Open Agenda

Environment Scrutiny Commission

Monday 20 January 2020
7.00 pm
Ground Floor Meeting Room G02A - 160 Tooley Street, London SE1 2QH

Membership

Councillor Leanne Werner (Chair)
Councillor Graham Neale (Vice-Chair)
Councillor Radha Burgess
Councillor Tom Flynn
Councillor Richard Leeming
Councillor Damian O'Brien
Councillor Michael Situ

Reserves

Councillor Peter Babudu
Councillor Karl Eastham
Councillor Renata Hamvas
Councillor Eleanor Kerslake
Councillor Lorraine Lauder MBE
Councillor Adele Morris

INFORMATION FOR MEMBERS OF THE PUBLIC

Access to information You have the right to request to inspect copies of minutes and reports on this agenda as well as the background documents used in the preparation of these reports.

Babysitting/Carers allowances If you are a resident of the borough and have paid someone to look after your children, an elderly dependant or a dependant with disabilities so that you could attend this meeting, you may claim an allowance from the council. Please collect a claim form at the meeting.

Access The council is committed to making its meetings accessible. Further details on building access, translation, provision of signers etc for this meeting are on the council's web site: www.southwark.gov.uk or please contact the person below.

Contact Julie Timbrell
on 020 7525 0514 or email: julie.timbrell@southwark.gov.uk

Members of the committee are summoned to attend this meeting
Eleanor Kelly
Chief Executive
Date: 10 January 2020

PRINTED ON RECYCLED PAPER

Environment Scrutiny Commission

Monday 20 January 2020
7.00 pm
Ground Floor Meeting Room G02A - 160 Tooley Street, London SE1 2QH

Order of Business

Item No.	Title	Page No.

PART A - OPEN BUSINESS

1. APOLOGIES

1. NOTIFICATION OF ANY ITEMS OF BUSINESS WHICH THE CHAIR DEEMS URGENT

In special circumstances, an item of business may be added to the agenda within five clear working days of the meeting.

3. DISCLOSURE OF INTERESTS AND DISPENSATION

Members to declare any interests and dispensations in respect of any item of business to be considered at this meeting.

4. MINUTES

To approve as a correct record the Minutes of the open section of the meeting on 4 December 2019, to follow.

5. NEW SOUTHWARK PLAN

This item will consider the New Southwark Plan and plans to amend this to deliver the Carbon Reduction Strategy.

6. REGENERATION AND IMPLEMENTING PLANNING POLICY

This item will consider how planning policy is being implemented on Southwark's regeneration schemes in order to reduce emissions and reach zero carbon.

Item No.	Title	Page No.

7. ROAD USER CHARGING 1 - 100

The following report is enclosed for discussion:

GREEN LIGHT: NEXT GENERATION ROAD USER CHARGING FOR A HEALTHIER, MORE LIVEABLE, LONDON

Silviya Barrett, with Martin Wedderburn and Erica Belcher

8. WORK PROGRAMME

The workplan is to follow.

DISCUSSION OF ANY OTHER OPEN ITEM AS NOTIFIED AT THE START OF THE MEETING.

PART B - CLOSED BUSINESS

DISCUSSION OF ANY CLOSED ITEMS AS NOTIFIED AT THE START OF THE MEETING AND ACCEPTED BY THE CHAIR AS URGENT.

Date: 10 January 2020

EXCLUSION OF PRESS AND PUBLIC

The following motion should be moved, seconded and approved if the sub-committee wishes to exclude the press and public to deal with reports revealing exempt information:

"That the public be excluded from the meeting for the following items of business on the grounds that they involve the likely disclosure of exempt information as defined in paragraphs 1-7, Access to Information Procedure rules of the Constitution."

GREEN LIGHT: NEXT GENERATION ROAD USER CHARGING FOR A HEALTHIER, MORE LIVEABLE, LONDON

Silviya Barrett, with Martin Wedderburn and Erica Belcher

GREEN LIGHT: NEXT GENERATION ROAD USER CHARGING FOR A HEALTHIER, MORE LIVEABLE, LONDON

Silviya Barrett, with Martin Wedderburn and Erica Belcher

Published by Centre for London, April 2019

About the authors

Silviya Barrett

Silviya is Research Manager at Centre for London. Silviya heads up Centre for London's Transport and Environment research programme and worked on the 2017 Commission on the Future of London's Roads and Streets. She also leads on the quarterly London Intelligence and has authored reports on affordable housing and young Londoners' aspirations. Prior to joining Centre for London in August 2016, Silviya worked at the London Chamber of Commerce and Industry, where she managed the research and survey programme and authored reports on issues affecting London businesses.

Martin Wedderburn

A Centre for London Associate, Martin is the founder of a small consultancy focussing on sustainable transport planning and pedestrian movement analysis. He works both locally and internationally to develop transport solutions that work at a human scale and to ensure that the full spatial, wider economic, social and environmental impacts of transport are assessed. Current and recent projects in London include work on improved connectivity in Old Oak and Park Royal, the business case for the Rotherhithe-Canary Wharf crossing, and assessing options for public transport to support regeneration in Thamesmead.

Erica Belcher

Erica is Research Assistant at Centre for London. Her research interests include housing, urban transport planning and the voluntary sector. At Centre for London she has co-authored reports on housing and inequality, public space and charitable giving. Prior to joining the Centre, Erica was Research Intern at the New Local Government Network and a workshop volunteer at Cardboard Citizens. Erica holds a BA (Hons) in Arts and Culture from Maastricht University, and an MSc in Comparative Politics from the London School of Economics.

Methods and acknowledgements

This report draws on interviews and workshops with urban mobility experts and stakeholders. Those involved included academics and experts in transport planning and management, design, user experience and smart technology, as well as campaigners and organisations representing different road user groups, including drivers, businesses, freight and logistics, taxi and private hire trade, shared mobility services, cyclists and pedestrians. We also carried out modelling and impact analysis, as well as a survey of international developments.

The authors would like to thank all those who provided expert advice and guidance on this report, especially the members of our Advisory Group: Kristine Beuret OBE (Director, Social Research Associates), Isabel Dedring (Global Transport Leader, Arup) Richard Dilks (Programme Director, Transport, London First), Peter Jones (Professor of Transport and Sustainable Development, University College London), Will Judge (Vice President, Global Enterprise Partnerships, Mastercard), Kate Laing (Programme Manager, Mobility Management, C40 Cities), Nick Lester-Davis (Independent Consultant), Lilli Matson (Director of Transport Strategy, Transport for London), Gunjan Parik (Programme Director, Transportation & Urban Planning, C40 Cities), Benoit Rossi (Global Head of Corporate Communication and Marketing, emovis) and Katharina Winbeck (Head of Transport, Environment and Infrastructure, London Councils).

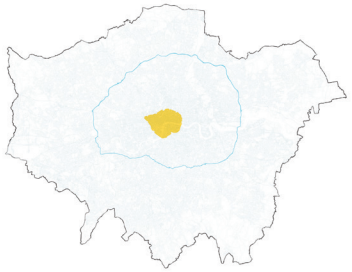
We are particularly grateful to all our interviewees and workshop participants who generously offered their time and expertise to the project. We would also like to thank Richard de Cani, Leon Shrewsbury, Patrick Andison and Victor Lanel at Arup for their contribution to the modelling and impact analysis.

Thanks are also due to the team at Centre for London, especially Ben Rogers for editing the report and helping steer the project. The views in this report are nevertheless solely those of the authors, and all errors and omissions remain our own.

This project would not have been possible without our funders –Van and Eva DuBose, and our major sponsors, Arup, emovis, Mastercard and the C40 Cities Climate Leadership Group – and we would like to thank them for their generous support.

The time has come to bring road user charging into the Digital Age

By 2025 London could have a growing number of charging schemes, each with differing:

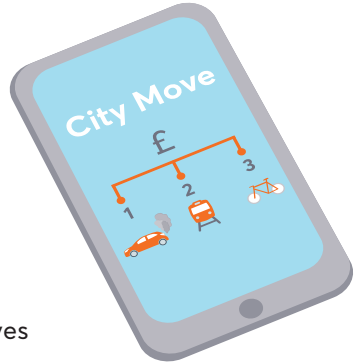


- Vehicle standards
- Hours of operation
- Charge amounts
- Payment arrangements

London should replace existing and planned schemes with a single system, which this report calls *City Move*.

City Move would:

- Charge drivers per mile
- Apply in areas of high demand and poor air quality

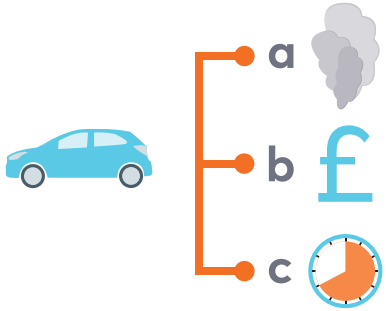


Rates would vary by:

- Vehicle class and emissions
- Local levels of congestion and pollution
- Availability of public transport alternatives

City Move would help people make informed travel choices.

It would be integrated with the rest of the transport system, comparing the costs and impacts of taking the bus, tube, train, car-sharing, taxi hailing, bike hire, cycling, walking, etc.



City Move would bring many benefits:

For users
- Simpler
- Smarter
- Fairer

For the city as a whole
- More efficient
- Healthier
- Greener

The technology exists and the Mayor of London has powers required to implement such a scheme.

Cities around the world are beginning to develop *City Move* type schemes. If London wants to remain at the forefront of transport innovation and to create a better urban environment, it needs to act now.

Summary

London has always been a leader in transport innovation. But with a fast-growing population and economy, the capital now faces a number of road-related transport challenges:

- Congestion has been growing in London, due to the reallocation of road space, population growth and a recent reversal of the longer-term decline in overall vehicle usage.

- Traffic-related air pollution has remained consistently above legal limits, harming the health and wellbeing of all Londoners, particularly children.

- Car dependency has led to a decline in physical activity and social connectivity.

- The number of people killed or seriously injured on London's roads remains high.

- The dominance of cars and other vehicles on London's roads blights the public realm and deters people from enjoying active lifestyles.

- Very little of the driver taxation collected by central government is spent on London's roads, creating an imbalance between the relative financial contributions of drivers and public transport users to overall transportation system costs in London, as well as a poor-quality road network.

- The current charging scheme does not fully compensate for the negative impacts of vehicle usage, which harm the poorest and most vulnerable in society the most.

Well-designed road user charging can help manage the demand for limited road space and reduce overall motor vehicle usage in favour of public transport, walking and cycling. But the way London's road users are currently charged has major drawbacks:

- When it was introduced in 2003, the Congestion Charge (CC) was world-leading and successfully encouraged the more efficient use of road space, but its effectiveness has diminished with the pace of growth in London and changing travel patterns.

- Although desperately needed to address a growing air quality crisis, the Ultra Low Emission Zone (ULEZ) – like the CC – does not reflect the level of vehicle usage; a driver who drives 1 kilometre is charged the same as one who drives 50 kilometres.

- Both the CC and ULEZ can be seen as unfair to people on low incomes.

- A growing number of road user charging regimes have been introduced or are planned for London – each with different vehicle standards, hours of operation, charge amounts and payment arrangements – creating an increasingly complicated system for the capital's drivers to navigate.

New technologies and changing public attitudes now present an opportunity to replace the current patchwork of road user charging schemes with a more sophisticated system that captures the true cost of journeys. The following design principles should form the basis of such a scheme, which the report calls *City Move*:

1. A distance-based scheme, with charges set in advance and varying according to vehicle characteristics, and recently observed local congestion and pollution levels at given times.

2. A single *City Move* London transport platform that allows users to compare, plan and pay for journeys across the full range of modes, proactively suggests alternatives and offers additional services.

3. An account linked to the individual, not the vehicle, enabling a fairer approach to charging, including targeted discounts and options to split the charge between passengers.

4. Charging levels set against specified objectives, with revenue spent on London's roads, public transport and associated environmental and public realm measures.

5. A website and smartphone app for user registration, journey planning and payment, satellite navigation for journey verification and roadside cameras for added enforcement.

6. A level of service or 'delay repay' guarantee, with drivers getting a partial or full refund where a journey takes significantly longer than estimated.

7. A system of Mobility Credits to promote uptake of the app and encourage healthier and greener ways of moving around.

8. A dedicated business account for managing all commercial vehicles, with cheaper pre-booked off-peak delivery slots to encourage retiming and consolidation.

A new smarter and more comprehensive scheme would offer substantial benefits both for the city, and for individual users. For users, the scheme would be:

Simpler

- Replaces a multitude of charges with a single system that is easy to understand and use.

- Tackles both congestion and pollution at the same time.

- Integrates additional driver services.

Smarter

- Reduces vehicle delays and makes journeys more reliable.

- Operates through smart technology that compares alternative journey options, enhancing choice for customers and promoting behaviour change.

Fairer

- Reflects the impact of individual journeys in terms of road surface damage, economic costs and environmental damage.

- Ensures that everyone that contributes to congestion and pollution pays, rather than just those within the narrow boundary of the current schemes.

- Charges less for drivers using cleaner vehicles, travelling in less congested areas or outside peak times, or in areas poorly served by public transport.

- Allows a more targeted and equitable approach to charging.

For all Londoners and the city as a whole, the scheme would be:

More efficient

- Promotes the use of public transport, walking and cycling, as well as car sharing, for more efficient use of space.

- Is able to adapt to different objectives as vehicle technology develops or new policy challenges emerge.

- Ensures that roads are self-financing and frees up funding for public transport and public realm improvements.

Healthier

- Reduces harmful emissions of all the main transport-related air pollutants.
- Improves road safety, particularly for vulnerable road users.
- Encourages people to socialise, exercise and lead active lifestyles.

Greener

- Incentivises a reduction in overall motor vehicle usage, as well as switching to cleaner vehicles.
- Encourages people to choose sustainable modes: public transport, walking and cycling.
- Allows for the creation of better green infrastructure and public realm throughout the city.

Our modelling shows that if drivers on the most congested roads are charged the equivalent of a cup of coffee or a bus ticket, emissions and air pollution could be reduced by up to a fifth. Analysis of the impact of a scheme based on the principles above on different user groups shows there would be no disproportionate disadvantage to any particular group.

This report elaborates the features of a scheme, based on the design principles set out, that can deliver these benefits. To realise these, the report calls on the Mayor of London to:

1. Develop a single, distance-based road user charging scheme to replace all existing schemes by the end of the 2020-2024 Mayoral term.

2. Prepare for implementation by developing a customer platform, upgrading the required GPS and mobile network capacity and conducting a pilot to test the technology.

3. Introduce the user platform across London from the beginning to maximise the number of drivers benefitting from the scheme's smart features and incentives, while gradually extending the charging regime, starting with areas of high demand and poor air quality.

4. Collaborate with other cities across England to introduce elements of the scheme in the implementation of Clean Air Zones, to improve overall air quality and meet health objectives.

5. Work with government to replace existing vehicle and fuel taxes with a national distance-based system, while enabling towns and cities to implement complementary schemes that tackle local congestion and pollution.

Introduction

A Bazalgette moment

Londoners have good reasons to feel proud of their transport system. The capital was the first city in the world to develop an underground railway service and the first to electrify that service. During the years between the World Wars, the newly integrated and fast expanding Underground employed some of the best designers, architects and artists of the day. They set a new standard for 20th century municipal design and communications, with beautiful stations, posters and bold, legible graphics, including the Underground roundel ('the most brilliant and elemental logo since the Christian cross'[1]) and Harry Beck's exceptionally user-friendly Underground map.

The development of London's transportation system shaped the way in which the city grew, helping to integrate areas of jobs and homes through access to high quality and easily accessible public transport. At the same time however, increasing car ownership, coupled with the historic constraints of a road network that evolved over centuries, led to a growing congestion problem.

The last 20 years have marked a new chapter in this history. The establishment in 2000 of Transport for London (TfL) as an agency under the newly established Mayor of London created a powerful and integrated transport system, bringing together most of the city's railways and strategic roads and all of its bus services – to the envy of English and many international cities. London's first Mayor used his new powers to introduce the Congestion Charge (CC) – at the time one of the most ambitious urban road pricing systems in the world. This was coupled with the expansion and improvement of public transport, including a major transformation of the Underground and urban rail network, as well as significant investment in the bus network. The world-beating ticketless, digital payment system (Oyster and later contactless account-based ticketing) was then introduced. And most recently TfL took the unusual step of opening most of its service data to the public, stimulating a host of new digital platforms that help enhance the customer journey.

We might call each of these developments a 'Bazalgette moment' – after Joseph Bazalgette, the great 19th century engineer who created London's modern sewer system, helping to eradicate cholera and other diseases in the process, and built some of those first underground train tunnels. Of course, the Bazalgette moments described above differed from one another. But they all represented a creative response on the part of bold and far-sighted city leaders to the transport, health and environmental challenges of the day, using newly available technologies.

The basic argument of this report is that London needs another Bazalgette moment.

The capital's roads are congested, polluted and dangerous. The Congestion Charge is no longer fit for purpose and the new Ultra Low Emission Zone, while a world-leading and much needed response to London's air quality crisis, is a blunt tool. The digital revolution is already making it easier for Londoners to navigate the capital, call up new transport services and pay for travel. It now provides an opportunity for the Mayor of London and TfL to create a smarter, fairer and healthier transport system – one with a new approach to road user charging at its heart.

Our fundamental recommendation is for London to move to a more sophisticated and comprehensive distance-based road user charging scheme, closely integrated with the rest of the capital's transport system.

The aim would be to replace the various charges currently spreading across the city with a single scheme that reflects all impacts of a journey. TfL's ambition should be to create a multi-modal platform worthy of Harry Beck's Underground map design: up-to-the-minute, beautiful and easy to use.

The scheme, which would apply to all motor vehicles every day and at all times, could be extended gradually, with charges first applied only to the most congested and polluted areas of the city. In return for any charge

incurred, drivers would benefit from improved traffic flow and journey time reliability, enabling TfL to offer a guaranteed level of service and potentially refunds for excessive journey delay – on the same model as 'delay repay' for trains. All funds raised would go back into maintaining and investing in London's roads and streets, public realm and public transport.

We believe, in short, that the approach we set out would be better for the driver – simpler, smarter, fairer – and better for the city – healthier, greener, and more efficient.

This report sets out the case for such a scheme, highlighting the impacts of congestion, the shortcomings of current responses, the parameters of a potential next generation scheme, and a plan for developing and implementing this in the next mayoral term.

Guiding principles

A number of principles have guided our proposals.

1. We recognise that urban transport is all about trade-offs. The space available for London's roads and streets is finite. Yet, they have to accommodate a variety of constantly changing demands. They enable people and goods to move around the city but also provide places to socialise, play, exercise and trade. The pressures on London's roads, moreover, are growing as the city's population and economic activity grow. Cars, vans, HGVs, buses, bikes and pedestrians are increasingly jostling for space. If London is going to remain a successful and liveable city, then we need to find the best ways of managing these conflicting demands. We need in particular to do everything we can to promote forms of transport that are less space-hungry, such as walking, cycling, buses and trains, and make sure that private and commercial vehicles are used as efficiently as possible and are as clean as possible.

2. Our approach has been highly pragmatic. We recognise that any new scheme will have to

operate within a number of real-world constraints. To begin with, we need to acknowledge that central government sets much of the policy that governs London's roads and streets. Vehicle Excise Duty (VED) and Fuel Duty are collected and spent nationally – with relatively little of London drivers' contribution going back into London's roads. There are strong arguments for moving to a national system of road user charging and for ensuring more of the charges paid by London's drivers are directed towards tackling its transport and environmental challenges. But central government seems very unlikely to change direction soon, so any new approaches by the Mayor and TfL will have to work within existing national policy.

3. We recognise the constraints imposed by public attitudes and the circumstances of London's residents and businesses. In fact, attitudes among Londoners are changing. More of us are concerned about air pollution and road safety. Fewer of us own cars and those that do are driving less. Developers report that both residents and workers are placing greater value on local quality of place; they want wider pavements and more green leisure spaces. Many of us are using smartphone apps to find our way around the city, make transport choices and pay for them, and we have become used to the principles of congestion and pollution charges and 'surge pricing'. As we will set out, a more integrated, up-to-date system of road user charging could have real appeal.

4. We also understand that living in London can be tough. Contrary to the view that London is a rich city favoured by national government, living standards have declined and household budgets are tight. Many London residents depend on their car to get by, especially in parts of outer London which are poorly served by public transport. Many businesses rely on vehicles to move people and goods around the capital. Against that background, we have

sought to develop proposals that can tackle London's most critical problems, without imposing excessive burdens on those that need their cars to get by. As far as possible we have tried to ensure any extra costs imposed on individual users are matched by extra benefits – for example, more predictable and less polluted journeys, a more liveable local environment or improved transport alternatives in the form of better public transport and 'new mobility services'.

1. System overload

As argued in the introduction, London has a proud history of transport innovation, and there is still much to be proud of today. The level of investment in recent years has been impressive. In the 20 years from the creation of TfL to the opening of Crossrail, the capacity of London's tube and rail system will have doubled.[2] This, alongside investment in new and improved cycle facilities and a dense bus network, has resulted in a sustained shift of travel behaviour away from private cars to public transport, and to some extent cycling.

But roads and streets still provide for 80 per cent of all journeys in the capital.[3] With London's population and economy growing fast, its roads, built environment and public services are under increasing pressure. We now face some big and fast-evolving transport and related environmental challenges.

Congestion

Londoners' transport habits have been changing, and we are travelling less for both work and leisure.[4] Technological innovation has enabled more remote and flexible working, while online retail and entertainment enable goods to be delivered to people's doorsteps. This has contributed to a decline in private car usage,[5] and in car ownership,[6] and a lower uptake of driving licences, especially among the young.[7]

However the move towards an 'on demand' economy, and the rise of new apps enabling mobile services, have translated into an increased usage of delivery vans, other light goods vehicles (LGVs), and taxis and private hire vehicles (PHVs). Total vehicle kilometres by LGVs increased by 33 per cent between 2000 and 2017.[8] Between 2013 and 2017, the number of licensed black taxis increased by just four per cent, while the number of licensed PHVs increased by 75 per cent.[9]

As a result, although the mix of vehicles on the roads has changed, overall demand has grown. Despite a longer-term downward trend, over the last few years total vehicle kilometres across Greater London have increased slightly, with a more pronounced rise in outer London.[10]

This reversal of the previous reduction in vehicle usage, combined with the proactive reallocation of road space to bus and cycle lanes, has led to growing congestion. Although not a perfect measure of congestion, average vehicle delay is the most commonly used. On that measure, London now ranks as the sixth most congested city in the world and the most congested in Western Europe.[11] The problem is particularly pronounced in central London, where average vehicle delays have increased by 46 per cent in the 10 years to 2016.[12] However, as Figure 1 illustrates, the issue now spreads far wider than central London, particularly at peak times.

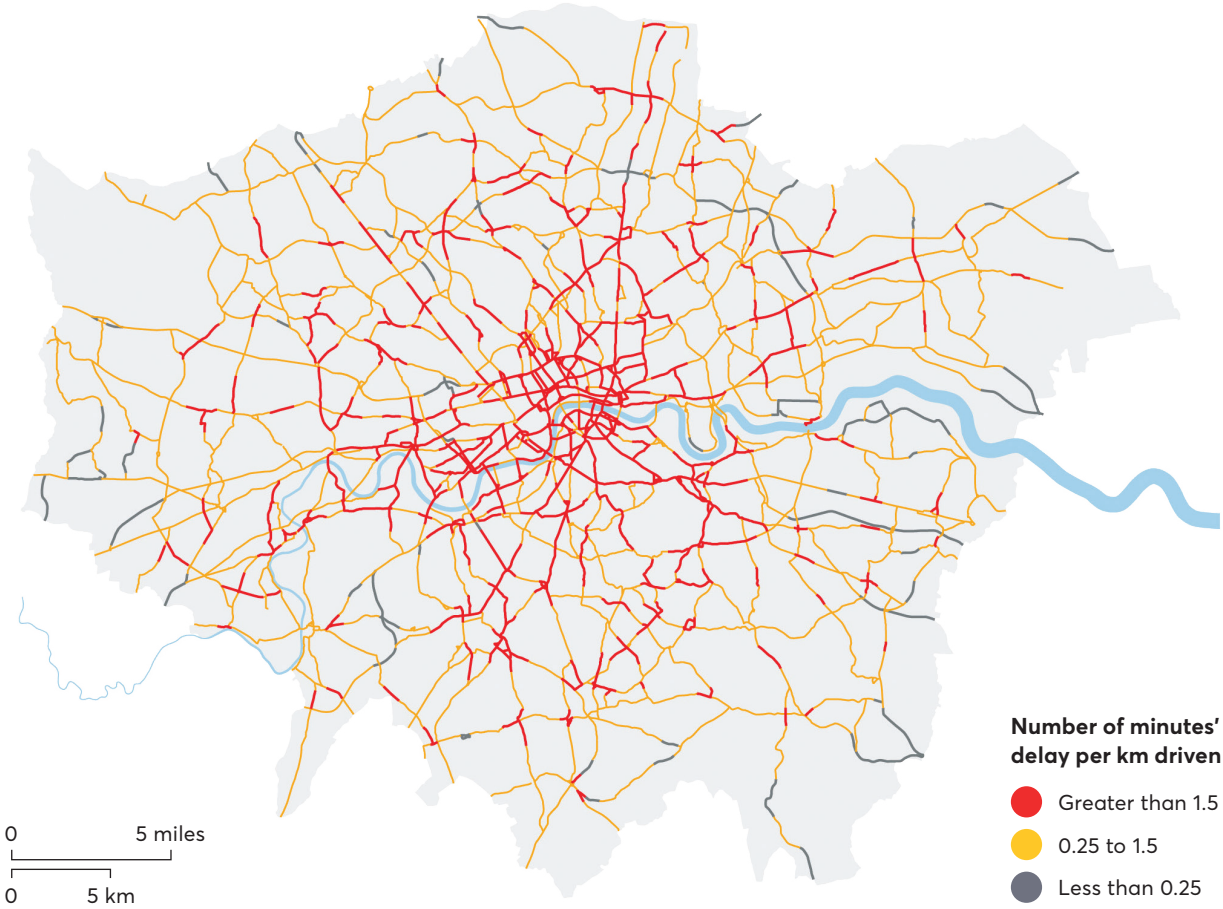
Congestion has a big impact on individual London residents, commuters, visitors, businesses and public services. It also affects London's overall productivity levels, economic competitiveness and reputation as a global city to do business in. London's drivers lost 277 hours to traffic jams in 2018, costing £4.9 billion in direct and indirect costs or £1,680 per driver.[13]

Congestion also impacts public transport users. Bus speeds in London have been declining faster than anywhere else in the UK, and this has a direct link to usage.[14] Indeed, London bus passenger numbers have declined by six per cent over the last three years – and as much as 15 per cent in some areas.[15] Yet, buses are among the most efficient forms of travel, especially at peak times. 4.5 times more people can be transported per hour by an average occupancy bus in the same area of road space, than by car.[16]

Pollution

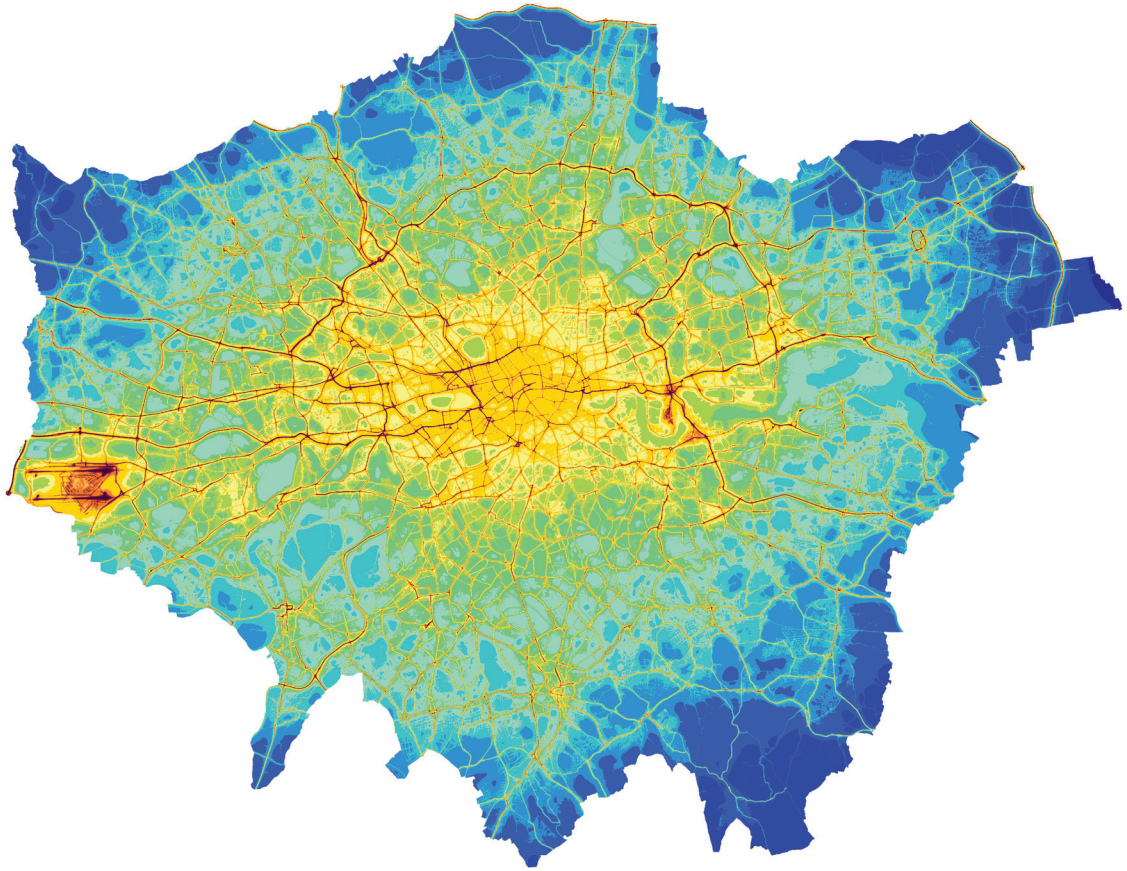
Road transport is a major contributor to carbon dioxide emissions and various pollutants that impact on local air quality. Approximately half of nitrogen dioxide (NO_2) and particulate matter (PM) air pollution in London is estimated to stem from road transport.[17] Electric vehicles offer an opportunity to improve air quality, but even these produce harmful emissions from brake, tyre and road wear: non-exhaust processes contribute approximately half of coarser PM10 and a quarter of finer PM2.5 road traffic emissions.[18] Manufacturing

Figure 1: Vehicle delay (minutes per km), weekday average, 2014-15



Source: Mayor of London (2018) Mayor's Transport Strategy

Figure 2: Annual mean NO_x concentrations, projection to 2020



Source: London Atmospheric Emissions Inventory 2013

cars, and in particular batteries, also has a significant environmental impact. The best way of improving air quality is to reduce overall vehicle usage.

There are now well established links between air pollution and a range of serious lung, heart, circulatory and other conditions.[19] These pollutants seem to be particularly harmful to children, older people and those with pre-existing lung and heart conditions.[20] Yet, London consistently breaches binding international pollution limits.[21] Contrary to popular belief, it is not only central London that suffers from high pollution levels, but other areas close to busy roads and centres of economic activity (see Figure 2).

In London, air pollution is responsible for 141,000 life years lost annually, as well as over 3,400 hospital admissions, and costs the economy an estimated £3.7 billion a year.[22] Little wonder that Public Health England recently called on London and other cities to take radical action – including introducing road user charges – to reduce the overall number of vehicles on the roads and incentivise a shift away from polluting vehicles.[23] While concern about air pollution among Londoners has grown, as more evidence of its impact on health has emerged, misconceptions about relative exposure persist. Nearly half (49 per cent) of Londoners believe they are least exposed to poor air quality whilst in a car;[24] yet, studies have shown that car drivers and passengers have the greatest exposure on more congested routes as they spend longer in slow moving traffic.[25]

Inactivity

As well as being a highly harmful source of air pollution, London's vehicles pose other less direct public health challenges. There are now well-established links between physical activity, health and wellbeing. Inactivity has played a big role in the rise of obesity, diabetes, heart disease, depression, dementia and other diseases. Physical inactivity is estimated to cost the UK as much as £1.2 billion a year and is the fourth most important risk factor for premature death.[26]

Yet, widespread car use and the domination of London's roads and streets by cars and other vehicles have contributed to a decline in physical activity such as walking and cycling, and, to some extent, social connectivity. Car owners in London are half as likely to undertake the government's recommended 30 minutes of activity a day than those who do not own cars.[27] Currently only an average of 16 per cent of travel time in London is spent walking or cycling.[28] Yet, nearly half of car trips made by London's residents could be cycled in around 10 minutes and more than a third of them could be walked in under 25 minutes.[29] It is estimated that recent public realm improvements to support active lifestyles in Walthamstow alone are delivering an increase in life expectancy of between seven and nine months.[30] Providing alternatives to car dependent lifestyles would help address some of the broader health needs of the population.

Road Safety

While London's roads have got safer, 3,750 people were seriously injured and 131 people killed in collisions on our roads in 2017, with vulnerable road users (pedestrians, cyclists and motorcyclists) comprising the vast majority of casualties.[31] This is a level of harm that would never be tolerated in other areas of life. The Mayor of London has also introduced a Vision Zero action plan with the goal of eliminating all deaths and serious injuries from London's transport network by 2041. Reducing traffic levels and speeds, widening pavements and creating safer routes for pedestrians and cyclists are all essential to meeting this goal.

Public realm

Roads and streets are not just conduits of movement but also places where people play, exercise, socialise, relax and trade. As the city grows and density increases, the availability of public outdoor space becomes increasingly important for liveability. It is sometimes argued that businesses oppose moves to curtail car use and tame

traffic, but London's leading developers invest heavily in creating an attractive, car-free or car-light public realm, because they understand that this is what businesses, shoppers and residents want.

However, London consistently ranks badly when it comes to the quality of its roads, streets and public realm. Low scores in these areas, as well as persistent congestion and pollution, were the main factors contributing to London's 41st place in Mercer's 2018 Global Quality of Living Ranking.[32] Cars take up a disproportionate amount of space not only on roads but also at the kerbside and in driveways, as the average car is parked and not in use at least 95 per cent of the time.[33] With fewer cars on the road, this space could be used for wider pavements, additional cycle lanes, green space or other public realm improvements.

Fair funding

The final issues facing London's transport system are those of funding and fairness. The way that roads are funded in London is complicated and in several respects curious, if not plain unfair.

All London drivers, like drivers throughout the country, are charged Vehicle Excise Duty (VED) and Fuel Duty, which are collected and spent nationally. While Fuel Duty goes towards general taxation, VED is now hypothecated to roads spending through the National Roads Fund. However, transport is an area devolved to the Mayor of London, so the capital does not receive a proportion of the National Roads Fund, as other regions do. Central government only takes responsibility for the motorways, which comprise 0.4 per cent of the total length of London's roads, so little of what the capital's drivers pay in vehicle taxation is spent on the capital's roads.

In London, there is also an imbalance between the relative financial contributions of drivers and some public transport users to the overall transportation system costs in London. Despite the current Mayor's policy to freeze bus and most tube and rail single journey fares, the price of daily and weekly caps and travelcards has

consistently increased, affecting regular commuters.[34] By comparison, the cost of driving in the UK has decreased, in part because Fuel Duty has been frozen since 2010. The Underground is the only TfL service that makes an operating surplus, which then goes to support other parts of the transport system. These include London's roads and streets, as the Congestion Charge, the only direct income in this area, is not sufficient to cover road maintenance and investment.[35]

However, TfL's budget has come under increasing pressure, from cuts to government grants, falling fare revenues (due to declining usage) and the delay in opening Crossrail.[36] And while TfL is responsible for the strategic road network in London, the remaining dense network of local roads is managed by local authorities, whose budgets have also declined. Although the boroughs receive some transport and environment funding from central government and TfL, their ability to raise transport related-funding themselves is largely limited to parking charges. Their core funding will have been reduced by 63 per cent in real terms over the decade to 2020.[37]

All this means that London's roads are not self-financing and sustained underinvestment has led to a poor quality network. Potholes, dangerous junctions and narrow pavements threaten the safety of drivers, pedestrians and cyclists alike.[38] It has been estimated that simply clearing the backlog of underinvestment on London's roads would take nine years and cost £466 million.[39]

Social equity

The issue of fairness extends beyond financial imbalances. It can be argued that drivers do not pay fair compensation for the wider negative impacts they cause on society as a whole, in terms of the economic cost of congestion and the health costs of pollution. Furthermore, these negative impacts harm the poorest and most vulnerable in society the most. People living in the capital's most deprived areas are, on average, exposed to about a quarter more NO_2 pollution than

those living in the wealthiest areas,[40] and nearly a quarter of London schoolchildren are exposed to illegal levels of air pollution.[41] Poorer people are also more likely to be exposed to road danger,[42] and to live and work in places with poor quality public realm and transport connectivity.[43] Yet, those groups contribute to the problem the least: middle income households have the highest car ownership, while low income households rely especially on buses.[44] Therefore, disadvantaged Londoners would benefit most from improved air quality and road safety, more reliable bus journeys and investment in public transport and healthier streets.

2.
The current system

Economists and environmentalists have long made the case for the principle of charging drivers for the use of roads, with prices varying according to the full range of costs that vehicles impose on others. The problem with road user charging up to now has been that it is hard to invent a system that works in practice. Digital technology, however, is changing all of that. All new vehicles have in-built GPS devices. Most drivers also have smartphones that can track their movements and allow simple payment options. Establishing a sophisticated system of road user charging suddenly looks practicable.

By comparison with some of the technologies we use to pay for planes, trains and ride-hailing services for example, the way London's road users are currently charged looks very crude. As already described, London's drivers pay taxes or charges both to national government, through VED and Fuel Duty, and to London government through a variety of schemes across the city.

National taxation and charges

– **Vehicle Excise Duty** is an annual vehicle tax. The first-year amount is based on the vehicle's emissions class. Thereafter, owners pay a flat annual rate, though there is a discount for hybrids and fully electric vehicles are exempt.

– **Fuel Duty** is included in the price paid for petrol and diesel, but not electricity. So the more a driver travels, the more Fuel Duty is paid, which encourages the use of fuel-efficient vehicles, but it does not reflect a vehicle's contribution to congestion or other externalities.

– Central government also charges both UK- and foreign-registered lorries of 12 tonnes or more the **HGV Road User Levy**, to compensate for their greater contribution to the wear and tear of the road network. The levy amount varies according to the vehicle's weight and emission class, and operators can pay one-off charges or through a registered account.[45]

– **The Dart Charge** for using the Dartford Crossing is also operated by central government. The charge varies by vehicle class (currently £2 per crossing for smaller vehicles with an account) and can be paid at retail outlets or via a phone account.[46]

London schemes

Ever since the Greater London Authority Act 1999 and the Transport Act 2000, London and other English cities have had the power to establish road user charging schemes. Cities are not required to hold local referenda or to obtain approval from the Secretary of State before introducing a charging scheme.[47]

The Congestion Charge

London is the only large city to have used these powers, with the establishment of the Congestion Charge (CC) in 2003.[48] At the time, it was the world's most geographically extensive levy on vehicles entering a city centre.[49] It charges all petrol and diesel vehicles entering central London on weekdays between 7am and 6pm a set daily fee (currently £11.50). While the charge has recently been extended to PHVs, exemptions remain for black taxis, electric vehicles, motorbikes, the emergency services and vehicles used by disabled people. Residents within the zone, disabled blue badge holders and cleaner vehicles are eligible for a discount.

At the time of its launch, the Congestion Charge was ambitious and technologically advanced. It was initially successful, with a 30 per cent reduction in congestion and 15 per cent less circulating traffic.[50] The scheme has also been credited with a significant fall in pollution levels in the year post-introduction and has allowed for the expansion of pavements and bike and bus lanes.[51] This in turn has added to overall transport capacity, as the city continued to grow, but it has also eroded earlier traffic congestion benefits.

The charge's weaknesses have become more obvious with time. The flat daily charge means that drivers pay the same whether they drive in the zone for a few minutes or all day, with the perverse result that, once they have

paid the charge, drivers may feel incentivised to drive more so as to get value from their payment. While it might have been politically expedient to offer residents a heavy discount, there is no particular logic to it – a car has the same impact whether it is driven by someone who lives in the zone or outside it. Likewise, while electric vehicles are less polluting, they still impose a cost in terms of congestion.

Moreover, the time-limited operation and geographical coverage of the charging regime have diminished its effectiveness. Traffic has increased out of 'working hours' when the charge does not apply, and along the perimeter of the zone, as drivers take a circuitous route to avoid it.[51] PHVs largely operate outside the reach of current charging: only 5.9 per cent of PHV trips are within the zone in charging hours, and 23 per cent of trips occur between midnight and 5am.[53] More generally, as Figure 1 illustrated, congestion in the city now spreads far beyond the Congestion Charge Zone, particularly along busy strategic routes at peak times.[54]

Environmental schemes

In addition to the Congestion Charge, a number of environmental charging schemes have been introduced. The Low Emission Zone (LEZ) started in 2008, covering most of Greater London and operating 24 hours a day. The most polluting larger diesel vehicles are required to pay high daily charges to enter the city (£100 for vans and £200 for HGVs, buses and coaches). The standards are being tightened from October 2020 to Euro 3 for vans and Euro VI for lorries, buses and coaches.

The Toxicity Charge (T-Charge) was added in 2017, covering the same area and hours of operation as the Congestion Charge, and charging both petrol and diesel vehicles below Euro 4/IV standard £10 a day. In April 2019 this was replaced with the Ultra Low Emission Zone (ULEZ). Initially covering the same area as the Congestion Charge, an expansion to the North and South Circular Roads is planned from October 2021. It operates 24 hours a day, seven days a

week and charges £12.50 daily for cars below Euro 4 petrol or Euro 6 diesel standards, £100 for vans below Euro 3 diesel standard, and £200 for HGVs and buses below Euro IV diesel standard.

The introduction of the ULEZ, tighter LEZ standards from 2020 and ULEZ extension in 2021 are certainly much needed. They will remove the most polluting vehicles from their respective areas of operation, and help improve concentrations of roadside pollutants, particularly NO_2. However, these interventions will have little impact on particulate matters emissions because they are not expected to significantly reduce overall car usage.[55] These environmental schemes will also do nothing to address congestion or other externalities.

Finally, like the Congestion Charge, the ULEZ is a blunt tool – a small proportion of drivers pay a flat daily charge regardless of how much they drive – while those outside the charging areas remain unaffected. Both the CC and ULEZ (and the plans for its extension) have also been criticised as unfair to users who may be unable to avoid the charges, such as people who live in areas without easy access to public transport, and those on low incomes who may struggle with the cost of replacing older vehicles.

River crossings

London's river crossings have long been free to use, but this is beginning to change. As mentioned above, the Dartford Crossing has been tolled since it opened in 1991.

In addition, the Mayor of London is planning a number of new East Thames river crossings, including the Silvertown Tunnel linking Silvertown to Greenwich. As with Dartford, using the new tunnel when it opens (expected in 2024) will incur a charge to pay for construction and upkeep. At the same time, TfL is also planning to introduce a charge on the nearby Blackwall Tunnel to help manage demand in the area.

Other schemes

Stepping back, the picture is of a growing patchwork of rather blunt charging regimes, each with a distinct justification (construction and maintenance costs, congestion, pollution), and different rules, vehicle standards, hours of operation and charge amounts.

But this is not the end of it. For this picture is likely to be further complicated by various other schemes being proposed and discussed. The City of London plans to introduce its own charging regime, unless existing schemes are reformed at the London level. And a number of boroughs are said to be considering introducing road charges to deal with local congestion and pollution hot spots.

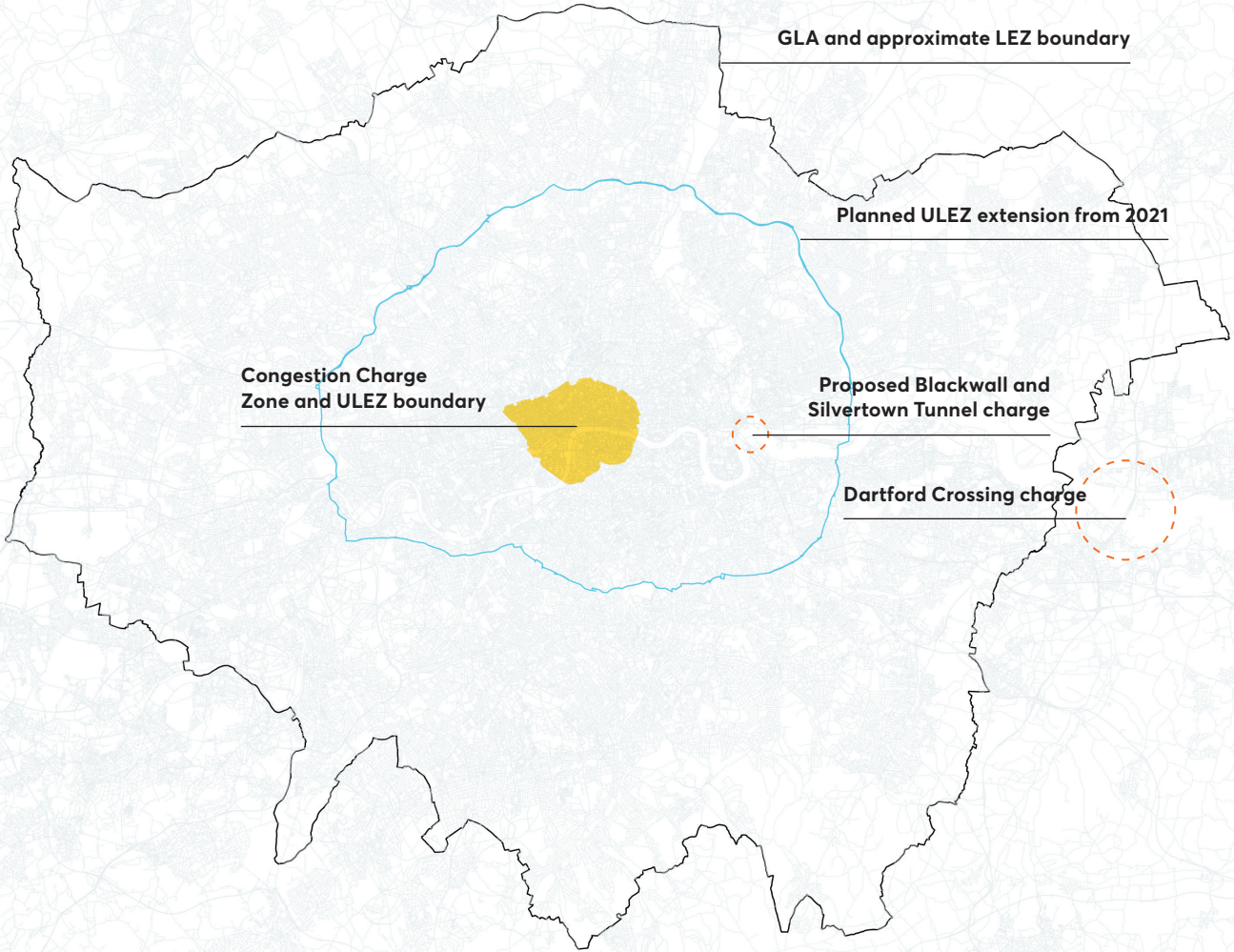
In short, at some point in the next five or so years a driver, whether behind the wheel of a private car, taxi, servicing or goods vehicle, could easily find themselves having to negotiate their way through a pack of different charging schemes (see Figure 3). And this is before taking into account other charges, such as parking permits and on-street parking fees. Replacing all charging schemes with a single comprehensive scheme would make the user experience much simpler.

Changing public attitudes

Public opposition has been a major barrier to the extension of road user charging in the past. In 2006, the Eddington Report recommended national pay-as-you-drive road user charging and the government of the day published plans for implementation.[56] However, following a public petition against the plans, which attracted 1.8 million signatures, the proposals were shelved.[57] Local plans have also been rejected. For example, a proposed charge in Manchester to leverage government funding and pay for public transport improvements was heavily defeated in a 2008 local referendum.[58]

More than a decade on, however, attitudes seem to be shifting. As more and more evidence of the health impacts of pollution has emerged, concerns have grown among the general public, as has acceptance of the ‘polluter pays’ principle. A majority across Britain

Figure 3: Map of existing and planned charging schemes in London



now perceive exhaust fumes from traffic in towns and cities as a serious problem (63 per cent agree, 37 per cent disagree) and believe that for the sake of the environment everyone should reduce how much they use their cars (61 per cent agree, 11 per cent disagree).[59] The proportion of respondents who believe that car users should pay higher taxes for the sake of the environment increased by 14 percentage points in the four years to 2017 (27 per cent agree, 45 per cent disagree).[60]

In London, more than half of residents believe that their health has been impacted by air pollution, while the proportion of Londoners who said they had suffered symptoms from poor air quality increased from 54 per cent in 2016 to 67 per cent in 2018.[61] Londoners have also long been supportive of the idea of a more sophisticated charging system. A 2016 survey found that 50 per cent of Londoners supported (and only 20 per cent opposed) charging based on how much you drive (for instance per mile, or per hour) as an alternative to the flat Congestion Charge, and 60 per cent agreed that introducing a mileage or time-based charge in congested parts of the road network in London would be fairer (13 per cent disagree).[62]

There is also growing support for road user charging from a variety of campaign groups who represent drivers and businesses, as well as pedestrian, cyclist, health and environmental charities.

3.
A next generation scheme for London

We have already suggested that new technologies offer the chance to replace the current complex, limited and blunt patchwork of charging regimes, with something simpler, smarter and fairer. As we emphasised in the introduction, London in particular is in prime position to create the world's first truly integrated transport system – one which allows city authorities to charge drivers on the same model as they charge bus and train passengers, and provides drivers, passengers and businesses with a single portal on which to plan and pay for all their journeys.

We now turn to describing the details of a scheme that could be effective and implementable, but also an attractive proposition, and how the road user charging component of it could work.

Charging structure

Road user charging schemes can be thought of as running across a spectrum from static cordon-based ones to fully dynamic. As already explained, cordon-based schemes charge a flat fee for driving within a specified charging zone. These schemes have the merit of being easy to understand and relatively simple to operate, but, as we have seen in the case of existing London schemes, they are insensitive to the amount a driver actually contributes to congestion and pollution. A car that drives for a few metres on a quiet road within the zone is charged the same as one that drives all day on the most congested routes.

Distance-based schemes, on the other hand, charge drivers per kilometre driven and can be varied on the basis of any number of factors to take into account the full environmental and network impacts of a journey. With a fully dynamic scheme, the charge is adjusted throughout the journey according to actual vehicle emissions and the real-time congestion and pollution levels along the route taken. This would most accurately reflect the actual full costs of a journey, as there can be significant differences between vehicles' certified emissions performance and the emissions under actual driving conditions.[63] However, a fully dynamic scheme would be less predictable as the driver would only be

aware of the final cost they have incurred once the journey is over, so they would not be in a position to make an informed choice about whether to travel or by what mode.

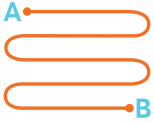
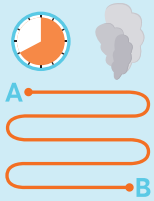
Against that background, we argue that the Congestion Charge, ULEZ and other London charging schemes should be replaced by a scheme which charges drivers according to the distance travelled and impact, but with the price set before the journey begins, based on typical levels of congestion and pollution along a recommended route. This is termed a **distance-based static variable charge scheme**. If the price is determined before the journey starts and traffic is reduced on busy roads at peak times, there would be no need for drivers to seek quieter local roads to avoid congestion or pollution hotspots.

The scheme would operate all day every day – like the ULEZ – but pricing journeys on the basis of typical congestion and pollution levels at the time in question, so that night time or weekend travel would be cheaper than at peak times. Charging levels can be reviewed and altered in line with changes in congestion and pollution levels and against transport and environmental policy objectives.

Table 1 describes some of the main types of road user charging schemes, with the one we propose highlighted in blue.

Design principle 1: London's existing charging schemes should be replaced by a distance-based scheme, with charges set in advance and varying according to vehicle characteristics and recently observed local congestion and pollution levels at given times.

Table 1: Options for scheme charging structures

	Charging structures	Pros ✓	Cons ✖
	**Cordon-based flat charge:** a set daily charge to enter a specific area	• Targets areas of high congestion or air pollution • Simple to understand	• Does not reflect the impact of individual journeys • Does not relate to the amount of driving done and may encourage drivers to make longer journeys
	**Distance-based flat charge:** a flat per-mile charge	• Encourages people to make fewer and/or shorter journeys • Distance travelled is a good indicator of the vehicles' contribution to road maintenance • Rewards efficiency • Predictable and transparent • Relatively easy to implement and enforce	• Not linked to local congestion and air pollution
	**Distance-based static variable charge:** a per-mile charge, varying according to factors including average congestion and pollution levels at specific times or on specific roads	• Reflects the impact of individual journeys • Conforms to the 'user pays, polluter pays' principle • Predictable and transparent • Enables informed travel choices and influences behaviour • Smarter and fairer than flat charges	• More complicated than flat charges • Standard tracking and measuring devices required
	**Distance-based dynamic charge:** as above but reflecting actual congestion and pollution levels in real time	• Most accurately reflects the real-time actual impact of individual journeys • Encourages better driving and can help manage disruption on the network • Can improve fuel efficiency and lead to emission savings	• Complicated to understand and administer • Not predictable or transparent • Cannot compare to other modes or pay in advance • Sophisticated tracking and measuring in-vehicle devices required

A new user platform

London's transport leaders have an impressive track record when it comes to commissioning cutting edge, user friendly design. They now need to extend that record by creating a single multimodal London transport platform – a simple integrated website and app for all London's road and public transport users.

The multimodal platform, which is referred to as *City Move* in the report, needs to have a variety of functions. It should allow users to:

- Register for a personal travel account that links Oyster, contactless and driver details.
- Explore journey options, comparing costs and benefits (monetary, time, environmental, health) across the full range of modes (private car, car club, car-sharing, ride hailing, bus, tube, train, bike hire, cycling, walking).
- Pay for journeys across the full range of modes, through a variety of payment mechanisms, including pre-pay, pay as you go and monthly billing.
- Keep track of their journeys and payments, to analyse long-term usage and calculate costs and benefits of alternative ways of moving around.

City Move would facilitate road user charging by enabling the user to enter the journey details in advance, calculating a recommended route, verifying the journey and making an automated payment. The platform could proactively suggest alternative journey options that could save time and/or money or promote healthy activity. For example:

- Travel an hour later and it would be cheaper;
- Share the ride to split the cost;

- Walk, cycle or drive to the nearest train station, then take the train and it would be faster;

- Cycle and it would make you fitter and save emissions, etc.

City Move could also provide drivers and car owners with other related services, including:

- Signposting available parking spaces and local parking regulations;

- Automatic payment of parking charges;

- Bookable drop-off/pick-up and loading bays.

Although there are a multitude of privately-operated apps that currently offer such services, including those in a single TfL platform would further simplify the process for drivers and would allow for better integration of the city's mobility services. Private operators would have the opportunity to integrate the TfL offer with other services.

Design principle 2: The scheme should operate through a single London transport platform, *City Move,* that allows users to compare, plan and pay for journeys across the full range of modes, including tube, train, bus, car, cycling and walking. The platform would proactively suggest cheaper, faster or healthier journey options and offer a number of added driver services.

Individual account

The multimodal account should be individual, rather than attached to vehicles. This would allow a more flexible, targeted and fair approach to charging. For example, existing exemptions or discounts, such as for disabled Blue Badge holders, could be extended to other underprivileged groups.[64] These could then be applied across modes.

Individual accounts would enable two people using the same vehicle at different times to pay through their respective accounts. However, each vehicle should be charged based on its use of the road, regardless of the number of persons transported, promoting ride sharing. When several users share a vehicle, any registered drivers among them would be able to pay for the journey via their account. The *City Move* platform could also enable the main user registering the journey to add passengers and to give the option to split the charge. Either way, all passengers would still have the benefits of live updates on traffic conditions and public transport status updates for multimodal journeys. In cases of non-payment, the vehicle owner would be charged. Abuse of the account could be prevented by smart security features such as two-step or fingerprint authentication.

The platform would also work for car hire, car clubs and ride hailing. For car hire and car clubs, as the individual customer is the driver, the charge should be applied to the customers' accounts. For private hire vehicles and taxis, the charge should be applied to the operator and potentially passed on to the customer via the fare. Passengers can pay the fare and the added charge directly when ordering the service via the app, while the operator would still be liable to pay the fees when not carrying passengers (or when carrying cash-paying passengers).

Design principle 3: The multimodal account should be linked to the individual, rather than the vehicle, enabling a fairer approach to charging, including targeted discounts and options to split the charge between passengers.

Objectives, pricing and spending

Road user charges, like other transport charges, should be set with reference to transport and environmental objectives, including objectives relating to:

- Traffic reduction and modal shift;
- Journey speeds, time and reliability ;
- Legal requirements and health impacts of carbon dioxide emissions and roadside pollution;
- Equity and accessibility.

These objectives and related performance targets should be defined by the Mayor and responsibility for achieving them should lie with the relevant delivery authorities.

The precise levels of road user charges would be reviewed annually, along with all other transport charges, against these objectives and performance targets. The charging levels should be calculated with reference to four factors in particular:

– **A base fee**, dependent on the vehicle class and size, that covers basic road maintenance;

– **A graduated emissions fee** dependent on the vehicle's emission standards;

– **A local impacts fee** reflecting the local congestion and pollution levels at a given time of day, based on recently recorded data;

– **The extent of alternative transport options** –drivers who live in areas, or travel at times of day, poorly served by public transport would be charged less.

The bill should be itemised by journey and the separate components broken down, so the pricing structure can be easy to understand, consistent and

transparent. The pricing structure could be linked to the existing public transport fare zone structure, which would also relate to the available travel alternatives. The congestion and air pollution 'heat maps' on which the pricing is based should be clearly signposted on the TfL website.

All income raised from any charging scheme should be directed into meeting the objectives the scheme is designed to achieve. Charges should not be used to generate general revenue. The first priority should be to make the maintenance of London's roads self-funding and tackling the backlog in road maintenance for the benefit of all road users. Any additional revenue should be invested in public transport, walking and cycling and associated environmental and public realm measures.

Design principle 4: Charging levels should be set to achieve specified objectives and reviewed annually against these. Revenue should be directed exclusively to meeting these objectives, and spent on London's roads, public transport and associated environmental and public realm measures.

Technology

The scheme would be delivered through three technological components:

- A website and smart app would allow drivers to create a travel account, review travel options by comparing the costs and benefits of driving against other options, and plan and pay for their journey.

- Satellite GPS enabled smartphones or in-vehicle devices would allow for the accurate tracking and charging of vehicle trips. All new cars now come with satellite navigation integrated as standard and 85 per cent of UK adults now own a smartphone.[65]

- Road-based Automatic Number Plate Recognition (ANPR) cameras would be used to strengthen enforcement. As ANPR cameras are already used in the CC Zone, there is good existing coverage within central London and the emergence of lightweight portable cameras for random checks makes enforcement relatively easy.

TfL already has a Journey Planner facility, a customer account platform for managing Oyster and contactless journeys, as well as account and pay-as-you go platforms for CC, LEZ and ULEZ charges. The new platform could be an integration and an extension of these existing platforms.

We recognise that some users may be concerned about the privacy implications of linking GPS tracking to a personal account. However, most consumers now use a variety of GPS-enabled smartphone applications, and countless private companies are already collecting such data with user permissions. People also tend to trust public authorities such as TfL with their data more than they do private companies – demonstrated with the widespread usage of Oyster and contactless cards on public transport. Nonetheless, TfL will need to be transparent and clear about the data collected, how it is used and how it is protected.

Drivers would be encouraged to create a travel account by offering a discount on charges or other incentives. Those who did not want to open a travel account for any reason (such as infrequent visitors to London, foreign drivers, or those with privacy concerns) could be offered the option to pay a set daily fee online or at a retail outlet.

Design principle 5: The scheme should be built around three technologies: (1) a web platform and a smartphone app for user registration, journey planning and payment; (2) in-vehicle satellite navigation or smart app for journey verification; and (3) roadside cameras for added enforcement.

Delay Repay

Drivers, especially commercial drivers, attach a high value to journey time reliability to enable better planning and scheduling. Delays can be costly to individuals and businesses, which then have implications for the wider economy. As discussed, objectives and performance targets for any charging regime should include one relating to journey time and delays. By reducing overall traffic levels on London's roads, the scheme would be able to improve journey time reliability for drivers who pay the charge. To formalise this benefit, TfL should explore the possibility of offering users a guaranteed level of service.

At the point of registering a journey, drivers would be quoted the charge amount but also a realistic journey time estimate. If this is then exceeded by a certain margin, drivers would be issued with a partial or full refund, similar to the system of Delay Repay on the rail network.[66]

The journey time quote would be calculated based on a recommended route taking into account any roadworks, traffic accidents or tailbacks. This route would need to be followed for the journey to be eligible for a refund. The GPS capability would verify the route and the journey time taken, as well as detecting any unusual delays or periods of non-movement to prevent drivers trying to claim a refund, for example, for making a stop on route.[67]

Design principle 6: The scheme could offer a level of service or 'delay repay' guarantee, with drivers getting a partial or full refund where a journey takes significantly longer than expected.

Mobility Credits

The multimodal user platform could also create a system of Mobility Credits – credit that can be used to pay for a number of travel options, including public transport, bike hires, car clubs, private hire, etc. as well as road user charges. Mobility Credits could be used to reward certain choices or to encourage changes in travel behaviour. For example, boroughs could offer residents credits as an incentive to give up their parking permits or developers could offer them in lieu of a parking space in new developments.[68]

In the context of road user charging, users could be offered Mobility Credits for:

- First registering for an account (promoting take-up of the app);
- Choosing public transport, walking, cycling or mixed modes for a journey that they used to make by car;
- Giving up a car or scrapping an older more polluting vehicle.

As the system of Mobility Credits becomes established, it could also be used by public authorities to promote active travel. For example, GPs could offer credits to patients who meet set walking and cycling targets.

Design principle 7: The scheme should include a system of Mobility Credits to promote uptake of the app and to encourage healthier and greener ways of moving around.

The business offer

The needs of businesses are different from those of individual travellers, and the scheme should offer a separate business interface. Business account options should suit different sizes and types of businesses. A business should be able to manage its whole fleet from a single account, and the business interface could offer some additional features, such as information and booking for servicing and loading bays. For large businesses and fleet operators, the business account could be linked to commercial Fleet Management Systems.

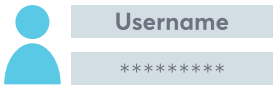
The scheme needs to support London's freight industry, while encouraging efficient supply chains. A distance-based scheme would promote the use of a smaller number of fully loaded vehicles to minimise total mileage, while varying the charge by vehicle emissions standard would promote the use of smaller zero tailpipe emission (e.g. electric) vehicles, especially for last mile deliveries in more central congested areas.

One price incentive to encourage retiming and consolidation of loads could be cheaper rates for pre-booked delivery slots outside of peak times. These slots would appeal to several types of freight users that have regular scheduling and relatively efficient utilisation rates in terms of volume carried, including the major parcel and logistics operators, distribution networks of large retailers, and some construction traffic. This would need to be accompanied by other measures to enable consolidation, retiming and use of alternative modes, such as facilitating delivery coordination, reviewing the London Lorry Control Scheme and promoting the use of rail and the river for freight.

Design principle 8: The scheme should offer a dedicated business account that easily manages all commercial vehicles. Cheaper pre-booked delivery slots outside of peak times could encourage retiming and consolidation.

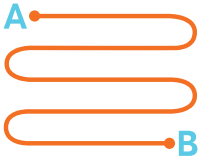
Figure 4: *City Move* user journey

User registers for an account, adding personal and payment details, any vehicle details and link to Oyster or contactless details.

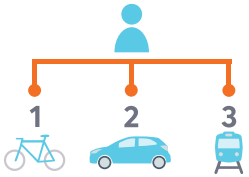


User account receives Mobility Credits upon registration when applicable

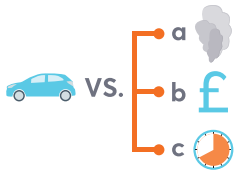
When planning a journey, user inputs journey start and end points



Platform calculates the best routes and presents a number of options, including train, bus, private car, car club, cycling, etc.

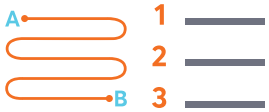


Platform compares the journey time, cost, emissions and physical activity impact of each option, and user selects preferred option

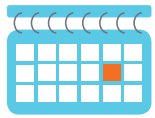


Platform verifies choice by presenting a number of alternatives, e.g. travel an hour later and it would be cheaper; drive to the station, then take the train and it would be faster, etc.

User has the option to add fellow passengers to the same journey and to split the cost with them



Platform produces journey instructions along the route



Any train tickets can be booked in advance, train and tube journeys are paid via Oyster or directly through the app, any driving charge is applied at the end of the journey

User has the option to find available car or bicycle parking space and pay for it via the app

User is emailed monthly updates including journey history, itemised billing, emissions impact and activity levels to date

4. Impact assessment

This chapter describes the principal benefits our proposal would bring to drivers and to the city as a whole, the impact we expect the scheme to have against the identified objectives, as well as how it would impact specific user groups.

Principal benefits

A more sophisticated and comprehensive scheme would offer substantial benefits both for the city, and for individual consumers. Chapter 2 described the current complex system of national vehicle taxation and local driver charges. Drivers would benefit from more predictable, smoother journeys and in comparison to the current system, the proposed scheme would be:

Simpler

The current multiple charging schemes come with different rules, vehicle standards, hours of operation, charge amounts and payment arrangements. The new scheme would replace all existing congestion and environmental charging schemes, as well as road tolls within the area of operation. It would be easy to understand and easy to use, and it would tackle both congestion and pollution at the same time. Additional driver services, such as parking permits and charges (which currently vary between and within different local authorities) could also be integrated to further simplify transactions for customers.

Smarter

While the Congestion Charge has failed to keep up with changing demand patterns, the new scheme would be modern, sophisticated and future-proof. The scheme would operate through a simple but smart platform. By comparing financial, environmental and health impacts, and offering alternative journey options, the scheme would enhance choice for customers and promote behaviour change. A charge per vehicle would also incentivise car sharing and carpooling. This would all help to reduce vehicle delays and make journeys more reliable.

Fairer

In contrast to set daily charges, a scheme that charges variable rates on the basis of vehicle characteristics, journey timing and distance, and local road conditions, would be fairer and reflect the real impact of individual journeys. It would comply more closely with the "user pays, polluter pays" principle. Rather than penalising the small proportion of drivers who enter the zones within which current schemes apply, the new charge would ensure that everyone who contributes to congestion and pollution pays. Cleaner vehicles would be charged less than polluting ones, and drivers would pay very little for travelling in less congested areas or outside peak times. Likewise, drivers who live in areas, or travel at times of day, that are poorly served by public transport would be charged less. The personal mobility account would allow a more targeted and fairer approach to charging, for example certain underprivileged groups could be offered reduced rates.

> While the CC focused on addressing congestion and the ULEZ on pollution, a next generation scheme should have equity at its core.

The scheme would also benefit London's residents, businesses and visitors as a whole. The scheme would create a city that is:

More efficient

The scheme would promote the uptake of cleaner vehicles and car sharing, as well as the use of public transport, walking and cycling instead of driving. This would reduce overall motor vehicle usage and enable more efficient use of space. Reduced vehicle delays and more reliable journeys would benefit all users equally. The scheme would be flexible and adaptable to technological innovation and changing consumer habits. Policymakers could respond to developing technology, new research and new mobility services by adding scheme variables and amending charging

bands.[69] Making roads self-financing would also free up funding for public transport and public realm improvements – making the alternatives to driving even more attractive. Among other benefits for London as a whole, the scheme would provide TfL with a much more detailed understanding of how people and goods are moving around the city, allowing it to adapt its policies, charges and services accordingly.

Healthier

The reduction in overall car usage would help to reduce all the main transport-related air pollutants, including particulate matter generated by zero tailpipe emission vehicles. This would benefit all Londoners, regardless of their choice of transport. Lighter traffic would also improve road safety, particularly for vulnerable road users. Streets less dominated by cars would encourage more people to socialise, exercise and lead active lifestyles.

Greener

Cleaner vehicles and reduced car usage would also drive down carbon dioxide emissions, which harm the environment and induce climate change. Encouraging people to choose public transport, walking and cycling would be more environmentally sustainable. Reduced personal car use and ownership would free up road and kerbside space and allow for the creation of better green infrastructure and public realm throughout the city – for the benefit and enjoyment of all.

Impacts of different scenarios

To help understand the impact of the proposed scheme, we modelled demand, emissions and air pollution reductions. We used total vehicle demand for 2021, as projected by TfL's modelling data as our baseline, and took the impact of existing and proposed policies into account. We tested a number of models against this baseline, varying the base charging levels and the multipliers for the different factors determining the charge, vehicle type, emissions class, congestion band

and area of London.[70] The results for reduced demand and emissions are for the whole of London.

We first tested a flat distance-based charge, regardless of vehicle type, emissions or journey location, as a baseline. As expected, the demand reduction would result mainly from outer London, where the majority of journeys are expected to take place, but which is not currently subject to congestion or environmental charging. In contrast, demand in central London would actually increase, as a flat distance-based charge would in most cases be cheaper than the existing CC and ULEZ charges, thus incentivising additional short journeys. The improvement in emissions and air pollution would also be low, as more polluting vehicles would not be targeted.

We then modelled the scheme design we recommend, i.e. with a charge that varied according to a vehicle's contribution to congestion and pollution.[71] The results were far superior than those on the flat charge model. Drivers on less congested roads would not be charged at all, excluding most of outer London. For the average driver making a 10-kilometre journey, we expect this to amount to in the region of £1.50 – the cost of a cup of coffee or a bus ticket – although journeys in the most congested and central parts of the city, using the most polluting vehicles, would be charged much more. This model could reduce overall demand by around 10-15 per cent and reduce total CO_2 emissions and air pollutants by 15-20 per cent across the whole of London. The largest reduction in demand would come from private vehicles and vans. There would be a reduction in demand in all areas but the biggest would be in inner London.

> Charging drivers on the most congested roads the equivalent of a cup of coffee or a bus ticket could reduce emissions and air pollution by up to a fifth.

We also tested a number of alternatives. For example, keeping the same base charge but charging all areas of London (not just the congested ones) produces the greatest impact: demand, emissions and

pollution reduction all in the region of 25-30 per cent. On the other hand, a lower base charge which again charges in all geographies produces similar results to the second model. However, charging all areas of London from the beginning might be problematic in practice.

Moving from a flat charge to a variable distance-based scheme would mean that businesses the freight, logistics and servicing sector, and others reliant on frequent deliveries, would be among those most affected. Yet, the modelling showed that penalising vans and lorries much more heavily than cars does not produce significant added benefit. This is likely because businesses that tend to use them are less able to reduce their journeys or use alternative modes. Nevertheless, the scheme design principles set out above seek to incentivise greater consolidation of freight to increase the efficient use of the road network.

User profiles

The user profiles below illustrate some of the impacts and benefits of our proposed scheme on different types of road users.

The regular commuter

Adam lives in Romford and regularly commutes by car to his job as a media executive at the Here East complex in the Olympic Park. Using a busy major road at peak times means that he incurs a significant cost across the week. His manager has now agreed for Adam to work flexible hours, so he now travels off-peak whenever possible, which makes the journey cheaper. He has also purchased a bike and, for meetings that require him to make the journey at peak times, he cycles the 10-minute journey to Romford station and then gets a direct train to Stratford, from where he can walk, take a bus or cycle on to Here East.

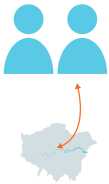
The suburban resident

Beth lives near Sutton and commutes by car to Surrey on a daily basis. Her journey to work is not yet included within the charging area but she does get charged at the

weekend, when she regularly uses congested routes to town centres and retail parks to see family and friends in other parts of south London. These journeys are now charged a little more than the equivalent single train fare but she also benefits from finding and paying for parking more easily. She has, however, now started to make some journeys using the new tram line for trips into local town centres, and appreciates the taxi booking facility available on the new app when making orbital journeys after dark. As her petrol car will need replacing in around four years' time, she is considering purchasing a hybrid or electric vehicle to limit the impact when the scheme is extended to Sutton.

The weekend driver

The Coopers are a family living in north London. Neither of the parents uses their car to commute to work, since they cycle and take the Underground respectively. Their two children get to school by walking and by bus. Yet, they do make use of their car outside off-peak times and, in particular, at weekends to take one of their children to regional gymnastics competitions. There are occasions when the times of these competitions coincide with heavy traffic on main roads in and out of London, and they have found themselves paying several pounds for these trips. Since the introduction of the scheme, the gymnastics club has been much more proactive in encouraging parents like the Coopers to offer lifts to other gymnasts whose families are less able to afford the additional costs.



The out-of-town visitor

The Dawsons live in Lincolnshire and are attending a wedding in central London. They find a hotel in inner London with parking and drive there on the evening before the wedding day. Since they drive very infrequently to London, they have a choice of paying a flat charge online or that they can purchase in a service station approaching London or register with London's new app to pay on a per-mile basis. Following the advice of a friend, they decide to register with the new app. Since they drive into London at a time of relatively

little congestion, the fee they pay is a small fraction of the flat charge. On the day of the wedding, they try out the app to find their way to the venue and opt to use the on-demand ride-hailing service, which for two people is marginally more expensive than public transport but carries them door-to-door.

The private hire driver

Erik is a self-employed private hire driver undertaking some business account journeys during the day and working through an on-demand ride-hailing service during the evening. He used to pay the daily Congestion Charge and was very concerned that the introduction of the scheme would have a detrimental impact on his business, with the distance-based element of the charge amounting to more in an average day than the Congestion Charge. In fact, he has seen an increase in demand in inner and areas of suburban London, with the new app stimulating demand, as more people see ride-hailing as an alternative to driving, and new markets opening up such as the early-morning and late-night shared taxis run on behalf of several NHS trusts for their staff. Since the ride hailing service is now connected to London-wide journey decisions, Erik is receiving better information about where demand is greatest. He is finding he has more productive working hours and incurring fewer dead miles where he does not earn.

The sole trader

Fay is a plumber working all over London clocking up around 10,000 miles in her van and is therefore among the most frequent road users in the capital. With a 6-year old diesel van, the new charge can represent a significant amount per month, if she is frequently called out to central London properties at peak travel times. She has to pass on most of the additional cost to her customers. However, she is no longer paying the daily Congestion Charge and ULEZ when she has a central London job, and the new app makes the transactions much simpler. With reduced journey times, she is also able to take on more jobs throughout the working day. Fay has reduced

her mileage in recent years by making fewer trips to suppliers, maintaining higher stock levels, and getting more items delivered straight to site. She has heard about support the Mayor is providing for commercial drivers to switch to cleaner vehicles and is exploring the option of an electric vehicle she can charge at home.

The small business

Garry runs a small craft brewery on an industrial estate in north London supplying beer to pubs, restaurants and wholesalers. Several years ago, the company invested in a second-hand 7.5 tonne vehicle to deliver directly to its clients. Undertaking frequent trips in inner London using a heavily polluting vehicle meant that the company was initially hit hard by the emissions-based elements in the new scheme but was unable to afford a newer vehicle. After several months, Garry got together with several other small companies to form a new logistics operation using zero-and low-emission vehicles and saving costs with more efficient fleet utilisation.

5. Implementation

Chapter 3 set out design principles for a new system of road user charging, while Chapter 4 examined its anticipated impact. This chapter looks at how a new scheme could be implemented in London, and its relation to national policy or schemes in other parts of the country.

Phasing

As described, the scheme would operate at all times of day and night. As a rule of principle, the charge should cover all motor vehicles using the roads. However, the Mayor may choose to exempt certain vehicles or user types (e.g. emergency vehicles and taxis) from some or all of the fee elements of the charge. As the account would be personal and multimodal, the platform could potentially be used to extend charging to other modes. The new distance-based charging scheme should eventually cover the whole of London, replacing all existing schemes affecting the highway network, but exact phasing would be a matter of political consideration.

The Mayor of London already has all the regulatory and legislative powers required to implement the scheme we recommend. We propose that the next Mayor of London should ask TfL to develop options for a new approach to road user charging, with a view to introducing the first version of a scheme by the end of the 2020-2024 Mayoral term.

Any new scheme would require the development of an integrated platform with sophisticated back office functions, new technological capability and robust testing before going live. In preparation for implementing the scheme, the Mayor and TfL would need to:

- **Determine scheme parameters.** TfL and the Mayor would first need to decide the basic scheme parameters, including charging structure, technology, user interface and payment methods, any exemptions and benefits, etc.

- **Develop the user platform and back office functionality.** TfL would then need to develop the technology that the scheme should be based on, including integration of the Journey Planner, Oyster and contactless user account and road user charging account systems into a new multimodal platform – as well as the application programming interfaces (APIs) required to integrate it into external platforms.

- **Upgrade GPS accuracy and 5G network connectivity.** Before implementing the scheme, TfL needs to ensure that there is sufficient coverage and capacity within the satellite networks and the 5G connectivity required for operating the system – across the areas that the scheme covers in any given period of time.

- **Pilot the scheme within the existing CC zone.** The new scheme and the associated platforms could initially be trialled in the existing Congestion Charging area. This will provide TfL with an opportunity to refine the technology and observe user response to the platform. Take-up of the trial could be incentivised by offering a daily cap at the level of the existing daily charge (similar to contactless ticketing), meaning that no users would pay more than the current combined Congestion Charge and ULEZ charge (if liable for the latter). This might have the impact of temporarily increasing congestion (by drivers that may have otherwise been deterred from making short journeys) and reducing revenue (from drivers that would otherwise have paid the full CC and ULEZ charges), but it would ensure the scheme and the technology behind it worked in practice.

Recommendation 1: The Mayor of London and Transport for London should prepare to introduce a distance-based road user charging scheme replacing all existing schemes, by the end of the 2020-2024 Mayoral term, by developing a customer platform, upgrading the required GPS and mobile network capacity, and conducting a pilot to test the technology.

Once the scheme design is ready, the platform should be launched across the whole of London, but there should be gradual extension of the charging regime.

- **Launching the platform across the whole of London.** Once the technology has been tested, the platform should be extended across the whole of London. This means that any local traffic restriction measures can be signposted through the journey planner website and app from day one. TfL should also encourage local authorities to roll local parking regulations and payments (and other mobility services) into the scheme – without changing the way in which prices are set and revenue is collected by local authorities. Launching the platform across the whole of London from day one would provide all drivers that sign up to it the opportunity to benefit from a simplified experience and from the range of incentives on offer, such as mobility credits for integrating public transport and road user charging accounts, etc.

- **Gradual extension of distance-based charging.** Charging could be extended gradually, with the new distance-based charging regime initially replacing the existing CC and ULEZ before being expanded into other areas of high demand and poor air quality, such as busy town centres, congested corridors or airports. The scheme would only be expanded to areas of relatively lower congestion and air pollution, and limited access to alternative transport modes – like much of outer London – once tangible improvements to public transport

and streets for walking and cycling are delivered. Nevertheless, drivers in unaffected areas would still be encouraged to sign up to the scheme, so that they can benefit from its incentives and features, and so that they avoid the risk of being penalised for unknowingly entering an area that does incur a charge.

Recommendation 2: The Mayor of London should introduce the user platform across London from the beginning to maximise the number of drivers benefitting from the scheme's smart features and incentives, while gradually extending the charging regime, starting with areas of high demand and poor air quality.

Relevance to other cities

National government largely views the management of congestion and pollution as a matter for individual cities. A number of cities across England are required to produce clean air plans as part of the government's Clean Air Strategy, and Clean Air Zones (CAZs) are one of the tools they can use.[72]

While the majority of cities tasked with creating plans recognise the need for charging schemes, in their implementation of CAZs many are opting for a set daily charge that applies to vans, trucks and buses only and not to private cars.[73] These schemes not only face the challenges of London's current cordon-based schemes, but also could be argued to impact on those users (such as businesses) who are least able to reduce usage or switch modes and to penalise public transport.

Charging private car users may be more politically controversial. But a distance-based scheme that reflects actual usage, improves journey time reliability and delivers other benefits, could improve public acceptability. London can lead the way trialling a scheme that can be used by other cities in their strategies to reduce congestion and improve air quality and health impacts. Close coordination between cities would also ensure technological compatibility wherever possible, and

help minimise discrepancies for businesses, such as in the freight and logistics sectors, that travel across the country.

Recommendation 3: The Mayor of London should collaborate with other cities across England to introduce elements of the proposed scheme in the implementation of Clean Air Zones, to improve overall air quality and health objectives.

National reform

What should the relation between the new approach to road user charging we are recommending for London and national taxation be?

The fundamentals of the national regime of road user taxes, centred on VED and Fuel Duty, have been in place for decades and are looking increasingly antiquated. These taxes do a poor job of ensuring the costs of driving reflect its impact. Many experts and campaign groups have argued these taxes should be replaced by a national system of distance-based road user charging.[74] London, moreover, does particularly badly out of the present system. Hardly any of the income raised through national road taxes that is hypothecated for roads goes to London's roads. And London is excluded from various funds that central government provides to other cities to help them manage congestion and pollution, such as Clean Air Zone implementation funding or the Transforming Cities Fund.

There are no signs that the government plans to revise road taxes in the short term. But with revenues from Fuel Duty projected to decline fast over the next 10 to 15 years, as drivers switch to cleaner hybrid and electric vehicles, the government is likely to be forced to move to a system of distance-based road user charging. Some have suggested it would also be required as part of a national regulatory regime for autonomous vehicles in the not-too-distant future.[75]

We argue that, while national government should replace existing road taxes with a pay-per-distance

system of road user charging, it is vital that any reforms by the government work with, rather than in conflict against, road user charging schemes in London and other cities, so that drivers do not find themselves paying twice – once to the city and then again to the Treasury. One option would be for central government to replace VED and Fuel Duty with a flat-rate per mile scheme (possibly variable for major and minor roads), with cities left to address the local aspects of congestion and pollution with regional or local road user charging schemes. In the meantime, the government should at least ensure that London can access Clean Air Zone funds and others on the same basis as other cities and regions.

Recommendation 4: The Government should work with regional leaders to replace existing vehicle and fuel taxes with a national distance-based system, while enabling towns and cities to implement complementary schemes that tackle local congestion and pollution.

Summary of recommendations

A new system of road user charging should feature the following design principles:

1. London's existing charging schemes should be replaced by a distance-based scheme, with charges set in advance and varying according to vehicle characteristics and recently observed local congestion and pollution levels at given times.

2. The scheme should operate through a single London transport platform, *City Move*, that allows users to compare, plan and pay for journeys across the full range of modes, including tube, train, bus, car, cycling and walking. The platform would proactively suggest cheaper, faster or healthier journey options and offer a number of added driver services.

3. The multimodal account should be linked to the individual, rather than the vehicle, enabling a fairer approach to charging, including targeted discounts and options to split the charge between passengers.

4. Charging levels should be set to achieve specified objectives and reviewed annually against these. Revenue should be directed exclusively to meeting these objectives, and spent on London's roads, public transport and associated environmental and public realm measures.

5. The scheme should be built around three technologies: (1) a web platform and a smartphone app for user registration, journey planning and payment; (2) in-vehicle satellite navigation or smart app for journey verification; and (3) roadside cameras for added enforcement.

6. The scheme could offer a level of service or 'delay repay' guarantee, with drivers getting a partial or full refund where a journey takes significantly longer than expected.

7. The scheme should include a system of Mobility Credits to promote uptake of the app and to encourage healthier and greener ways of moving around.

8. The scheme should offer a dedicated business account that easily manages all commercial vehicles. Cheaper pre-booked delivery slots outside of peak times could encourage retiming and consolidation.

To realise the benefits of such a scheme, we recommend that:

1. The Mayor of London and Transport for London should prepare to introduce a distance-based road user charging scheme replacing all existing schemes, by the end of the 2020-2024 Mayoral term, by developing a customer platform, upgrading the required GPS and mobile network capacity, and conducting a pilot to test the technology.

2. The Mayor of London should introduce the user platform across London from the beginning to maximise the number of drivers benefitting from the scheme's smart features and incentives, while gradually extending the charging regime, starting with areas of high demand and poor air quality.

3. The Mayor of London should collaborate with other cities across England to introduce elements of the proposed distance-based variable scheme in the implementation of Clean Air Zones, to improve overall air quality and health objectives.

4. The Government should work with regional leaders to replace existing vehicle and fuel taxes with a national distance-based system, while enabling towns and cities to implement complementary schemes that tackle local congestion and pollution.

Appendix: Selected examples from other cities

Scheme	Details	Impacts	Main lessons
Singapore: Electronic Road Pricing (ERP)	When it started in 1975 as the manually enforced "Area Licensing Scheme", it was the world's first successful congestion charge. Converted to ERP in 1998, it is a fully dynamic scheme with price varying according to time of day and level of real-time congestion, measured through a mandatory in-vehicle unit.	The scheme reduced traffic in the inner city by 24 per cent and increased average speed from 30-35 km/ph to 40-45 km/ph. It increased bus and train ridership by 15 per cent since its introduction and reduced carbon emissions by 103 kilo-tonnes in the first decade of operation. It raised $152 million in revenue in 2014, 40 per cent of which covers the system's maintenance and operation and the remainder is used to fund road and transport improvement projects.	The dynamic system has been able to drive more targeted behavioural shift, but its operating cost is quite significant. Implementation has been politically feasible due to the city-state structure of Singapore.
Stockholm, Sweden: Congestion Tax	Established in 2006, the scheme operates on workday daytimes only. Enforced by roadside cameras, the rate varies according to time of day and there is a daily cap.	A seven-month trial was conducted in 2006. Prior to its introduction, 80 per cent of residents opposed the proposal. Yet, as congestion declined by 30-50 per cent during the trial, at the end of it, a majority (53 per cent) voted in favour of making the scheme permanent. Traffic levels have seen a 22 per cent reduction in the 10 years to 2015, despite a growing population in Stockholm.	A well-directed trial can successfully achieve public acceptance in the face of initial objection and change behaviour.
Oslo, Norway: Toll Ring	A cordon - and corridor - based scheme is in operation in Oslo, as part of the national toll system Auto-PASS. The charge varies according to vehicle characteristics and is higher at peak times. Drivers who opt to fit an in-vehicle Auto-PASS unit benefit from a 10 per cent discount on all charges, as well as hourly and monthly caps.	The scheme has reduced the usage of fossil fuel powered vehicles and increased the number of electric vehicles by 39 per cent in the year to September 2018.[76] Revenue has been used to pay for road maintenance and public transport improvements.	The uptake of in-vehicle units can be incentivised through reduced charging rates.

Scheme	Details	Impacts	Main lessons
Milan, Italy: Area C	Introduced in 2008 as Ecopass, the scheme was initially an emissions-based charge for vehicles entering the city centre. It evolved into the Area C congestion charge in 2012. It is a set daily charge on all vehicles entering the zone on workday daytimes, but access is forbidden for vehicles below Euro 3 standard. Italian vehicles can manage their payments through an in-car 'Telepass' unit.	Within four years, central Milan saw 29 per cent fewer car trips compared to the year prior to the implementation of Area C. A 2012 lawsuit resulted in the temporary suspension, leading to a two-month spike in traffic. Revenue from the scheme is also used to fund public transport, including a bike share scheme.	Implementing vehicle restrictions in historic city centres can have marked benefits for pedestrian and cyclists and improve the economic vibrancy of the city centre.
Los Angeles, USA: LA Express Lanes	Lone drivers are able to pay to use ExpressLanes, designated for vehicles with two or more occupants, to take advantage of guaranteed average travel speed set by the transport authority.	Revenue has been committed on active travel and public transport networks serving low-income communities within three miles of the lanes, in order to help off-set negative health externalities. [77]	Focusing improvements of active travel and public transport alternatives on areas of poor provision helps address equity implications.
USA: E-Zpass	Established in 1987, this system incorporates multiple charging schemes, operated by 38 separate agencies across 16 states in Northeastern and Midwestern USA. An in-vehicle unit with a pre-paid debit account provides interoperability across multiple charging schemes, while each agency establishes their own charging structure.	There are now over 35 million E-ZPass transponders in circulation, and the shift to standardized electronic tolling has expedited the process and reduced peak and shoulder period congestion. E-ZPass has also been used to pay for parking at airports and there have been pilots using E–ZPass to pay for restaurants (drive-thru) and petrol stations.	Standardizing technology can allow for highly interoperable systems that are able to efficiently apply variable road pricing in multiple jurisdictions, as well as be used for different vehicle related expenses.

Scheme	Details	Impacts	Main lessons
Ireland: e-Flow	Established in 2007, eFlow uses an in-vehicle 'tag' to facilitate barrier-free payments across all of Ireland's toll roads. Drivers can pay seamlessly via an app, launched in 2017, after registering personal and payment details.	The scheme has been widely marketed with posters highlighting the ease of payment and other benefits to the user. The app has become the preferred choice for making payments and assisted in increasing compliance levels.	Using technology to simplify the process for drivers, alongside a strong brand and coherent messaging, can increase take-up.
Oregon, USA: OReGO	Diminishing fuel tax revenues, due to high ownership levels of hybrid and electric vehicles,[78] led to the need to create a more reliable source of funding for road maintenance. Launched in 2015, OReGO offers volunteers the option to pay a per-mile road usage charge instead of fuel tax. Fuel tax is refunded in the bill at the pump.	OReGO volunteers can choose from a number of private-sector partners providing the in-vehicle devices and secure mileage reporting. Paying per mile links to the 'user pays' principle and makes the relationship between road use and funding more visible to drivers, which is expected to motivate more frequent use of alternative transport options.	Provided the right legislation, distance-based charging can successfully replace nationally-collected fuel duty as a revenue source for road maintenance.

References

1. Martin, A. (1996). Underground Overground: A Passenger's History of the Tube.
2. Centre for London estimate based on Transport for London (TfL) data.
3. TfL (2019). Roads. Retrieved from: https://tfl.gov.uk/corporate/about-tfl/what-we-do/roads
4. The average number of trips per person declining 20 per cent in the last ten years. TfL (2018). Travel in London Report 11.
5. Travel time spent as the driver/passenger of a car falling from 26.1 to 18.7 minutes per person per day in the ten years to 2018. TfL (2018). London Travel Demand Survey: 2017/18.
6. The number of licensed vehicles per head declined by eight per cent between 2009 and 2017, despite the population growing by 11 per cent in the same period. Department for Transport (DfT) (2019). Number of Licensed Vehicles by type; Office for National Statistics (2018). Population Estimates for UK, England and Wales, Scotland and Northern Ireland.
7. Across England, 30 per cent of 17-20 year olds had a full driving licence in 2017 compared to 48 per cent in 1994, and two-thirds (67 per cent) of 21-29 year olds had a full driving licence in 2017 compared to three-quarters (75 per cent) in 1994. DfT (2018). NTS0201: Full car driving licence holders by age and gender: England.
8. DfT (2018). TRA0206: Motor vehicle traffic (vehicle kilometres) by vehicle type, region and country in Great Britain; TfL travel in London report 11, Figure 7.4
9. TfL (2018). Travel in London. Report 11. Individual data on vehicle kilometres by taxi and PHV is not currently available. They are currently listed in the same category as other cars.
10. DfT (2018) TRA0206; TfL (2018) Travel in London. Report 11. Figure 7.1
11. Reed, T., & Kidd, J. (2019). Global Traffic Scorecard, Altrincham: INRIX Research
12. TfL (2017). Travel in London Report 10.
13. Reed, T., & Kidd, J. (2019). Global Traffic Scorecard, Altrincham: INRIX Research
14. Begg, D. (2016). The impact of congestion on Bus Passengers, Greener Journeys.
15. Barrett, S., & Belcher, E. (2019). The London Intelligence Issue 7. London: Centre for London

16. SLoCaT Partnership (2018). Transport and Climate Change Global Status Report 2018, p. 77. Available at: http://slocat.net/tcc-gsr
17. Greater London Authority (2017). Draft Environment Strategy – Appendix 2: Evidence Base, Figures 5, 6, 7.
18. Barlow, T., Boulter, P., McCrae, I., et al. (2007). Non-Exhaust Particulate Matter Emissions from Road Traffic: Summary Report prepared for Department for the Environment, Food and Rural Affairs, and the Devolved Administrations.
19. Royal College of Physicians (2016). Every breath we take: the lifelong impact of air pollution. Report of a working party.
20. WHO quoted at https://www.gov.uk/government/news/plan-for-roadside-no2-concentrations-published
21. See Figure 28, Barrett, S., & Belcher, E. (2019). The London Intelligence Issue 7. London: Centre for London
22. Walton, H. et. al. (2015). Understanding the Health Impacts of Air Pollution in London. London: King's College London for Transport for London and the Greater London Authority
23. Public Health England (2019). Improving outdoor air quality and health: review of interventions.
24. London Councils (2018). Air Quality Poll, June 2018. Retrieved from: https://www.londoncouncils.gov.uk/our-key-themes/environment/air-quality-london/air-quality-public-polling/2018-air-quality-polling
25. Carrington, D., (13 December 2018) Cyclists 'exposed to less air pollution than drivers' on busy routes. Retrieved from: https://www.theguardian.com/environment/2018/dec/13/cyclists-exposed-to-less-air-pollution-than-drivers-on-congested-routes-study
26. British Heart Foundation (2017). Physical Inactivity and Sedentary Behaviour Report 2017.
27. Mayor of London (2015). Health Impact of Cars in London. London: Greater London Authority.
28. TfL (2018). London Travel Demand Survey: 2017/18
29. Mayor of London (2015).
30. Dajnak, D & Walton, H. (2018). Waltham Forest study of life expectancy benefits of increased physical activity from walking and cycling. London: Kings College London.
31. TfL (2017). Casualties in Greater London during 2017: September 2018. Retrieved from: http://content.tfl.gov.uk/casualties-in-greater-london-2017.pdf

32. Mercer (20 March 2018) Vienna tops Mercer's 20th Quality of Living Ranking. Retrieved from: https://www.mercer.com/newsroom/2018-quality-of-living-survey.html
33. Walker, T., (2017). 'It's the worst place to park in the world' – why Britain is at war over parking. The Guardian. Retrieved from: https://www.theguardian.com/world/2017/may/29/car-parking-spaces-wars-britain-worst
34. TfL (2019). Fares from 2 January 2019. Retrieved from: https://tfl.gov.uk/campaign/new-fares#on-this-page-7
35. The CC provided a net income of only £156 million, while TfL had a total of £725 million gross expenditure on streets in 2017/18. TfL (2018). Annual Report and Statement of Accounts 2017/18.
36. London Assembly Budget and Performance Committee (2018). TfL Finances: The End of the Line?, London: Greater London Authority.
37. London Councils (2018). State of the City Report: London's Highways 2018. London Councils.
38. The RAC Pothole Index 2018 estimated UK drivers were more than 2.5 times as likely to suffer a pothole breakdown than they were in 2006. RAC (2018). Drivers more than twice as likely to breakdown due to hitting a pothole than 12 years ago. [Press Release]. Retrieved from: https://media.rac.co.uk/pressreleases/drivers-more-than-twice-as-likely-to-breakdown-due-to-hitting-a-pothole-than-12-years-ago-2759961
39. Asphalt Industry Alliance (2018). Annual Local Authority Road Maintenance Survey 2018.
40. Aether (2013). Analysing Air Pollution Exposure in London. Report to Greater London Authority. Oxford: Aether Ltd.
41. Royal College of Physicians (2016). Every breath we take: the lifelong impact of air pollution. Report of a working party.
42. Edwards et al. (2006). Deprivation and Road Safety in London: A report to the London Road Safety Unit. London: LSHTM; Royal Society for the Prevention of Accidents (2012). Social Factors in Road Safety: Policy Paper.
43. Hanna, K. and Bosetti, N. (2015). Inside Out: The New Geography of Wealth and Poverty in London. London: Centre for London.

44. Office for National Statistics (2019). Percentage of households with cars by income group, tenure and household composition.
45. DfT (2019). HGV Road User Levy. Retrieved from: https://www.gov.uk/government/collections/hgv-road-user-levy#announcements
46. DfT (2019). Pay the Dartford Crossing charge (Dart Charge). Retrieved from: https://www.gov.uk/pay-dartford-crossing-charge
47. Butcher, L. (2018). Local road charges, Briefing Paper Number SN01171. London: House of Commons Library
48. Except for Durham, which introduced a small charge for vehicles entering its World Heritage Site.
49. Montgomery, C. (2013). Happy City: Transforming Our Lives Through Urban Design. First edition, New York: Farrar, Straus and Groux.
50. TfL (2018). Changes to the Congestion Charge. Report to the Mayor on the consultation.
51. TfL (2008). Central London Congestion Charging Impacts monitoring: Sixth Annual Report, July 2008.
52. TfL (2018). Travel in London Report 11.
53. London First (2016). Jams Today, Jams Tomorrow: How smarter congestion charging can keep London moving.
54. See TomTom Traffic Index. Retrieved from: https://www.tomtom.com/en_gb/trafficindex/city/london
55. Aether (2019). Air Pollution Exposure in London: Impact of the London Environment Strategy. A Report for the Greater London Authority. Oxford: Aether Ltd.
56. Eddington, R. (2006). The Eddington Transport Study, The case for action: Sir Rod Eddington's advice to Government, 39-41.
57. BBC (21 February 2007). PM denies road toll 'stealth tax'. Retrieved from: http://news.bbc.co.uk/1/hi/uk_politics/6381153.stm
58. Sturcke, J. (12 December 2008). Manchester says no to congestion charging. Retrieved form: https://www.theguardian.com/politics/2008/dec/12/congestioncharging-transport
59. DfT (2018). British Social Attitudes Survey (ATT03).
60. Ibid.
61. London Councils (2018). Air Quality Poll, June 2018.

62. Populus (2016). Traffic Congestion and Road Charging Survey. Retrieved from: https://www.london.gov.uk/sites/default/files/survey_results_-_congestion_and_road_charging.pdf
63. Ricardo (2019). Real-world emissions in the London ULEZ, https://ee.ricardo.com/news/real-world-emissions-in-the-london-ulez
64. Some literature suggests charging levels could be linked to social, as well as vehicle, characteristics, for example for senior citizens, key workers or different income groups. See for example, Walker, J. and Pickford, A. "Types of road pricing, and measuring scheme cost and performance" in Walker, J. (ed) (2018). Road Pricing: Technologies, economics and acceptability, The Institution of Engineering and Technology, p. 79.
65. Consultancy.uk (2017). UK smartphone penetration continues to rise to 85 per cent of adult population.
66. A journey time guarantee was proposed in Volterra and Jacobs' Wolfson Prize shortlisted entry: Volterra and Jacobs (2017). Pricing for Prosperity.
67. There are a number of other practical issues that would need to be addressed to prevent abuse of the system. For example, only longer journeys may be eligible for a refund to prevent drivers seeking compensation for shorter journeys that exceed the estimate by under 10 minutes. If an accident beyond the highway authority's control happens on route, this may also make the journey ineligible for a refund.
68. Barrett, S., Colthorpe, T., & Wedderburn, M. (2017). Street Smarts: Report of the Commission on the Future of London's Roads and Streets. London: Centre for London
69. Millard-Ball, A. (2019). The autonomous vehicle parking problem in Transport Policy, Vol. 75, 99-108.
70. Detailed analysis and assumptions used in the modelling will be published separately and are available on request from Centre for London.
71. The lowest congestion bands, 1 and 2, are not charged at all; band 4 is charged twice as much as band 3 and band 5 three times as much. All geographies are charged but Inner London charged double and Central quadruple. Electric vehicles are not charged at all, hybrids only the base charge and the multiplier rises to 5 for Euro 1 vehicles. Black cabs are not charged, LGV and HGV are charged 1.5 times more as cars.

72. Department for Environment, Food & Rural Affairs (2019). Clean Air Strategy 2019.
73. There are four classes of Clean Air Zone: Class A charges buses, coaches, taxis and PHVs; Class B covers all of those plus HGVs; Class C covers all from Class B plus LGVs; Class D covers all from Class C plus cars. Many cities are opting for Class C.
74. BVRLA (2019). Road to Zero: time to shift gear on tax; ICE (2019) Pay As You Go: Achieving Sustainable Roads Funding in England.
75. Millard-Ball, A. (2019). The autonomous vehicle parking problem in Transport Policy, Vol. 75, 99-108.
76. TU (2 October 2018) 917,000 fewer compasses with fossil-powered cars since the rush hour fee was introduced. Retrieved from: https://www.tu.no/artikler/917-000-faerre-bompasseringer-med-fossildrevne-biler-siden-rushtidsavgiften-ble-innfort/447651
77. Twenty-Eight by '28 (N.D.) Twenty-Eight by '28 Programme Financing/Funding Plan White Paper. Retrieved from: http://metro.legistar1.com/metro/attachments/18984512-fa10-4b43-aa52-524cfd8bb69a.pdf
78. Opiola, J. (2013). Oregon tests new mileage-based charging scheme. Retrieved from: http://www.itsinternational.com/categories/charging-tolling/features/oregon-tests-new-mileage-base-charging-scheme/

Published by:
Centre for London 2019

32 - 33 Hatton Garden
London , EC1N 8DL
T: 020 3757 5555
hello@centreforlondon.org
centreforlondon.org
Company Number: 8414909
Charity Number: 1151435

About Centre for London

We are London's think tank.
Our mission is to develop new solutions to London's critical challenges and advocate for a fair and prosperous global city.

We are a politically independent charity.
We help national and London policymakers think beyond the next election and plan for the future.

We have ideas with impact.
Through research, analysis and events we generate bold and creative solutions that improve the city we share.

We believe in the power of collaboration.
We bring together people from different parts of the city - with a range of experience and expertise - to develop new ideas and implement them.

As a charity we rely on the support of our funders.
Our work is funded by a mixture of organisations and individuals who share our vision for a better London.

Find out more at **centreforlondon.org**

London's roads and streets are increasingly congested, polluted and dominated by cars. Road user charging can help manage demand for limited road space and reduce reliance on cars, but the current system is increasingly complicated. Green Light examines how technology can help create a simpler, smarter system and a healthier, more liveable city.

This project has been generously supported by funders Van and Eva DuBose and major sponsors Arup, emovis, Mastercard and the C40 Cities Climate Leadership Group.

CENTRE FOR LONDON

ENVIRONMENT SCRUTINY COMMISSION

MUNICIPAL YEAR 2019-20

AGENDA DISTRIBUTION LIST (OPEN)

NOTE: Original held by Scrutiny Team; all amendments/queries to Fitzroy Williams Tel: 020 7525 7102

Name	No of copies	Name	No of copies
		Julie Timbrell, Scrutiny Team SPARES	10
		External	
Electronic Copy **Members** <u>Councillors:</u> Councillor Leanne Werner Councillor Tom Flynn Councillor Radha Burgess Councillor Michael Situ Councillor Richard Leeming Councillor Graham Neale Councillor Damian O'Brien <u>Coopted member:</u> Jeremy Leach **Reserves Members** Councillor Peter Babudu Councillor Karl Eastham Councillor Renata Hamvas Councillor Eleanor Kerslake Councillor Lorraine Lauder MBE Councillor Adele Morris		**Total: 10** **Dated: September 2019**	