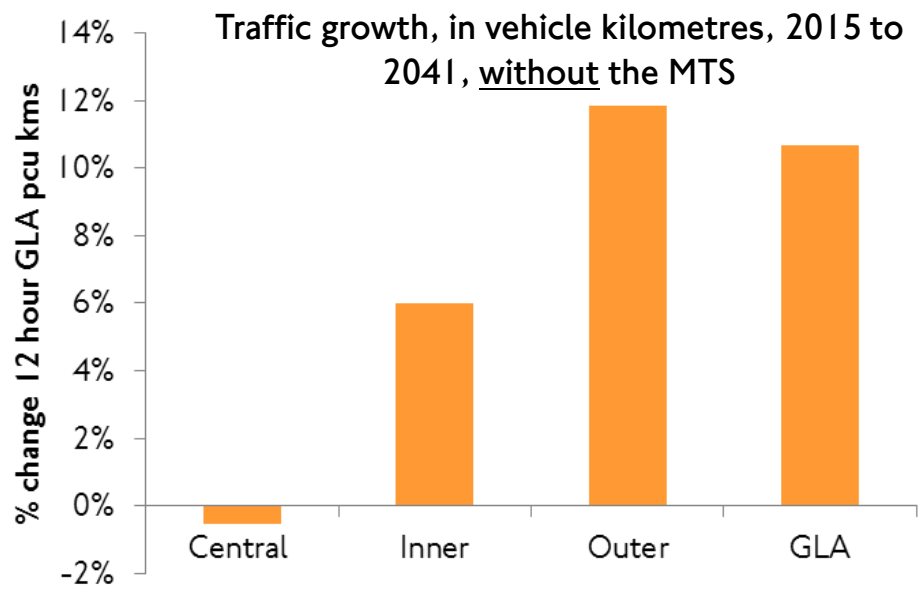
Growth in number of trips made in London, actual and forecast



By the 2040s, there will be 40% more travel happening in London than when TfL was formed in 2001.



- Public Transport
- Walk
- Cycle
- Car



With the measures proposed in the Mayor's Transport Strategy, by 2041 80% of trips will be by sustainable modes

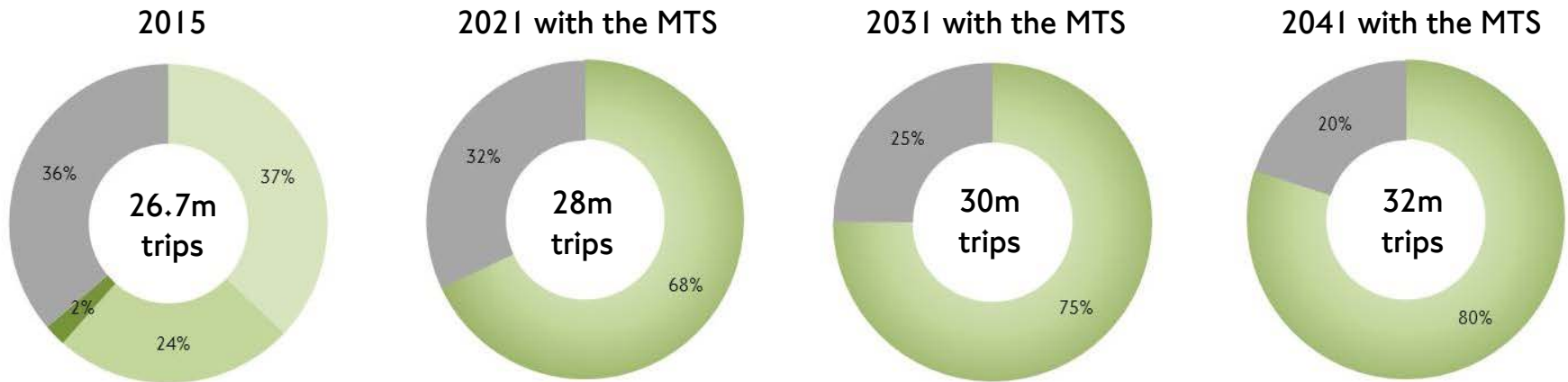
The delivery of the MTS would enable travel in London to increase, in line with expectations from population and economic growth, by 5 million trips per day to 32 million in 2041 in a sustainable way.

Without the interventions proposed in the MTS, the sustainable mode share is expected to rise from 64% to 70%. With the

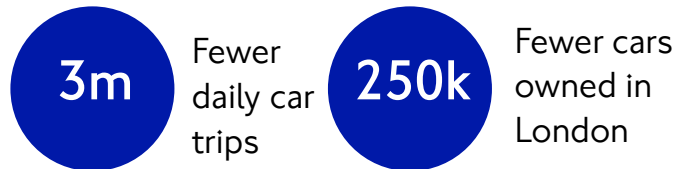
interventions proposed in the MTS, the sustainable mode share is expected to reach 80% by 2041.

This represents a reduction in the car mode share of 16 percentage points from 2015, a fall of around 45%, and the car mode share is 10 percentage points lower than expected without the MTS.

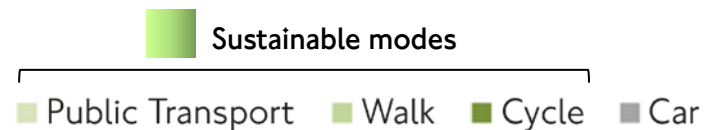
Mode share of travel in London, with the MTS



With the MTS, by 2041 there will be...



By 2041, travel will have risen by around a quarter but car travel will have fallen by around a third.



The mode share will vary across London but all regions will see shift from car to sustainable modes

The scale and nature of mode shift will vary across the city. Central London is expected to become almost car-free by 2041, with only one in twenty trips made by car with the strategy. Inner London will continue to shift away from the car, with less than one in ten trips made by car by 2041.

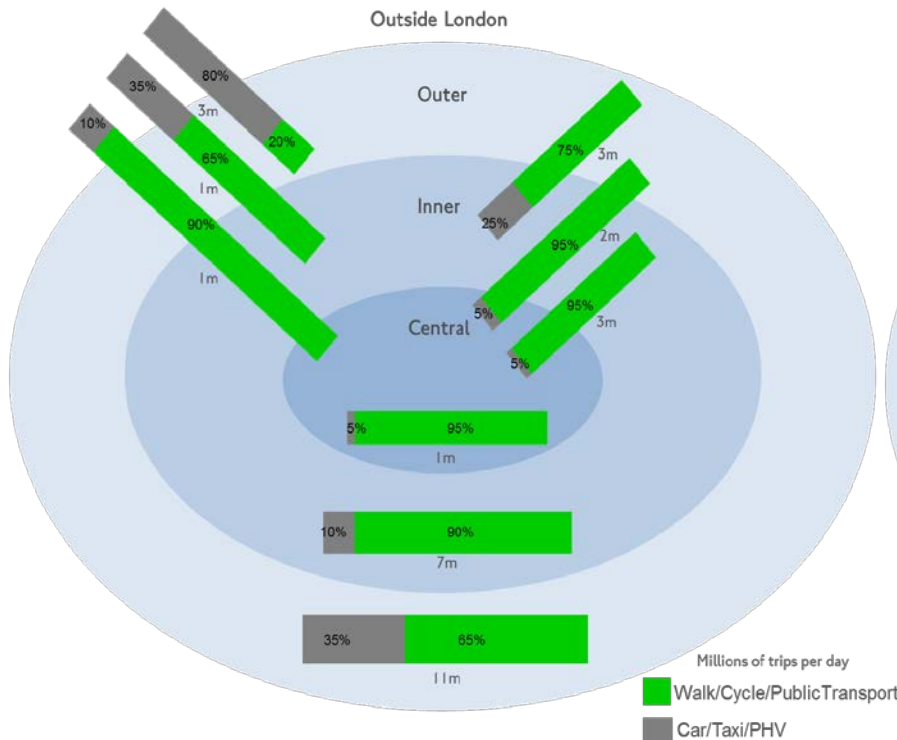
Whilst outer London will still be where the majority of car trips are made, the car mode

share is expected to fall significantly from more than a third to around a quarter of trips. This is a reduction of around 1.8 million car trips in outer London alone.

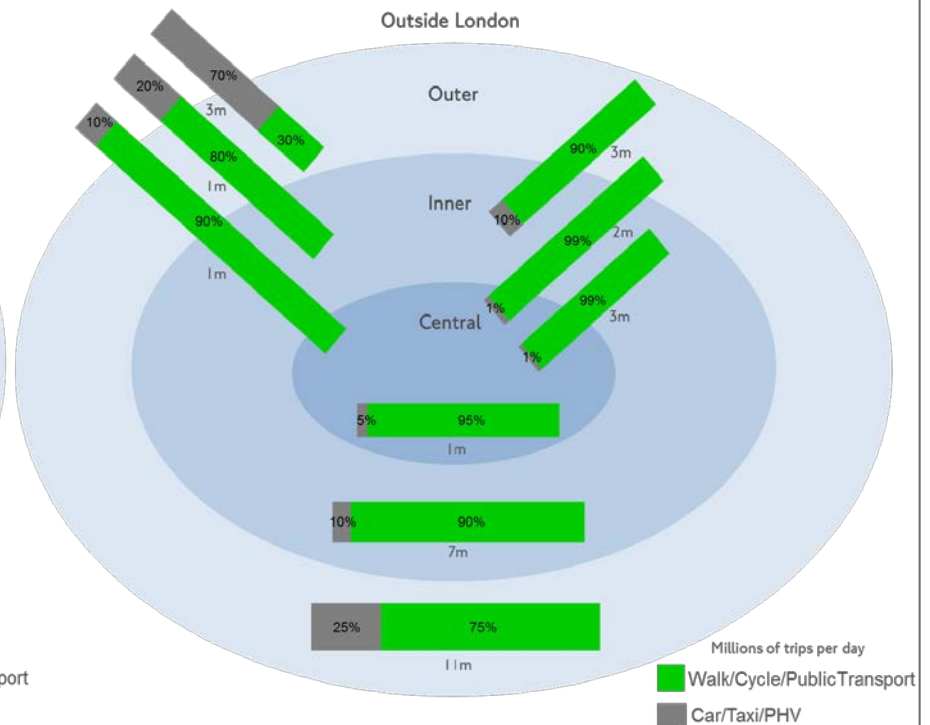
Travel into London will also become less dependent on the car, although travel from outside London into outer London will still mostly be made by car, simply reflecting the lack of available alternatives.

Trips by mode and origin/destination, with and without the MTS

2041: with funded programme



2041: with Mayor's Transport Strategy



**Developing the MTS:
assessing the impact of
major schemes & proposals**

To inform the development of the MTS, the impacts of major schemes and proposals have been tested

The following slides describe the results of analysis carried out to test the impacts of major schemes and proposals contained within the MTS.

In some instances, schemes are well developed and a great deal of modelling and analysis has been undertaken. In other cases, new ideas have been developed for the MTS, tested using an illustrative approach to ensure the possible

impacts are understood.

This section focuses on some of the largest schemes and also on the new and bespoke testing carried out for the MTS itself. The 'illustrative interventions' tests shown here were preliminary tests conducted to explore impacts, and in general are more extreme than the versions included in the final package modelling for the MTS.

The next section describes the impacts of the following interventions:

Crossrail 2	Tube, DLR and Tram upgrades
London suburban rail network	Enhancing the bus network (illustrative)
Mini-radial networks to town centres with interchange hubs	Increased cycling (illustrative)
Bakerloo line extension	Better public transport and reduced car travel in town centres and Opportunity Areas (illustrative)
Silvertown tunnel	Road pricing (illustrative)
Ultra Low Emission Zone	Focussed growth in high density, well connected areas (illustrative)

A London Suburban Metro would offer improved frequencies, journey times and interchange opportunities

South London relies on its suburban rail network for connectivity to central London. However, there is a substantial and growing gap between the level of service that can be offered on National Rail in south London, and the frequency and reliability now offered on the Tube and bus network.

Creating a London Suburban Metro in south

London could increase capacity into central London on these services by over a third in the peak period, providing capacity for an additional 125,000 passengers to travel to central London in the morning peak. This could deliver peak period capacity increases on suburban services of around two thirds at Victoria and Charing Cross and a half at Cannon Street.

Capacity to central London

125,000 more people could travel into central London in the morning peak



- 20% more capacity due to longer or improved rolling stock
- 80% more capacity due to higher service frequencies

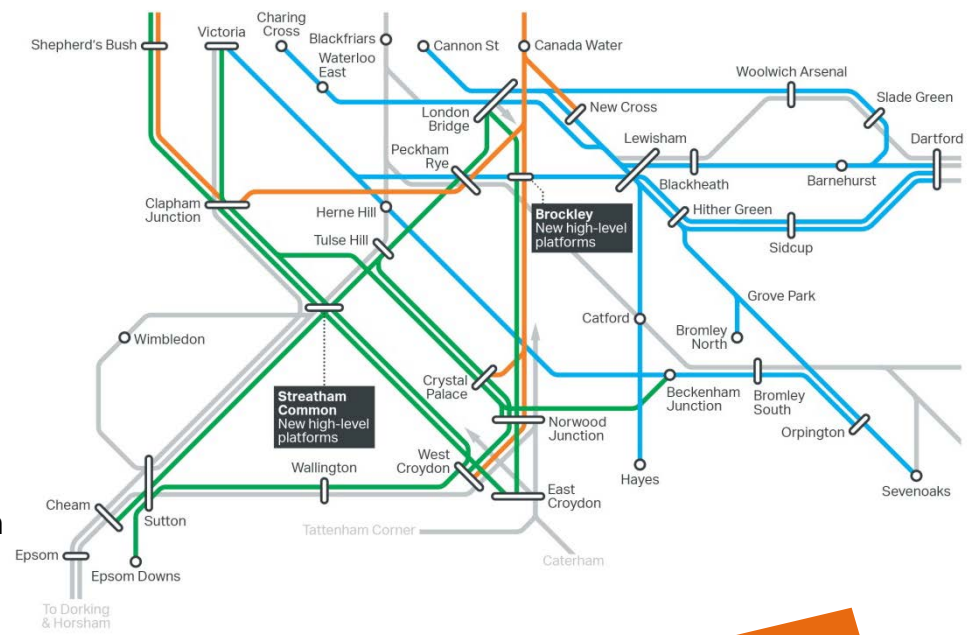
Capacity on non-radial services across London

38,000 more people could travel on non-radial services around inner and outer London



- 55% of new capacity provided by east and west London rail lines
- 45% of new capacity provided by Tram services

Proposed London Suburban Metro in south London



— Overground (2017)

— South Central — South Eastern
 Could be contracted by TfL using Overground brand, subject to operational analysis

Other related services
 may not be contracted by TfL for operational reasons

A London Suburban Metro could be delivered by the late 2020s.



Extending the Bakerloo line to Lewisham and beyond improves connectivity, reduces crowding and unlocks development

The MTS proposes the extension of the Bakerloo line from Elephant and Castle to Lewisham, with interchanges with Overground, DLR and National Rail services at New Cross Gate and Lewisham. This would deliver an increase in frequency on the Bakerloo Line to 33 trains per hour, providing the capacity for 65,000 more journeys in the morning and evening peaks. Lewisham and New Cross Gate would offer significantly improved connectivity

to the Overground, DLR and National Rail services. Journey times from Lewisham to central London will fall by 9 minutes, and the better connectivity means that up to 2.6 million jobs will become 10 minutes closer to the area served. The Bakerloo Line Extension would also deliver crowding relief on National Rail by providing an alternative route into London, and on local bus services by providing local London underground capacity.

The Bakerloo extension would unlock 25,000 new homes and 5,000 new jobs in the Old Kent Road and the Lewisham, Catford and New Cross Opportunity Areas.

Benefits of the Bakerloo line extension for new homes and jobs

-  Improved Labour Supply
-  Affordable Homes
-  Regeneration and Quality of Life

The BLE relieves labour supply constraints by increasing capacity of the transport network, providing new connections, helping relieve bottlenecks at main termini stations

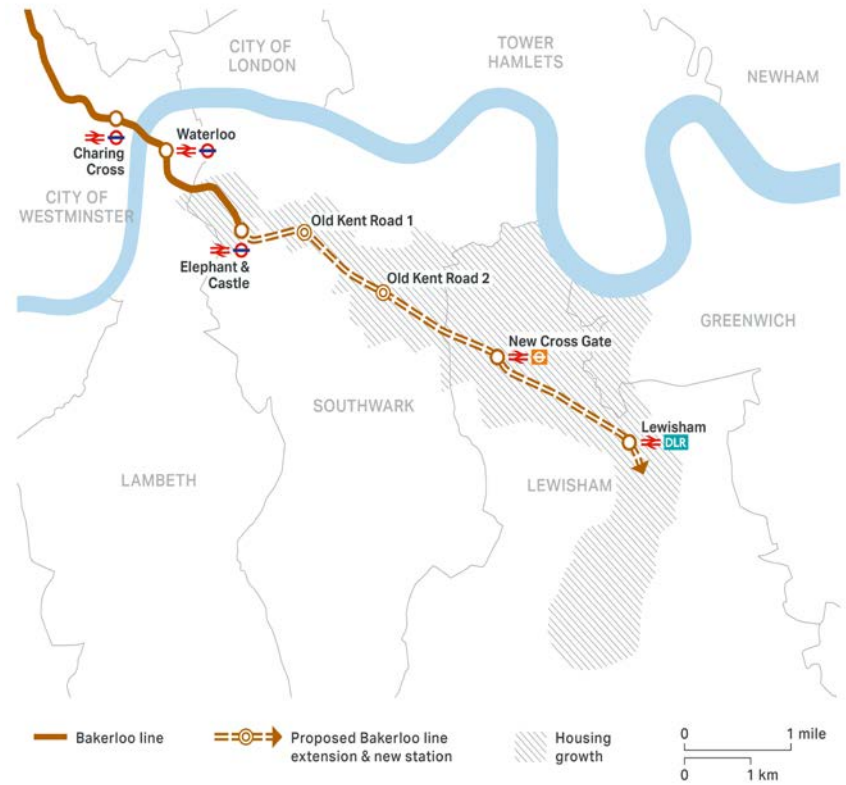
By stimulating higher rates of delivery of new housing within Opportunity Areas, BLE will support productivity growth in London's Central Activities Zone (CAZ)

By enabling an increase in the supply of new housing, the BLE will improve the affordability of housing for non-CAZ workers as well

The BLE will support much needed regeneration in areas of south east London that have been held back from sharing in London's success by inadequate transport connectivity

The BLE will improve the quality of life for south east London residents by improving connectivity to key locations, tackling road congestion and poor air quality on main routes

Bakerloo line extension



The Silvertown tunnel will provide a reliable and resilient cross-river road link, enabling new bus links

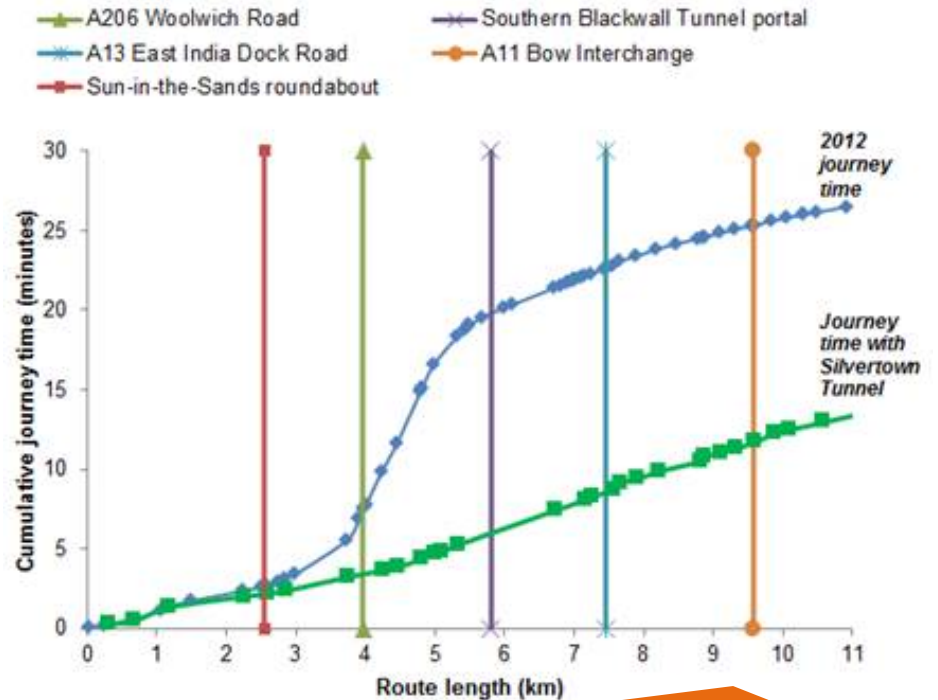
Involving construction of a new highway tunnel under the River Thames between the Greenwich Peninsula and Silvertown. The tunnel is proposed to be charged for general traffic, locking in the benefits so that there will be minimal changes to overall traffic levels. The tunnel includes a dedicated bus/coach and HGV lane in each direction and will deliver at least 20 buses per hour in the opening year.

The Silvertown tunnel increases the resilience of the strategic road network in east and south-east London. Over-height vehicles typically result in over 1,000 unplanned closures each year at the Blackwall tunnel; unplanned closures would reduce significantly. This makes the region more attractive for investment, with 3,000 new jobs expected to be created by 2041 as a result of the scheme.

Potential bus routes enabled by the Silvertown tunnel



Comparison of average weekday journey time with the Silvertown tunnel and as observed in 2012



Eliminates the severe congestion that routinely affects the Blackwall Tunnel, with journey time savings of up to 20 minutes at peak times expected on the approaches to the tunnels.



The Ultra Low Emission Zone will reduce emissions from road transport and bring benefits to health

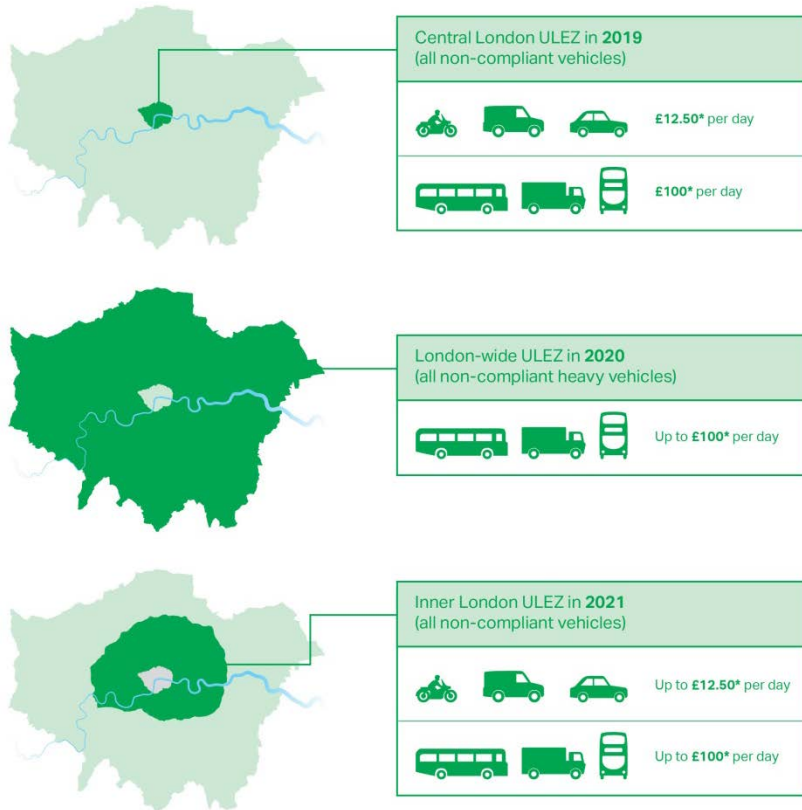
Air pollution caused by carcinogenic diesel emissions, high levels of nitrogen dioxide (NO₂) and particulate matter (PM) exacerbate health conditions and shorten the lives of Londoners.

The Ultra Low Emissions Zone (ULEZ) will cover the same area as the Congestion Charging Zone. A daily charge (7 days a week) of £12.50 for light vehicles and £100 for heavy

vehicles will be applied for vehicles that that don't meet the required standard (Euro 4 for petrol and Euro 6 for diesel).

Subject to consultation, the original September 2020 start date for the central ULEZ is being brought forward to April 2019. This is ahead of a series of expansions London-wide for heavy vehicles in 2020 and of £12.50 for light vehicles and £100 for heavy across inner London for light vehicles in 2021.

Ultra Low Emission Zone proposals



ULEZ standards: Petrol – Euro 4; Diesel – Euro 6/VI; Motorcycle and L-Cat – Euro 3
 *ULEZ charge levels are indicative only and refer to the current scheme proposals

Impacts:

- As a result of implementing the ULEZ in central London sooner, road transport NO_x emissions in central London are expected to reduce by 20% in 2019.
- The area of central London exceeding legal limit values for NO₂ would reduce from 30% to 22% and 42% fewer people in central London would be living in areas exceeding the legal limits for NO₂ concentrations.
- There will also be 'knock on' benefits outside central London as a result of cleaner vehicles passing through inner and outer London to access central London.
- There are benefits in reducing exposure to air pollution by introducing ULEZ 17 months earlier, for example reducing the risk of hospital admissions for heart and lung conditions worsening symptoms and severity of asthma.



MTS proposes capacity and frequency increases on the Elizabeth line, tube, trams & DLR beyond current funded plans

Upgrades will improve the capacity, frequency and reliability of TfL's train services to support the demand generated by a growing population and economy, reduce crowding and encourage people to travel by public transport.

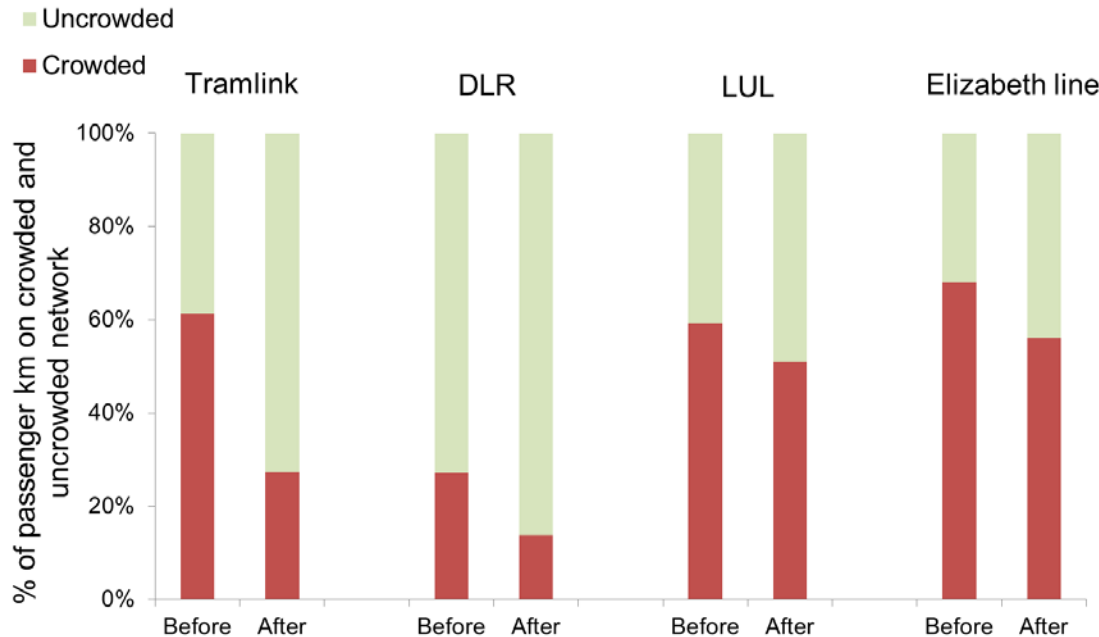
The improvements significantly increase morning peak capacity in 2041 by 26 per cent across the London network, with 1 per cent arising from Tram improvements, 4 per cent

from DLR improvements, 16 per cent from London Underground improvements and 6 per cent from the Elizabeth line frequency increase. The increase in capacity significantly reduces crowding across TfL's rail network in London.

The upgrades increase frequencies on many lines to 36 or 37 trains per hour, considered the maximum for reliable operations.

On average, the proportion of passenger kilometres travelled in crowded conditions (greater than 4 people per square metre) is reduced from above 50% to approximately 35% by this package of improvements.

2041 Crowding before and after TfL rail frequency and capacity improvements



Increased service frequency to 30 trains per hour.



Increased frequency to 30 trains per hour.



Increased frequency to 7.5 trains per hour on all routes.



Increased capacity & frequency on:

- Central Line (37tph)
- Piccadilly Line (36tph),
- Jubilee Line (36tph)
- Northern Line (towards 36tph)
- Waterloo & City Line (30tph)
- Bakerloo Line (26tph)

tph = trains per hour



Improving and expanding the bus network would encourage more people to travel by bus

This illustrative test was carried out to understand the potential demand for improved bus services, and to explore the potential role for buses in delivering mode shift from the car.

The test includes a number of measures including bus priority, bus frequency and the quality of buses, each expected to make buses more attractive.

The measures tested were:

- 20% reduction in bus journey time over 2011 levels in inner and outer London.
- Increase in bus frequency in line with population growth by borough outside central London.
- Factor to represent bus service quality improvements.

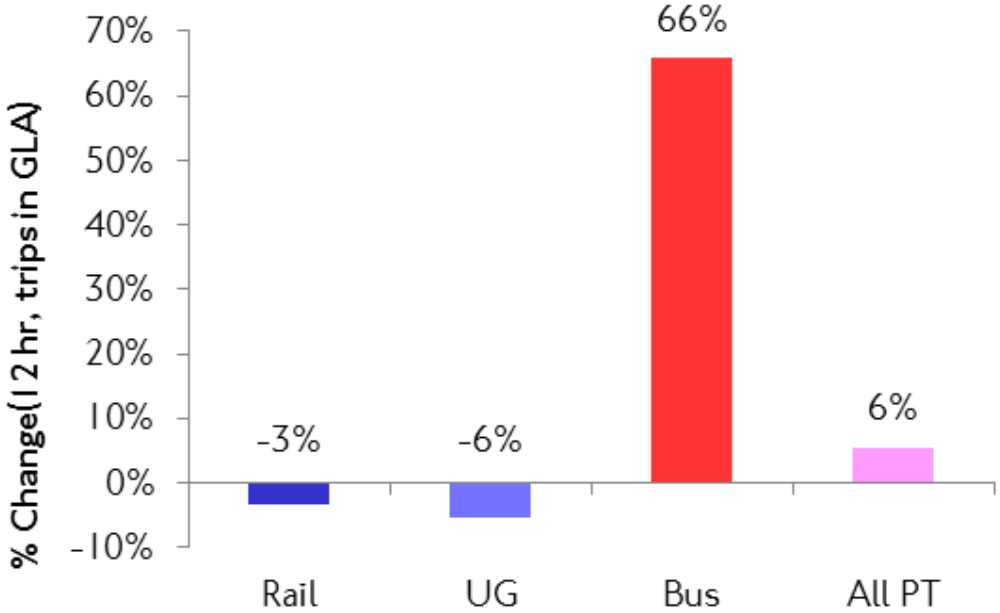


Testing to what extent might bus priority, frequency and quality improvements deliver increased bus use, with expected benefits to mode share, connectivity and congestion levels?

Key findings:

- Improving bus connectivity and quality significantly increases bus usage with a 65% increase in passenger kilometres.
- The scale of growth suggests that the investment is realising otherwise suppressed demand for bus services.
- Overall, public transport use increases by 500,000 trips per day compared to the 2041 reference case. There is a small reduction in rail and Underground use of approximately 5% but this is more than offset by the increased bus demand.
- Some trips come from the car but more come from active modes, reflecting the distribution of those trips and also because car remains attractive. This suggests that improving the bus network would enable mode shift, but that measures to deter people from using their cars would also be required to deliver widespread mode shift.

Change in public transport passenger kilometres, 2041 compared to reference case



A significant increase in cycling could deliver a more efficient use of the street network and a healthier population

This test was designed to identify the impact of a very substantial increase in cycle travel on public transport and the road network. The cycle mode share currently stands at 2% and the reference case assumes a 6% cycle mode share by 2041.

The test did not explore how an increase in cycling could be achieved; for which separate

analytical work using bespoke tools has been undertaken.

As such, the test involved increasing the cycle mode share to 15%. The test assumes that there is a slightly greater reduction in car than public transport trips, with some reduction in walking for shorter journeys.

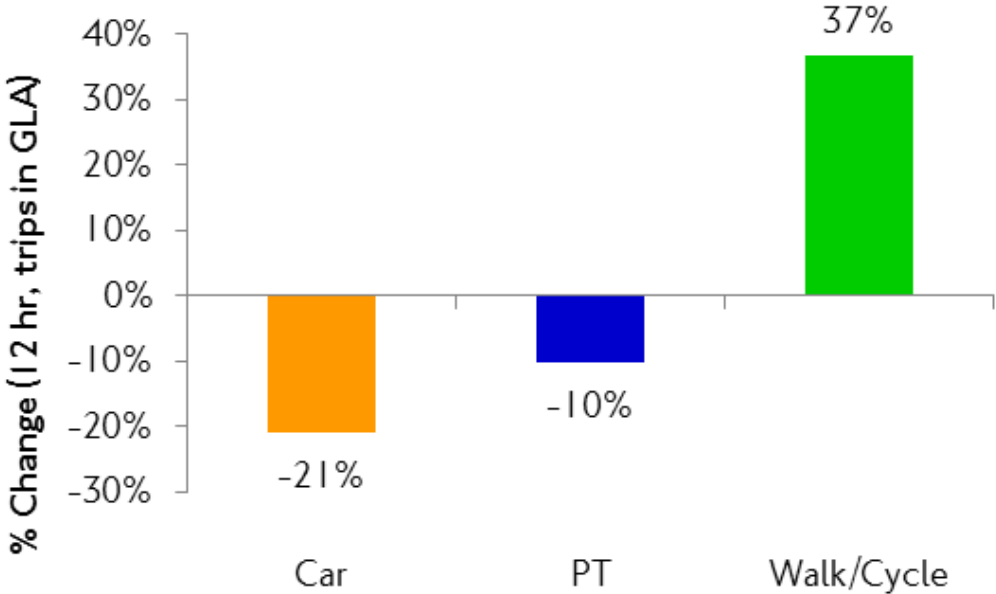


Testing how an increase in cycling could contribute to relieving public transport pressure on central London and what the impact might be on highway congestion.

Key findings:

- A 15% cycle mode share could reduce the number of car trips in London by 1.2 million on an average day.
- This would have the effect of reducing traffic congestion by 13% across London – this reflects the greater space efficiency of cycles compared to cars.
- People would also be expected to switch to cycling from public transport, relieving pressure on the bus and Underground networks in particular.
- There would be some reduction in walk travel, but overall the number of trips made by active modes could increase by nearly 40%.

Change in trips by mode with 15% cycle mode share, 2041 compared to reference case



Measures to deter car ownership alongside better public transport connections can deliver mode shift in growth areas

A significant proportion of future car growth comes from opportunity area developments and four in ten journeys made by London residents start or end in a town centre. This test was designed to understand to what extent traffic growth and congestion could be mitigated by a broad package of interventions discouraging car ownership, reducing parking and increasing public transport connectivity.

To illustrate what could be achieved with radical measures, the following changes were made to model parameters:

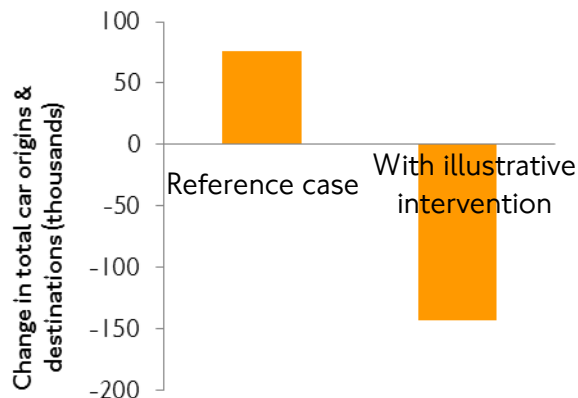
- Public transport was made more appealing and better connected.
- Private car ownership and private non-residential parking was removed in town centres and Opportunity Areas.



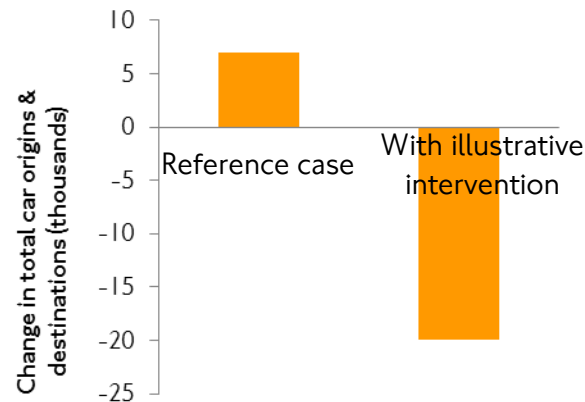
Testing to what extent congestion and traffic growth might be mitigated by reducing car parking and car ownership, and improving public transport accessibility in opportunity areas and town centres.

Low car ownership on its own could deliver a high sustainable mode share, but public transport investment is necessary to provide the connectivity to make these attractive places to live, work and visit.

Change in car trips, Opportunity Areas, 2041



Change in car trips, Town Centres, 2041



Key findings:

- Discouraging car usage and increasing public transport connectivity in Opportunity Areas and town centres produces a significant decrease in car use of 600,000 trips per day.
- Most of the car trips shift to public transport, with some switching to walking and cycling. It is likely that in actuality the reduction in car use and parking would free up considerable road space, and would be accompanied by a programme of Healthy Streets measures which would encourage active travel more than this.
- There is an associated decrease in congestion across Greater London of 9%. The greatest reduction is in inner London at 11%.

Changing the way road use is paid for could deliver mode shift, reduce traffic and cut emissions harmful to health

The purpose of this test was to explore the benefits that changing the way road use is paid for might achieve in terms of mode shift, traffic reduction, congestion relief and environmental benefits.

The aim was also to understand the potential impact on public transport, walking and cycling.

A distance-based charge per kilometre was introduced to the model for inner and outer London.

This test was purely designed as an illustration of the relationships between the scale of charging and the possible impacts, and does not represent a real-world scheme design.

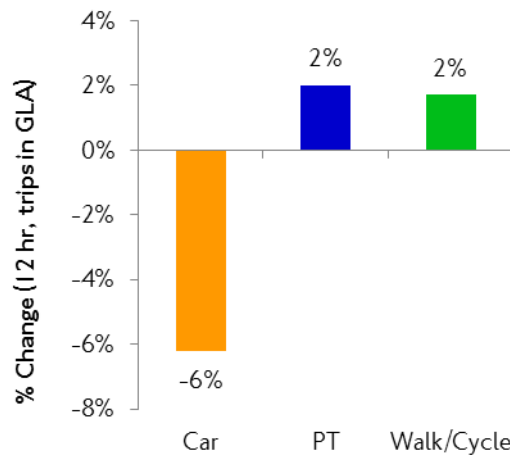


Testing to what extent changing the way road use is paid for might achieve vehicle kilometres reductions, mode shift, crowding relief and environmental benefits.

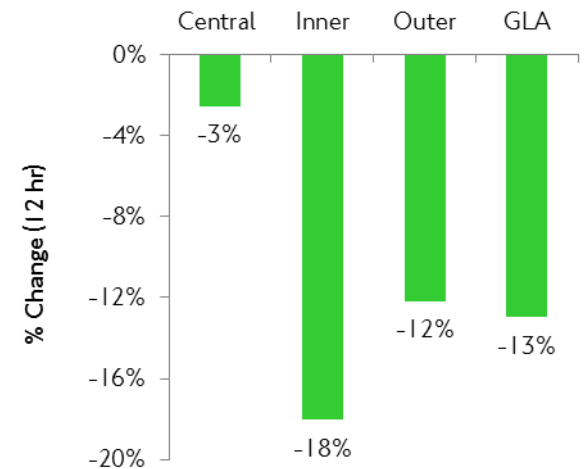
Key findings:

- This test generated mode shift away from car with a reduction of 350,000 car trips per day, which shift equally to walking/cycling and public transport.
- Bus passenger kilometres increase by 6% London-wide.
- There are significant reductions in car kilometres and congestion across inner and outer London, with 5,000,000 fewer car kilometres on the roads overall and a 15% reduction in congestion across inner and outer London.
- There are also vehicle kilometres and congestion benefits in central London.

Change in trips by mode, 2041 compared to reference case



Reduction in congestion, 2041 compared to reference case



If coupled with improvements to the public transport offer and Healthy Streets, the impact of such a scheme would be greater.



If population growth takes place mostly in denser and well connected areas, sustainable travel will be more likely

This illustrative test is designed to understand to what extent integrating housing land use and public transport connectivity can deliver mode shift from car to sustainable modes. This means testing whether encouraging growth in more dense and better connected areas would deliver a higher sustainable mode share than more dispersed growth.

The measures tested were:

- All growth to happen only in areas with a public transport accessibility level of 4 or above, within 1 km of a town centre or with access to greater than 600,000 jobs within 45 minutes and a rail station within 1 km.
- This also results in a reduction in car ownership, as car ownership is related to population density.

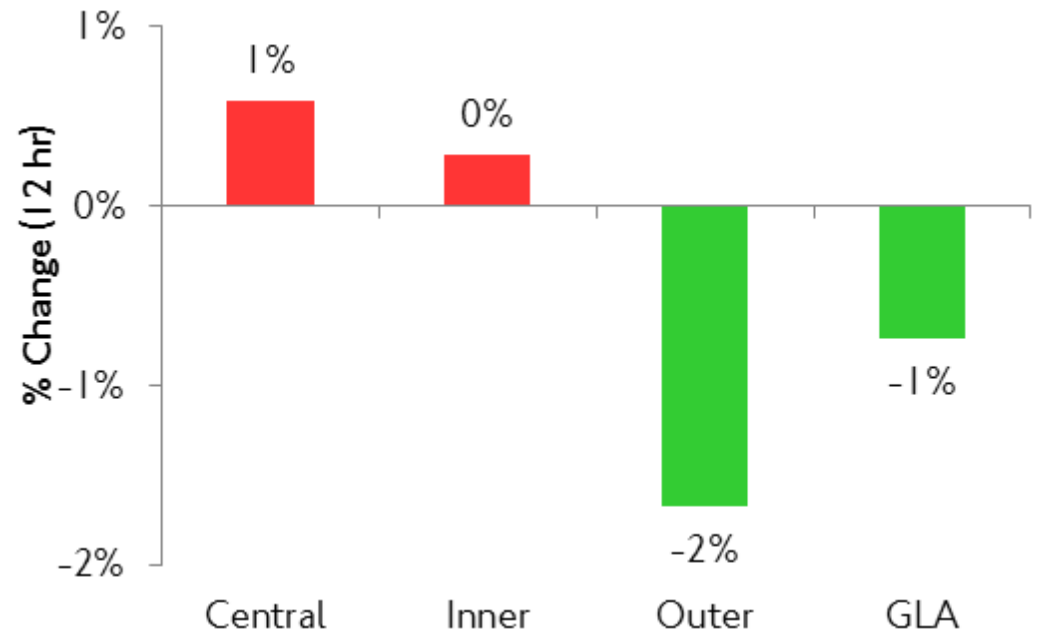


Testing to what extent integrating housing land use and public transport accessibility/access to local services can impact mode share, achieve vehicle kilometres reductions and reduce congestion.

Key findings:

- Focusing population growth in areas with good public transport connectivity reduces car trips by 74,000 trips per day. This is less than might be expected, and reflects the fact that a significant proportion of London's growth is already expected to take place in relatively high density and well connected areas.
- Congestion would marginally increase in central and inner London (by 1%) due to an increase in population growth in these areas, and decreases in outer London by 1 to 2%.
- There is also a small reduction in public transport passenger kilometres as people travel shorter distances.
- Much of future population growth is already planned in areas with good public transport connectivity and this scenario does not have significant impacts on mode shift nor congestion.

Change in congestion as a result of more focused growth, 2041 compared to reference case



Assessing the impact of the draft MTS

Six strategic modelling packages have been defined to determine the schemes and policies deliver the Mayor's vision

Package A. With the funded programme, London could accommodate some growth, but at the expense of traffic growth, congestion, crowding and poor bus performance.

Package B. Bus priority and some limited rail based frequency improvements to the existing network could improve travel experience, but would not tackle traffic levels.

Package C. Upgrades of the remaining Tube lines and other rail services including the London Suburban Metro are needed to tackle crowding on the Tube and maximise the potential of rail in South London.

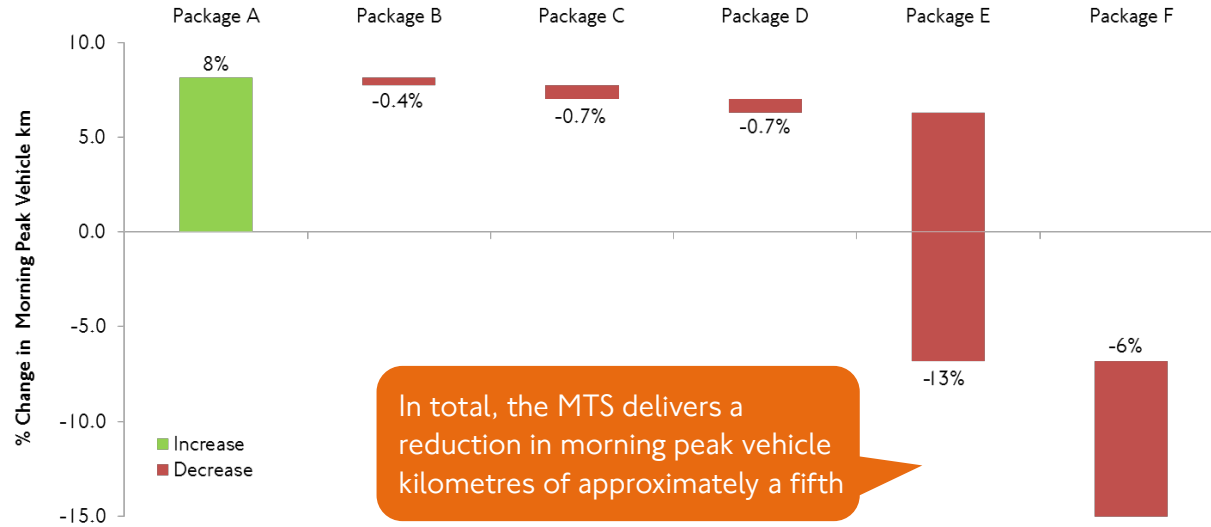
Package D. New rail connections will reduce crowding, unlock development and enable London to accommodate greater growth.

Package E. Traffic reduction measures could free up the space needed to achieve Healthy Streets for Londoners and reduce emissions.

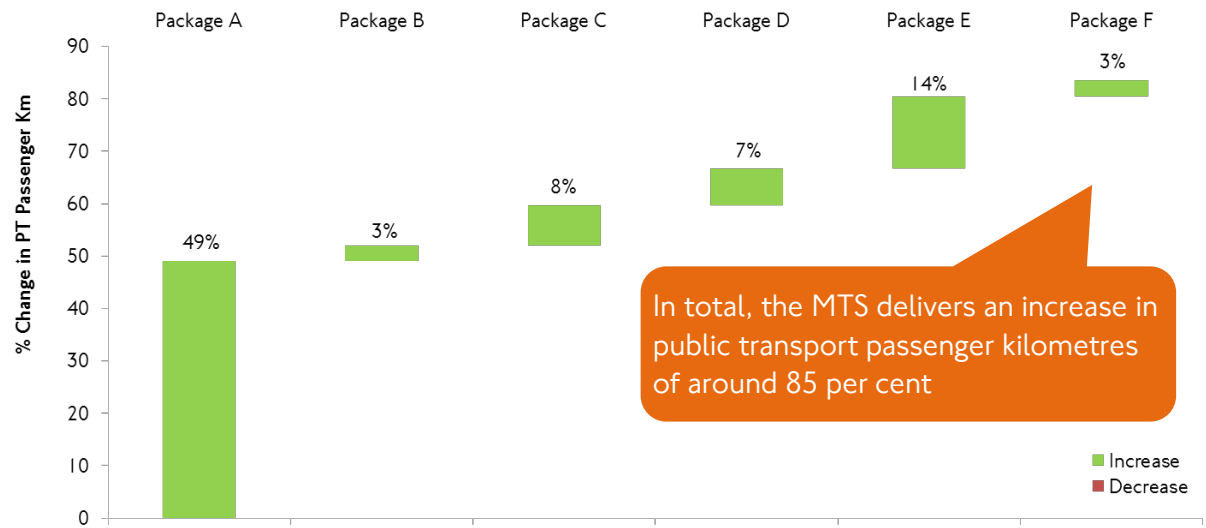
Package F. In the longer term, changing the way road use is paid for could help deliver an 80 per cent sustainable mode share for London.

The MTS scenario includes all of packages A to F

Morning peak vehicle kilometres (general traffic), packages A (Reference Case) to F, 2041



Public transport passenger kilometres, packages A (Reference Case) to F, 2041



Ten outcomes describe how the MTS will deliver the Mayor's aims, transforming the streets and transport network

Ten outcomes have been identified, reflecting the Mayor's aims and the adoption of the Healthy Streets Approach, each incorporating several quantified measures. The outcomes describe how the strategy will mean that 80% of trips are made by a sustainable mode, and how the strategy will deliver Healthy Streets and healthy people, a good public transport experience, and new homes and jobs.

The ten outcomes are presented below and described in turn throughout the remainder of this report. Inevitably, not all aspects of the strategy can be quantified or forecast, and some schemes and proposals are more developed than others at this stage. The MTS outcomes will form the basis of future monitoring and evaluation of the MTS and will be used to guide decision making in TfL and London's boroughs.

1. 80% of journeys will be made by sustainable modes – public transport, walking and cycling – by 2041, compared to 64% today

Healthy Streets and Healthy People

A Good Public Transport Experience

New Homes & Jobs

Active	Safe	Efficient	Green	Connected	Accessible	Quality	Good Growth	Unlocking
2. London's streets will be healthy and more Londoners will travel actively	3. London's transport system will be safe & secure	4. London's streets will be used more efficiently & have less traffic on them	5. London's streets will be clean and green	6. More people will travel on an expanded public transport network	7. Public transport will be affordable and accessible to all	8. Journeys by public transport will be pleasant, fast and reliable	9. Sustainable travel will be the best option in new developments	10. Transport investment will unlock the delivery of new homes & jobs

<p>All Londoners to be doing a healthy level of activity through travel</p> <p>Everyone who is able to should be sufficiently active for health through their regular travel, demonstrated by 70% of people reporting two periods of ten minutes spent walking or cycling on the previous day by 2041</p> <p>Walking or cycling will be the best choice for shorter journeys</p> <p>By 2041 70% of Londoners will live within 400m of the London-wide cycle network, the walking environment will be more appealing so that 3 to 5 million more trips could be made by active modes every day</p>	<p>Aim for there to be no deaths or serious injuries on London's streets</p> <p>A 65% reduction in the number of people killed or seriously injured on London's streets by 2022 (against 2005-09 levels) and a 70% reduction by 2030 (against 2010-14 levels). By 2030, no one will be killed in or by London buses</p> <p>Everyone will be able to feel safe and secure when travelling on the street</p> <p>By 2041, the proportion of people who say that they don't feel safe walking by themselves in their local area – currently one in six people – will fall, and fewer people will say that they are deterred from travelling by safety concerns</p>	<p>Falling car ownership and use</p> <p>By 2041 there will be at least 3 million fewer daily car trips and a quarter of a million fewer cars owned in London</p> <p>Less road freight transport at peak times in central London</p> <p>A 10% reduction in morning peak freight transport in central London by 2026</p> <p>Traffic will fall and congestion kept in check, allowing more efficient operations</p> <p>Falling car use and more efficient freight activity reduces overall traffic levels by 10-15% by 2041. Traffic congestion remains broadly at today's levels during peak periods</p>	<p>London's transport will be on track to be zero emission by 2050</p> <p>By 2041 a 72% reduction in CO2 emissions from transport (excluding aviation, 2013 base), with road and rail transport on a clear trajectory to reach zero carbon by 2050</p> <p>A 94% reduction in road transport NOx emissions by 2041, and compliance with legal limits for NO2 levels on London's streets</p> <p>A 47% reduction in road transport PM2.5 and 36% reduction in road transport PM10 emissions</p> <p>Streets will be greener and not too noisy</p> <p>Transport schemes will deliver a net positive impact on biodiversity. Fewer people will be affected by noise from traffic. The transport system will be more resilient to effects of climate change</p>	<p>Between 14 and 15 million trips will be made by public transport every day</p> <p>By 2041 total travel will increase by around 60% on London's buses and nearly 100% on the tube and rail network (measured by passenger kilometres)</p> <p>The public transport network will offer new connections and more frequent services</p> <p>Total capacity on rail services (London Underground, DLR, tram and national rail) will increase by around 90% with more than 80 million additional seat kilometres</p> <p>The Thames will be used more for passengers and freight</p>	<p>The Mayor has frozen fares to make travel more affordable</p> <p>The Mayor will seek to ensure public transport fare levels enable affordable access to travel for all Londoners, including any devolved rail services in TfL's affordable fares pledge</p> <p>Everyone will be able to travel spontaneously and independently</p> <p>On average, the amount of extra time spent travelling to make a journey on the step-free network compared to the same journey on the full network will reduce by around 60%. Travel time, customer care and the overall accessibility of the network will also be improved</p>	<p>Bus journeys will be quick and reliable – an attractive alternative to the car</p> <p>Bus speeds will improve by 10-15% London-wide by 2041, with particular improvements expected in central and inner London</p> <p>Rail and Tube journeys will be less crowded despite rising passenger volumes</p> <p>By 2041, crowding on rail and underground services will reduce by around 10-20% compared to today, measured in terms of the total crowded distance compared to total distance travelled</p>	<p>Car dependency will be reduced and more people will live in well connected areas</p> <p>Fewer London residents will be dependent on a car to access opportunities and services. About 1 million more people will be living in places with the best transport connections</p> <p>Across London, improved rail and bus services will improve connectivity</p> <p>In total, 7.6m people will live within 45 minutes travel time of central London, 2.3m more than today. The number of jobs accessible to the average Londoner within 45 minutes by PT will increase by 70%</p>	<p>Rail capacity to central London will increase by over 80%, with new public transport services improving connectivity and reducing crowding, enabling the delivery of new homes</p> <p>Crossrail 2 will provide new direct connections through central London, relieving crowding and supporting 200,000 new homes and 200,000 new jobs.</p> <p>The Bakerloo line extension will enable over 25,000 new homes and 5,000 jobs in the Old Kent Road Opportunity Area.</p> <p>An extension of the DLR to Thamesmead could enable up to 17,000 new homes and around 3,000 new jobs</p> <p>Development will also be supported by bus service improvements</p> <p>Transport for London land will, where possible, be brought forward for development</p> <p>By 2020/21, TfL will start on the property development sites that will deliver 10,000 homes</p>
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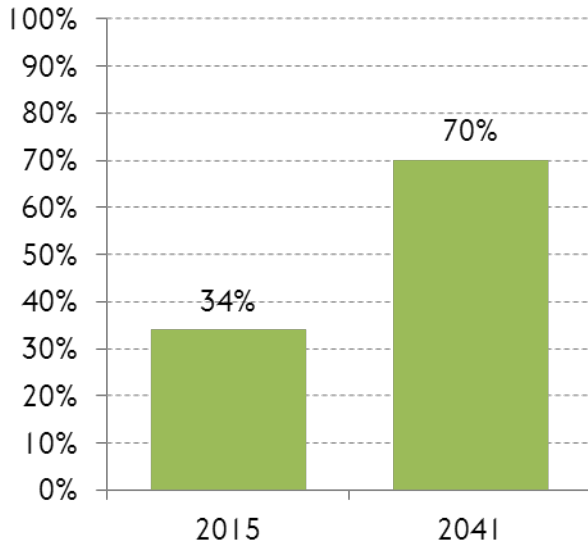
London's streets will be healthy and more Londoners will travel actively

The Mayor's aim is for all Londoners to be doing a healthy level of activity through travel. This means that all Londoners will do at least the 20 minutes of active travel they need to stay healthy each day, including trips walked or cycled all the way and as part of public transport trips.

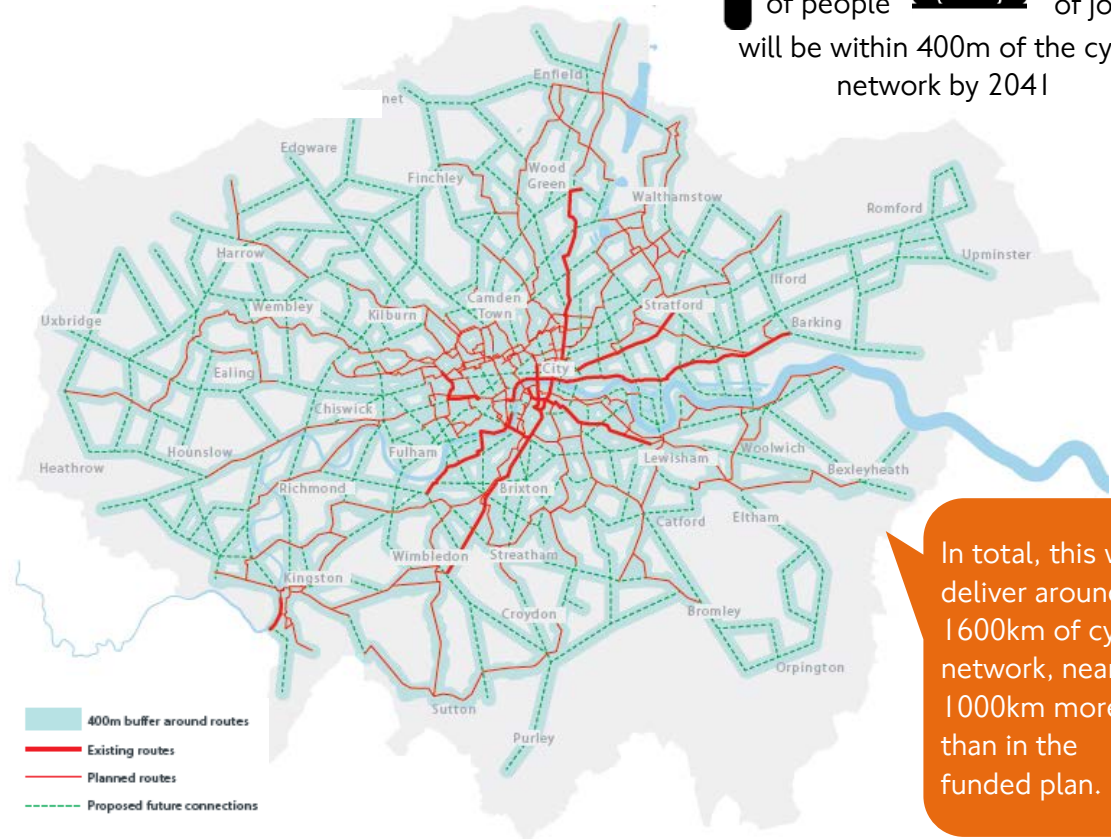
By 2041, walking or cycling will be the best

choice for shorter distance journeys London-wide. To achieve this, by 2041 70% of Londoners will live within 400m of the London-wide cycle network and the walking environment will be made appealing using the Healthy Streets Approach. By 2041, between 3 and 5 million more trips could be made by active modes every day than in 2015.

Proportion of Londoners reporting doing 2 x 10 minutes of active travel on any given day, 2015 and 2041



Current and potential strategic cycle network with a 400m buffer



70% of people
80% of jobs
will be within 400m of the cycle network by 2041

If 70% of Londoners report doing 2 x 10 minutes of active travel on the previous day, then we consider that all Londoners can be assumed to be doing a healthy level of activity through travel.

In total, this will deliver around 1600km of cycle network, nearly 1000km more than in the funded plan.



London's streets will be safe and secure

The MTS will help to ensure **everyone will be able to feel safe and secure when travelling**, with fewer people deterred from travelling because of concerns about their personal security, crime and antisocial behaviour. The proportion of people who say that they don't feel safe walking by themselves in their local area - currently one in six people - will fall.

Measures which give greater focus to high harm offences such as sexual offences and hate crime should result in increases in reported offences in the short to medium term as victims and witnesses are encouraged and supported to report these crimes. Reductions in crime will be delivered in the longer term as the London Transport community Safety Partnership works to eradicate these offences from the public transport network.

The proposals will support the Mayor's vision for a healthier London by delivering improvements in safety and security and reducing key barriers to walking, cycling and using public transport more often.

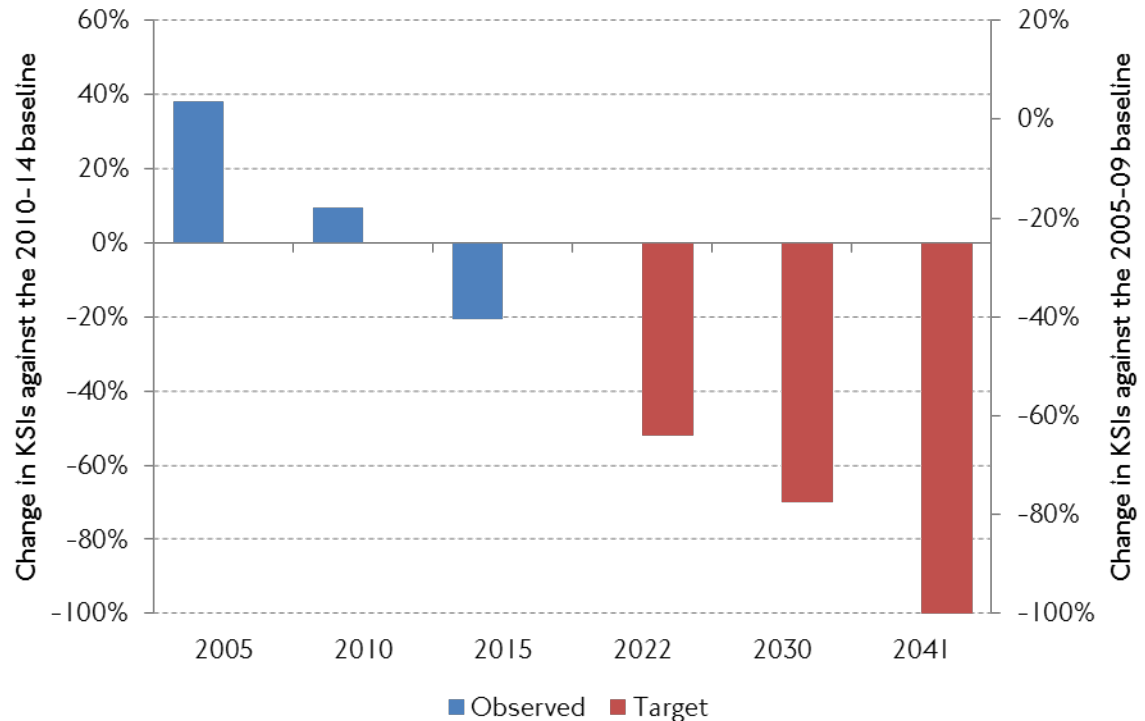
Tackling road danger with the aim for there to be no deaths or serious injuries on London's streets

The Mayor's aim is for there to be no deaths or serious injuries on London's streets. In 2015, 2,092 people were killed or seriously injured (KSIs) on London's streets, 42% below the 2005-09 baseline.

the number of people killed or seriously injured on London's streets by 2022 (against 2005-09 levels) and a 70% reduction by 2030 (against 2010-14 levels), with the goal that by 2041, no one will be killed or seriously injured on London's streets.

The goal set in the MTS is a 65% reduction in

Number of people killed or seriously injured on London's roads, trends and goals for the future, 2005 to 2041



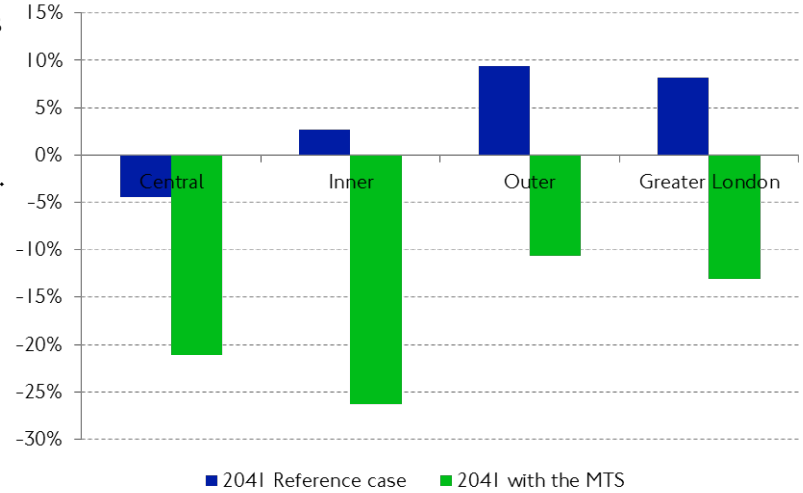
Buses and coaches are disproportionately involved in collisions with pedestrians and cyclists and in the last three years over 200 pedestrians or cyclists were killed or seriously injured in collisions involving buses or coaches. The Mayor's aim is that by 2030, no one will be killed in or by London buses.



London's streets will be used more efficiently & have less traffic

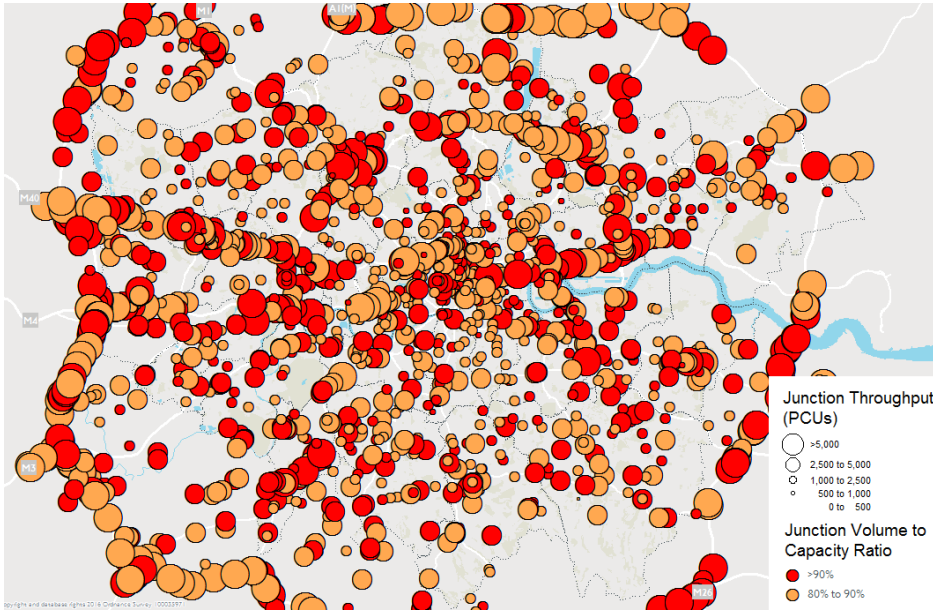
Falling car use and more efficient freight activity resulting from the MTS removes 6 million kilometres of traffic on an average day by 2041 compared to 2015. Traffic congestion remains broadly at today's levels during peak periods. Without the MTS traffic and congestion were expected to rise.

Comparison of the percentage change in vehicle kilometres between 2015 and 2041, with and without the MTS

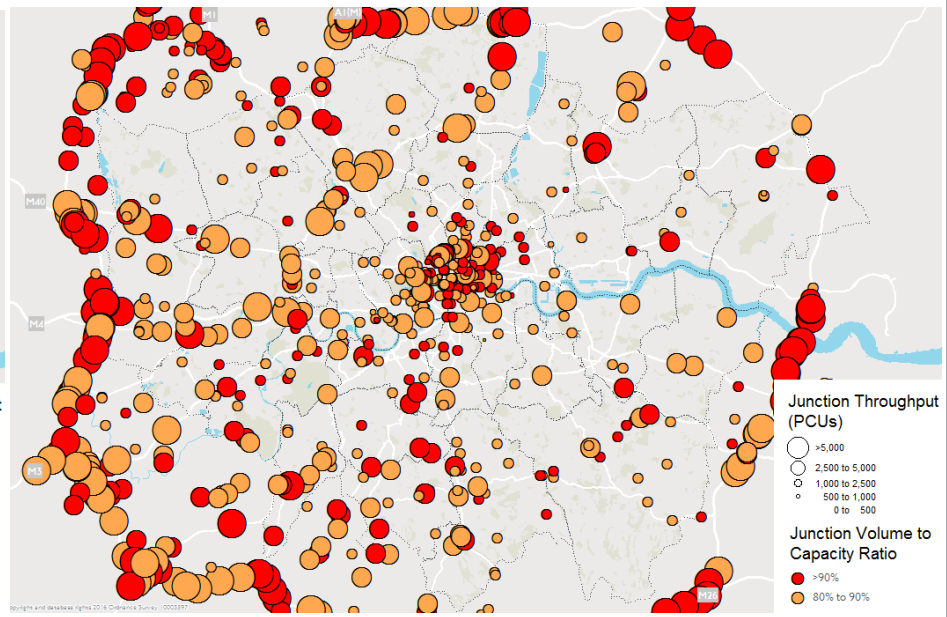


Without the MTS, freight traffic in the central London morning peak was expected to increase by up to 10 per cent in the next ten years; with the MTS, freight traffic is expected to reduce by 10% by 2026 in the central London morning peak.

Comparison of capacity and flow at junctions, 2041, without the MTS



Comparison of capacity and flow at junctions, 2041, with the MTS



London's streets will be clean and green

The Mayor's aims are for all taxis and private hire vehicles to be zero emission capable by 2033, buses to be zero emission by 2037, for all new road vehicles driven in London to be zero emission by 2040, and for London's entire transport system to be zero emission by 2050.

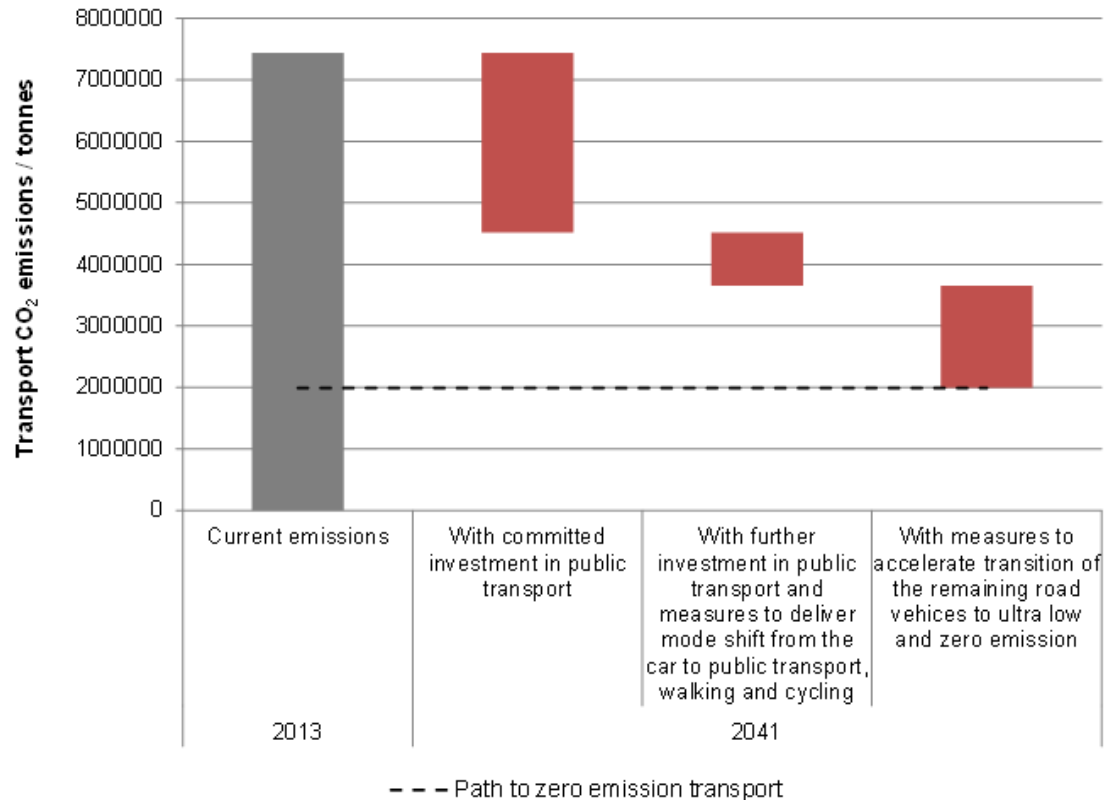
Modelling carried out to assess the proposals contained in the strategy assumes the mode shift and wider transport changes as described

- above, as well as the following assumptions:
- the uptake of ultra-low emission vehicles across all vehicle types is in line with the trajectory required for all road transport to become fully zero emission by 2050; and
- That the carbon intensity of the national grid will reduce in line with Government projections.

This could deliver:

- a 72% reduction in CO₂ emissions from transport (excluding aviation, 2013 base) in London by 2041, with road and rail transport on a clear trajectory to reach zero carbon by 2050;
- a 94% reduction in road transport NO_x emissions by 2041, and compliance with legal limit values for NO₂ levels on London's streets;
- a 47% reduction in road transport PM_{2.5} and 36% reduction in road transport PM₁₀ emissions by 2041; and
- Transport schemes will deliver a net positive impact on biodiversity. Fewer people will be affected by noise from traffic. The transport system will be more resilient to effects of climate change.

Road, rail and shipping CO₂ emissions, 2013 to 2041



More people will travel on an expanded public transport network

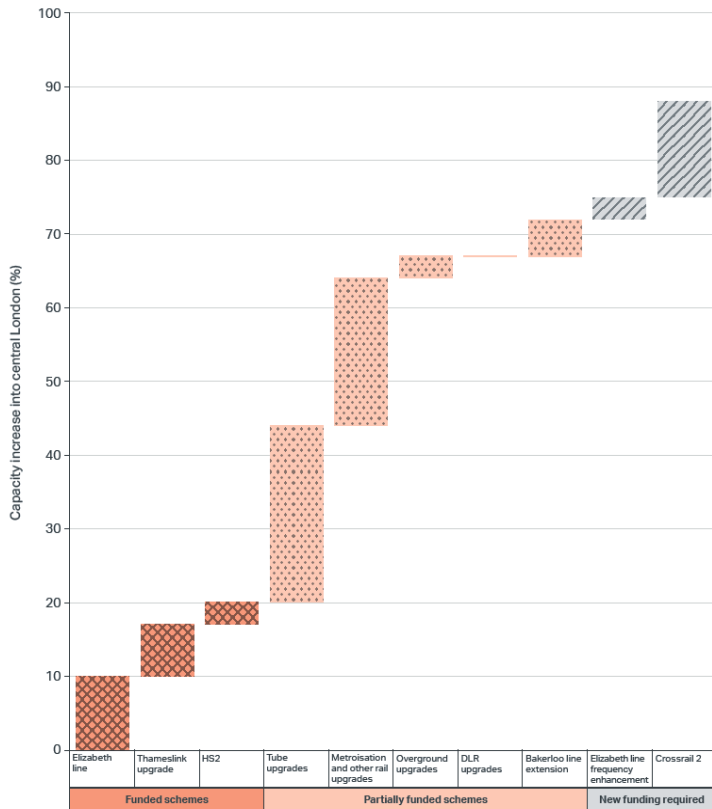
The package of schemes included in the MTS will mean that total capacity on rail services will increase by around 90% between 2015 and 2041, with more than 80 million additional seat kilometres.

On the bus network, capacity would increase in line with population, equivalent to an increase of around 30% between 2015 and 2041 in terms of the kilometres operated.

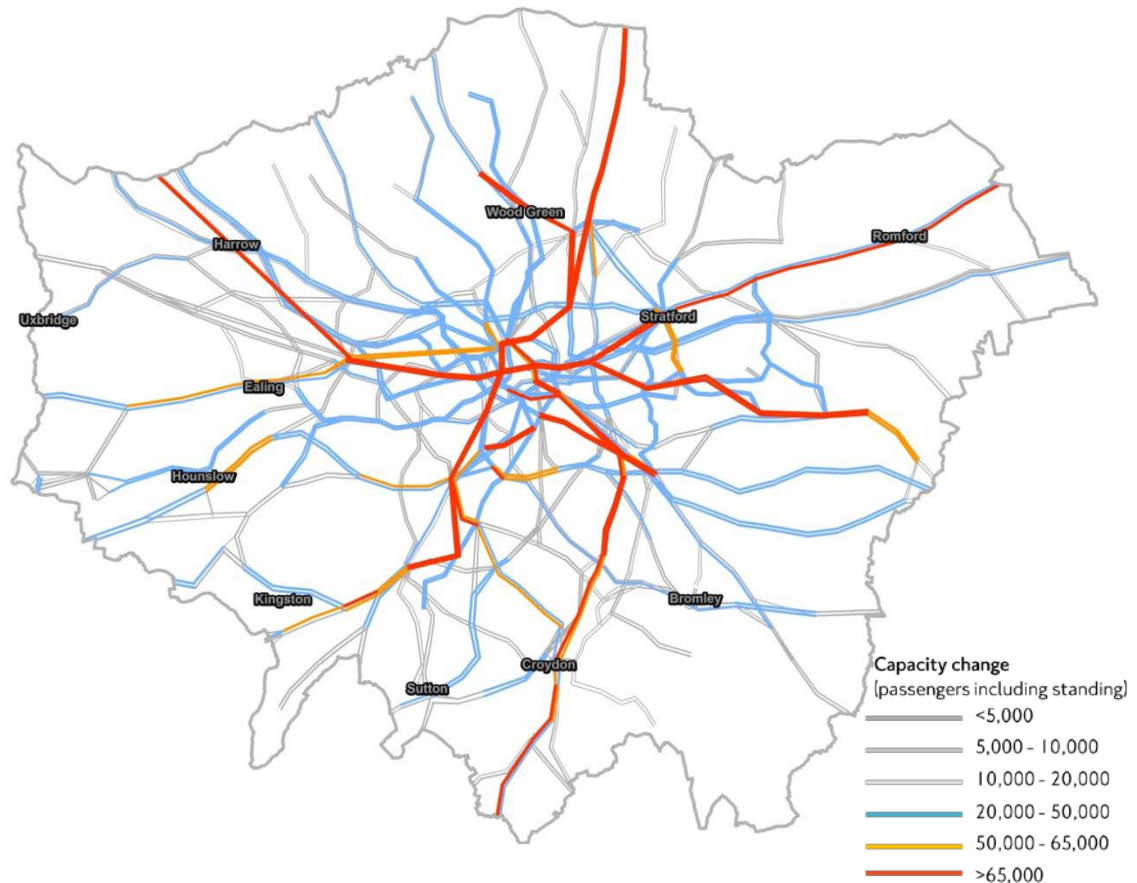
It is anticipated that the measures included in the MTS will result in a near doubling of the total distance travelled on public transport services from 2015 to 2041. By 2041 total travel will increase by around 60% on London's buses and nearly 100% on the tube and rail network.

The Thames will be used more for passengers and freight.

Rail capacity improvements to central London, morning peak, 2015 to 2041, with the MTS



Rail capacity increases, morning peak, 2015 to 2041, with the MTS



Public transport will be affordable and accessible to all

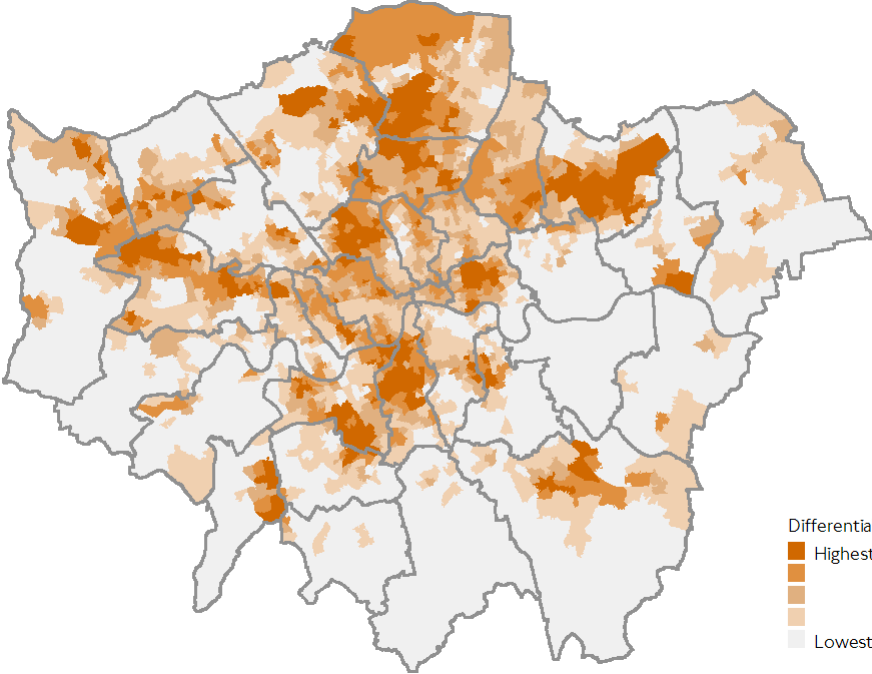
The Mayor will seek to ensure public transport fare levels enable affordable access to travel for all Londoners, including any devolved rail services in TfL's affordable fares pledge, and has frozen fares to make travel more affordable.

On average, the amount of extra time spent travelling to make a journey on the step-free network compared to the same journey on the

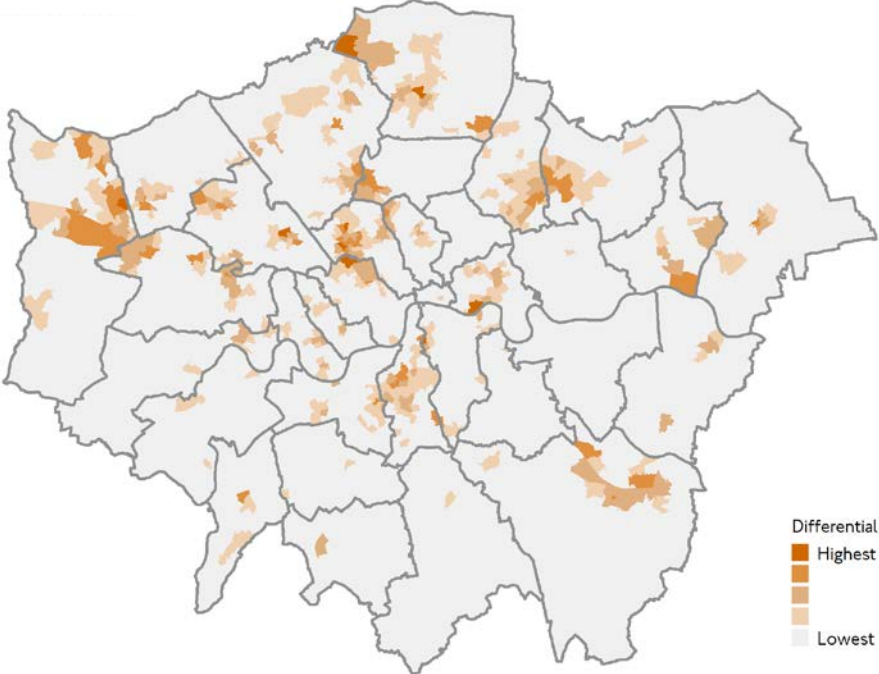
full network will reduce by around 60%. Travel time, customer care and the overall accessibility of the network will also be improved.

The maps below show how the difference in travel time for those needing to use the step-free network will be reduced between 2015 and 2041 with the interventions proposed in the MTS.

Difference in travel time, step free compared to full network, 2015



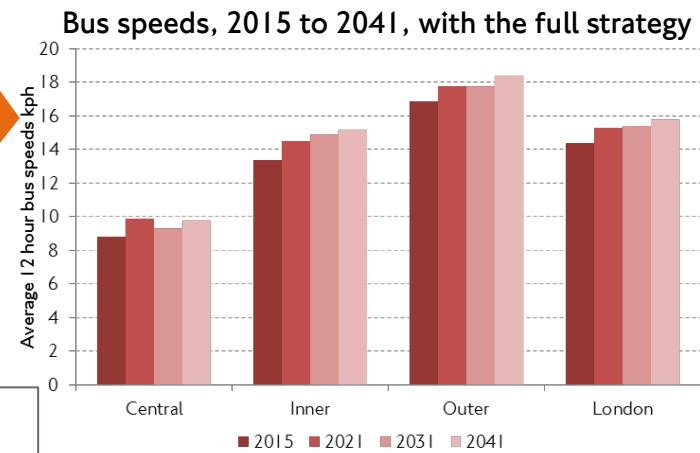
Difference in travel time, step free compared to full network, 2041 with interventions proposed in MTS



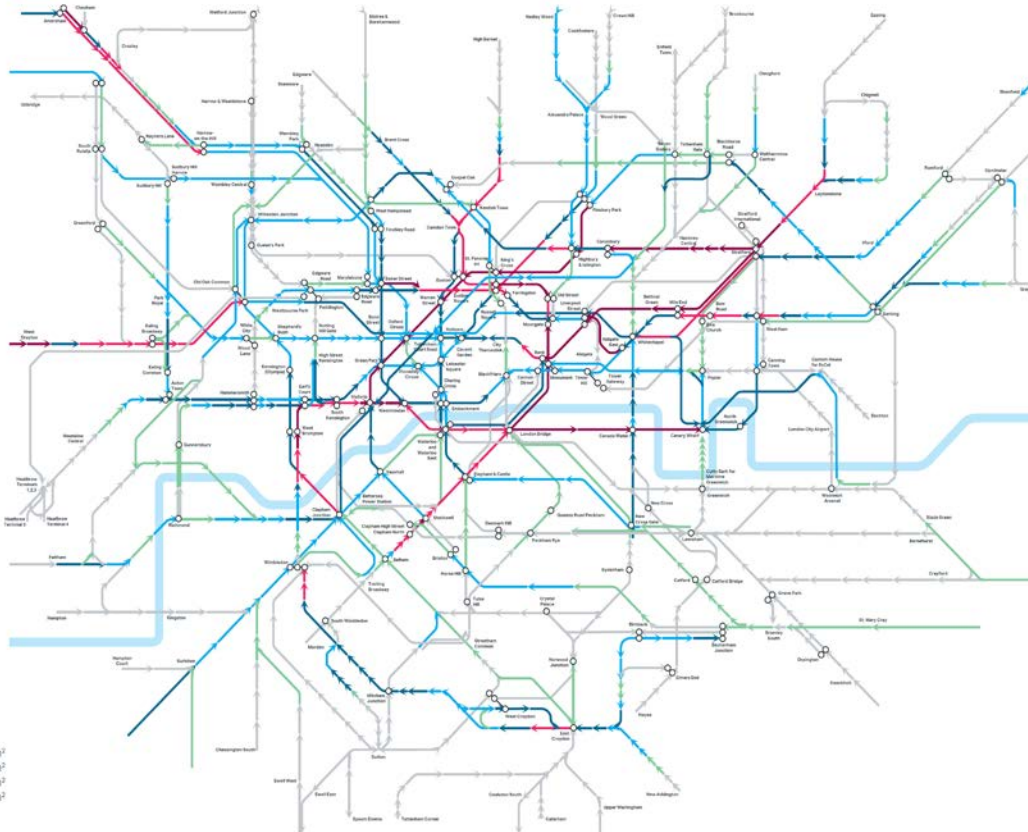
Journeys by public transport will be pleasant, fast and reliable

Bus speeds are expected to improve as a result of an overall increase in traffic speeds as well as the reallocation of road space to buses.

Bus speeds will improve by 10-15 % London-wide by 2041, with particular improvements expected in central and inner London.

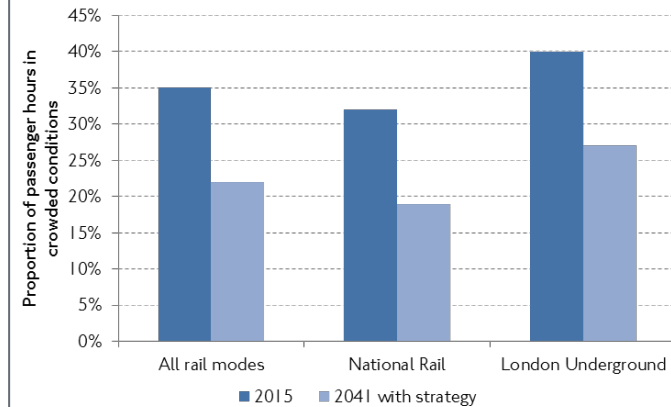


Crowding on the National Rail, Tube, DLR and Tram network, 2041, morning peak, with the MTS



By 2041, crowding on rail and underground services will reduce by around 10-20% compared to today, measured in terms of the total crowded distance compared to the total distance travelled.

Proportion of passenger kilometres on crowded links, morning peak, 2041, with the full strategy



Note: 'crowded conditions' is defined here as 4 or more people standing per square metre



Sustainable travel will be the best option in new developments

New and enhanced public transport connections and improvements to bus speeds will mean that London residents will be better connected to jobs, services and to one another. In total, 7.6m people will live within 45min travel time of central London, 2.3m more than today.

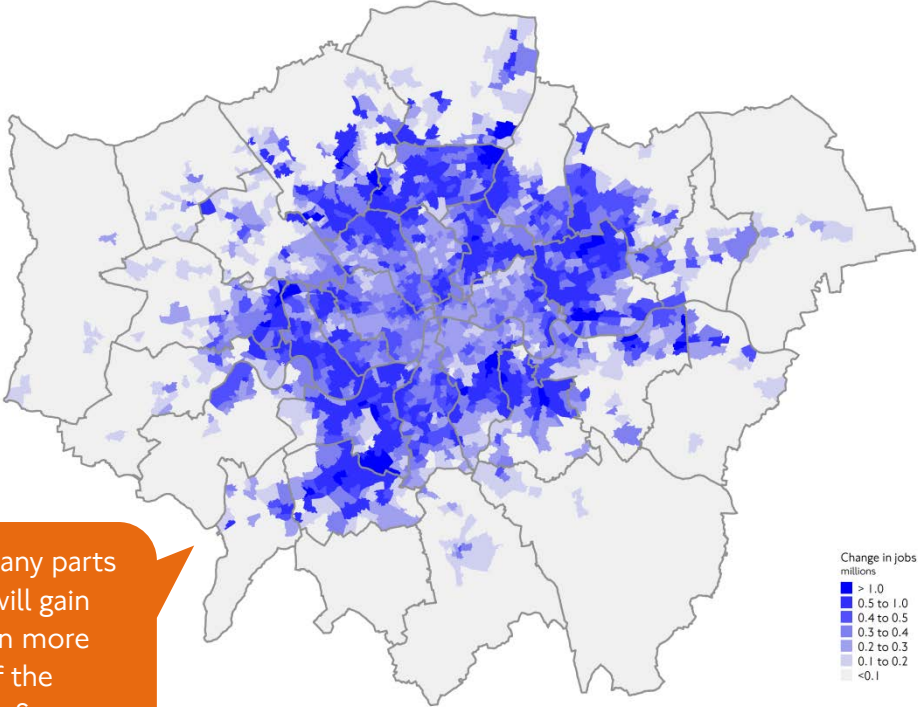
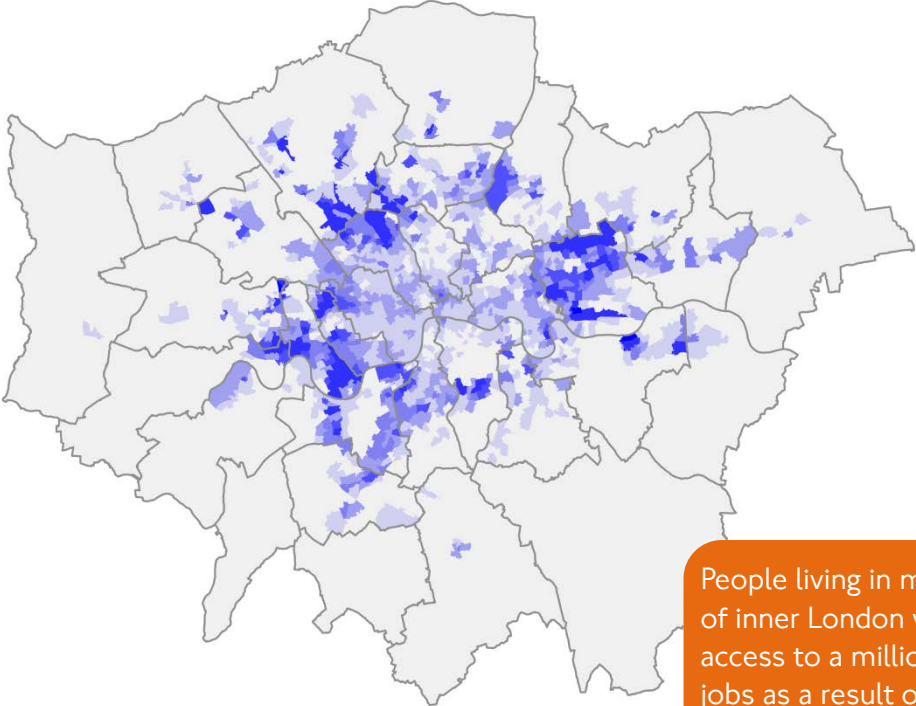
The number of jobs accessible to the average Londoner within 45 minutes by public

transport will increase by 70%.

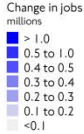
Fewer London residents will be dependent on a car to access opportunities and services. Nearly 1.8m more people will be living in places with the best transport connections, defined as areas with a public transport accessibility rating of four or above.

Increase in jobs reachable within 45 minutes travel time by zone, 2041 compared to 2015, without MTS

Increase in jobs reachable within 45 minutes travel time by zone, 2041 compared to 2015, with MTS



People living in many parts of inner London will gain access to a million more jobs as a result of the Mayor's Transport Strategy.



Note: these maps are designed to show the benefits of improvements to the transport network and therefore do not include projected growth in employment



Transport investment will unlock the delivery of new homes & jobs

Transport investment can support growth in the Central Activities Zone, in and around town centres and Opportunity Areas, with plans expected to deliver higher than average sustainable mode shares in growth areas.

Rail capacity to central London will increase by over 80%, with new public transport services improving connectivity and reducing crowding, enabling the delivery of new homes.

Areas where transport is the enabler of significant change to an area

Crossrail 2 will provide new direct connections through central London, relieving crowding and supporting 200,000 new homes and 200,000 new jobs.

Significant investment in transport infrastructure at the area around Old Oak could act as a catalyst for unlocking development opportunities. There is space to create 25,500 new homes and 65,000 jobs.

TfL's planned extension of the London Overground to Barking Riverside will support the delivery of 11,000 new homes.

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.

An extension of the DLR to Thamesmead could enable up to 17,000 new homes and around 3,000 new jobs

The Bakerloo line extension will enable over 25,000 new homes and 5,000 jobs in the Old Kent Road Opportunity Area.

10,000 homes on transport land

Transport for London land will, where possible, be brought forward for development. By 2020/21, TfL will start on the property development sites that will deliver 10,000 homes.

