



Proposed changes to the ULEZ (start date and emissions standards)

Consultation and information document
April 2017

About Transport for London

Part of the Greater London Authority family of organisations led by Mayor of London Sadiq Khan, we are the integrated transport authority responsible for delivering the Mayor's strategy and commitments on transport.

As a core element in the Mayor's overall plan for London, our purpose is to keep London moving, working and growing, and to make life in our city better. We reinvest all of our income to run and improve London's transport services and to make it safer, more modern and affordable for everyone.

Our operational responsibilities include London Underground, London Buses, Docklands Light Railway (DLR), London Overground, TfL Rail, London Trams, London River Services, London Dial-a-Ride, Victoria Coach Station, Santander Cycles and the Emirates Air Line.

On the roads, we regulate taxis and the private hire trade, run the Congestion Charging and Low Emission Zone (LEZ) schemes, manage the city's 580km red route network, operate all of the Capital's 6,300 traffic signals and work to ensure a safe environment for all road users.

We are delivering one of the world's largest programmes of transport capital investment, which is building the Elizabeth line, modernising Tube services and stations, transforming the road network and making it safer, especially for more vulnerable road users, such as pedestrians and cyclists.

We work hard to make journeys easier through effective use of technology and data. We provide modern ways to pay, through Oyster and contactless payment cards, and provide information in a wide range of formats to help people move around London.

Real-time travel information is provided directly by us and through third party organisations, which use the data we make openly and freely available to power apps and other services.

We listen to, and act upon, feedback and complaints to constantly improve our services and work with communities, representative groups, businesses and many other stakeholders to shape transport provision in London.

Improving and expanding transport in London is central to driving economic growth, jobs and housing throughout the United Kingdom. Where possible, we are using our land to provide thousands of new, affordable homes. Our own supply chain creates tens of thousands of jobs and apprenticeships across the country.

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Overview

Air pollution is one of the most significant challenges facing the Capital, affecting the health of every Londoner.

The Mayor's Clean Air Action Plan¹, announced in July 2016, outlines the Mayor's commitment to addressing London's poor air quality. This includes the introduction of the, now confirmed, Emissions Surcharge (often dubbed the 'T-Charge')², introducing the Ultra Low Emission Zone (ULEZ) sooner (addressed in this consultation) and expanding the size of the zone (to be consulted on later in the year).

The Mayor's Clean Air Action Plan also included the development of a detailed proposal for a national diesel scrappage fund for the Government to implement³ and proposals for Low Emission Bus Zones (previously called 'clean bus corridors')⁴.

The ULEZ will require most vehicles driving within central London to meet specified exhaust emissions standards or pay a daily charge. It was confirmed it would start on 7 September 2020 by the previous administration following a statutory consultation⁵.

This consultation is part of a series relating to the Mayor's new proposals to tackle air quality (see Chapter 4 for more detail). It is Stage 3a, and informed by the responses to Stages 1 and 2, it looks at the following two proposals:

- Proposal 1: Introducing the central London ULEZ on 8 April 2019 (17 months earlier than it is currently due to begin)
- Proposal 2: Revising the ULEZ emissions standards to include particulate matter (PM) emissions from diesel vehicles from that date. The ULEZ standards currently only relate to nitrogen oxides (NO_x)

This is a formal statutory consultation by the Mayor and Transport for London (TfL) and we invite you to provide your views. A summary of the consultation and a short questionnaire can be found at: tfl.gov.uk/airquality-consultation

The Mayor is expected to make a decision on whether to confirm the proposals (with or without modifications) in summer 2017, after reviewing public and stakeholder responses to this consultation and other relevant considerations.

¹ <https://www.london.gov.uk/press-releases/mayoral/mayor-unveils-action-plan-to-battle-toxic-air>

² <https://consultations.tfl.gov.uk/environment/air-quality-consultation-phase-2016/>

³ <https://www.london.gov.uk/press-releases/mayoral/mayor-urges-government-over-diesel-scrappage-fund>

⁴ <https://www.london.gov.uk/press-releases/mayoral/mayor-announces-10-new-low-emission-bus-zones>

⁵ <https://consultations.tfl.gov.uk/environment/ultra-low-emission-zone/>

Expanding the ULEZ

Later this year, we plan to consult on proposals to expand the ULEZ on behalf of the Mayor. No additional information regarding the emerging ideas for expanding the ULEZ is included in this consultation. However, any relevant consultation responses received as part of this consultation and responses to the previous Stage 1 and 2 consultations, will be taken into consideration when developing proposals for expanding the ULEZ.

The Mayor's Transport Strategy

The Mayor's longer-term approach for addressing emissions from transport, to reduce air pollution and mitigate climate change, will be included in the new draft Mayor's Transport Strategy (MTS) being consulted on this spring, with the final version anticipated to be published at the end of the year.

The ULEZ is an important step in tackling harmful emissions from road transport in London. The London-wide LEZ, which was first introduced in 2008, was designed to tackle PM emissions and the current ULEZ was designed to tackle NO_x emissions. The Mayor is now proposing to tighten ULEZ to tackle both NO_x and PM in recognition that more needs to be done to reduce these pollutants and improve the health of Londoners.

The MTS will set out how the Mayor plans to build on the ULEZ and achieve his ambition for a zero carbon London by 2050. Whilst the current objective of emissions based road user charging schemes in London, such as the ULEZ, is to discourage the use of the oldest, most polluting petrol and diesel vehicles, ultimately achieving a zero carbon city will involve phasing out the use of fossil fuels altogether.

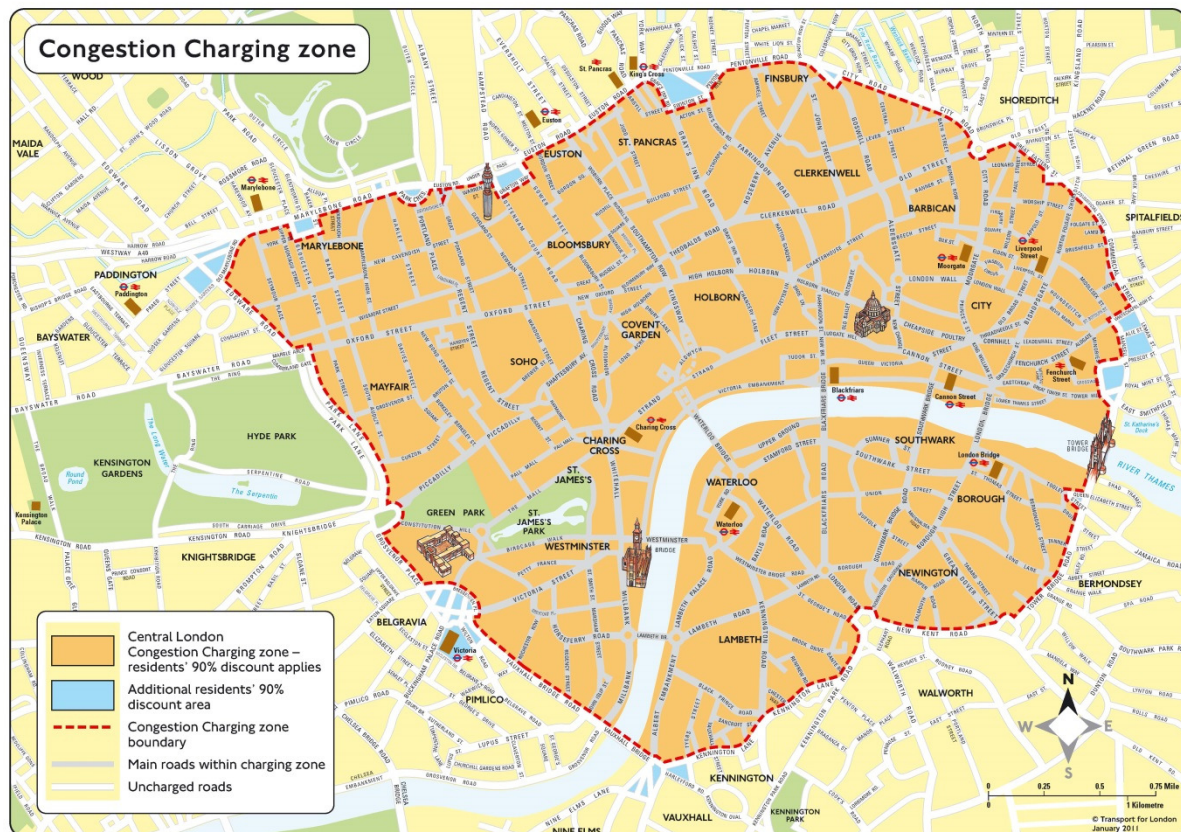
Chapter 1: Proposals to amend the Ultra Low Emission Zone (ULEZ)

1.1 The current ULEZ emissions standards and charges

The start date for the ULEZ was confirmed by the previous administration as 7 September 2020⁶.

From this date, all cars (except taxis, which are subject to environmental requirements through the taxi licensing system), motorcycles, vans, minibuses, buses, coaches and heavy goods vehicles (HGVs) will need to meet certain exhaust emissions standards (ULEZ standards), or pay a daily charge, when travelling in the ULEZ. Currently the zone covers the same area as the Congestion Charging zone (CCZ) in central London.

Figure 1: Congestion Charging zone



⁶ The previous administration confirmed the ULEZ scheme as part of a statutory consultation. More detail can be found here <https://consultations.tfl.gov.uk/environment/ultra-low-emission-zone/>

Table 1 is a summary of the current ULEZ standards and daily charges (see Appendix A for more details on the Euro standards). The ULEZ will operate 24 hours a day, every day of the year, including weekends and public holidays. The daily ULEZ charge is payable in addition to any Congestion Charge or LEZ charges that are already applied.

Table 1: Current ULEZ emissions standards

Vehicle type (includes hybrid vehicles)	Minimum NO_x emissions standards⁷	Date from which newly registered vehicles must meet the new emissions standards (usually a year earlier for earlier adopters – see Appendix A)	Daily charge if vehicle is not compliant with ULEZ standards⁸
Motorcycle, moped etc – Category L	Euro 3	From 1 July 2007	£12.50
Car and small van – Categories M1 and N1 (I)	Euro 4 (petrol)	From 1 January 2006	£12.50
	Euro 6 (diesel)	From 1 September 2015	
Large van and minibus – Categories N1 (II and III) and M2	Euro 4 (petrol)	From 1 January 2007	£12.50
	Euro 6 (diesel)	From 1 September 2016	
HGV – Categories N2 and N3	Euro VI	From 1 January 2014	£100
Bus/coach – Category M3	Euro VI	From 1 January 2014	£100

In addition to meeting the ULEZ standards we have also set additional requirements that all double-decker buses operating in the ULEZ in central London are hybrid⁹ and all single-decker buses have zero harmful exhaust emissions¹⁰.

Under the current scheme, a vehicle complies with the ULEZ standards if it meets the NO_x emissions limit for the corresponding Euro standard set out in Table 1. This

⁷ Euro standards for heavy duty diesel engines use Roman numerals (I–VI) and light duty vehicle standards use Arabic numerals (1–6). The current ULEZ standards only apply to the level of NO_x emissions

⁸ This is payable in addition to any applicable LEZ and/or Congestion Charge

⁹ A hybrid vehicle utilises batteries and electric traction motors working in conjunction with the internal combustion engine

¹⁰ A zero emission vehicle utilises either rechargeable batteries and electric traction motors, or a hydrogen fuel cell and electric traction motors. The term “zero harmful exhaust emissions” is used here in recognition that these vehicles still produce PM emissions from their tyres and brakes. These vehicles are often simply referred to as ‘zero emission’.

applies to vehicles that were sold meeting the required Euro standard ('type approved') or that have been adapted (or 'retrofitted') and certified to meet the required Euro emissions standard for NO_x.

We have developed an online compliance checker tool¹¹ to enable drivers to check whether or not their vehicle meets the ULEZ standards. For vehicle owners considering retrofitting their vehicles to meet the emissions standard, the Government is developing a national retrofit certification scheme¹², which, once in place, can be used to provide evidence to TfL that a vehicle has been retrofitted to meet the required Euro standard.

The ULEZ currently covers the same area as the Congestion Charge zone, which is clearly signposted (see Figure 1 on page 7). There will be no barriers or toll booths. Cameras will read vehicle number plates as vehicles are driven into and within the zone and check them against a database to establish whether or not a vehicle is compliant with the requirements of the scheme¹³.

If a vehicle does not comply with the ULEZ standards and the daily ULEZ charge is not paid, a Penalty Charge Notice (PCN) will be issued. This penalty, which must be paid by the vehicle's registered keeper or operator, is in addition to any Congestion Charge or LEZ penalties received for non-payment of those charges. For motorcycles, cars, vans and minibuses this will be £130 (reduced to £65 if paid within 14 days). For HGVs, coaches and buses it will be £1,000 (reduced to £500 if paid within 14 days).

1.2 Proposal 1: Introduction of the ULEZ in April 2019

The Mayor is proposing an earlier start date for the ULEZ standards and non-compliance charges to improve air quality sooner than currently planned. It is proposed that the ULEZ is introduced on 8 April 2019, approximately 17 months earlier than the previously approved start of 7 September 2020. The estimated impacts of this proposal can be found in Chapter 5. An independent Integrated Impact Assessment (IIA) was also carried out by Jacobs Consultancy. A summary of the findings is provided in section 5.11 of this document and the full report is attached as Appendix H.

¹¹ <https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/check-your-vehicle>

¹² See paragraph 94, page 22 of Defra's Improving air quality in the UK, UK overview document, December 2015 (<https://www.gov.uk/government/publications/air-quality-in-the-uk-plan-to-reduce-nitrogen-dioxide-emissions>)

¹³ The database will be compiled using information from the Driver and Vehicle Standards Agency, vehicle manufacturers and drivers and operators who have registered with TfL

Residents' vehicles

Under approved arrangements, registered residents who live within the ULEZ¹⁴ and who have vehicles that are not compliant with the ULEZ emissions standards will benefit from a three-year 'sunset period' from the start of the ULEZ (currently 7 September 2020). This would mean that for three years, registered residents would be entitled to a 100 per cent discount on the ULEZ daily charge. At the end of this period (from 7 September 2023) residents will be liable for the full daily charge if they use a vehicle that does not meet the ULEZ emissions standards.

We are proposing to maintain the residents' sunset period at three years. Therefore, the end of the sunset period would also be brought forward by 17 months, and end in April 2022. As a result, ULEZ residents would need to comply with the ULEZ emissions standards from 11 April 2022 or pay the daily charge.

Residents would continue to pay the Emissions Surcharge, at a discounted rate of 90 per cent, during the ULEZ sunset period.

Views are sought as to whether the proposed residents' sunset period is appropriate.

Disabled tax class vehicles

The currently confirmed ULEZ scheme sets out that vehicles with a disabled tax class, which are exempt from Vehicle Excise Duty, will benefit from a three-year sunset period from the start of the ULEZ. This includes vehicles used by a disabled person and disabled passenger vehicles. The criteria and eligibility for these tax classes is set by the Government. This is not to be confused with Blue Badge holders, who will not be eligible for a discounted ULEZ charge.

In view of the limited alternative options for disabled tax class vehicles, which may have substantial and expensive modifications, we are proposing to maintain the end of the sunset period for vehicles with a disabled tax class at September 2023, meaning these vehicles will have a sunset period of approximately 4.5 years.

Views are sought as to whether the proposed sunset period for disabled tax class vehicles is appropriate.

Taxis

Taxis are currently exempt from the ULEZ, because their emissions are being addressed through environmental licensing requirements, and there are no proposals to change this. In 2015, following the original ULEZ consultation, we announced new zero emission capable (ZEC) licensing requirements for taxis to be introduced from 2018. These are detailed in section 3.4.

¹⁴ The ULEZ residents' discount is available to registered residents within the zone and in designated areas next to the zone (which will be the same areas as applies to the Congestion Charge residents' discount). A resident who moves out of the ULEZ area would no longer be eligible for this discount.

Other discounts and exemptions

Other approved exemptions and discounts to the ULEZ are based largely on those of the LEZ. These include military vehicles, historic tax class vehicles, Showman's vehicles and non-road going vehicles which may be driven on the highway (for example some agricultural vehicles excavators and certain types of mobile crane). Further detail is provided on the TfL website¹⁵. There are no proposals to change these existing approved discounts and exemptions.

TfL bus fleet

Irrespective of whether the Mayor decides to introduce the ULEZ in 2019, we have committed to ensure all TfL buses operating in the ULEZ will meet the Euro VI emissions standard for both NO_x and PM by 8 April 2019 at the latest.

As part of the original ULEZ proposals, we committed to additional requirements to ensure all double-decker TfL buses operating in the central London ULEZ are hybrid and all single-decker TfL buses are zero emission¹⁰ from September 2020.

We have now committed to bringing forward the hybrid requirement for double-decker buses in central London to September 2019. We are also aiming to introduce the zero emission single-decker buses as quickly as possible. Charging infrastructure is required to operate these buses and we remain committed to all single-decker buses being zero emission by September 2020 at the latest, however they will still be at least Euro VI by April 2019.

1.3 Proposal 2: Revision of ULEZ emissions standards for diesel vehicles to include particulate matter emissions

As described in Chapter 2, particulate matter (PM) is one of the pollutants of most concern in London. The ULEZ scheme approved by the previous Mayor only sets an emissions standard for NO_x emissions. The Mayor is proposing to strengthen the emissions standards to also cover PM emissions from diesel vehicles. Older diesel vehicles emit significantly higher PM from exhausts, and the Euro 6 PM limit for diesel vehicles is 90 per cent lower than the equivalent at Euro 3.

The Euro 4 standard for petrol vehicles does not include limits for PM emissions and therefore petrol vehicles will not be affected by this change. PM limits for diesel vehicles were introduced for earlier diesel Euro standards than for petrol Euro standards, due to the higher PM emissions of early diesel vehicles.

Although London is compliant with legal limits for concentrations of PM, it is important that more is done to further reduce levels and bring about further health benefits. Changing the ULEZ emissions standards to cover both NO_x and PM emissions limits is a clear indication that the Mayor is serious about improving air quality and wants the very cleanest diesel vehicles on London's roads.

¹⁵ <https://tfl.gov.uk/modes/driving/low-emission-zone/check-if-your-vehicle-is-affected/exemptions-and-discounts>

The proposed change will align with the Government’s proposed Clean Air Zone Framework, which forms part of the national plan to meet legal limits for NO₂ concentrations and sets emissions standards for both NO_x and PM. The proposed change will also align the ULEZ emissions standard with the Government’s anticipated national Euro VI retrofit certification standard for heavy-duty vehicles, which requires diesel vehicles to meet both NO_x and PM emissions standards in order to be certified. The national retrofit certification scheme will be used to certify retrofitted vehicles for ULEZ and would therefore mean certified vehicles already comply with Euro VI emissions limits for both NO_x and PM.

Diesel vehicles that are type approved as Euro 6/VI already meet the proposed ULEZ emissions standards for both pollutants and will not be affected by this change.

Table 2: Proposed revised ULEZ emissions standards (with the inclusion of PM standards)

Vehicle type (includes hybrid vehicles)	Minimum NO _x emissions standards	Proposed additional minimum PM emissions standards	Date from which newly registered vehicles must meet the new emissions standards (usually a year earlier for earlier adopters – see Appendix A)	Daily charge if vehicle is not compliant with ULEZ standards ¹⁶
Motorcycle, moped etc – Category L	Euro 3	n/a	From 1 July 2007	£12.50
Car and small van – Categories M1 and N1 (I)	Euro 4 (petrol)	n/a	From 1 January 2006	£12.50
	Euro 6 (diesel)	Euro 6 (diesel)	From 1 September 2015	
Large van and minibus – Categories N1 (II and III) and M2	Euro 4 (petrol)	n/a	From 1 January 2007	£12.50
	Euro 6 (diesel)	Euro 6 (diesel)	From 1 September 2016	
HGV – Categories N2 and N3	Euro VI	Euro VI	From 1 January 2014	£100
Bus/coach – Category M3	Euro VI	Euro VI	From 1 January 2014	£100

1.4 Payment by app

We are also proposing a revision to the Scheme Order to enable payment of the ULEZ and LEZ charges by app¹⁷, in line with payments for the Congestion Charge.

¹⁶ This is payable in addition to any applicable LEZ and/or Congestion Charge

¹⁷ A charge is paid by app if it is paid by credit or debit card through a software application, for the use on an electronic device (eg smartphone), provided for that purpose by TfL

1.5 Summary of the proposed consultation changes to the ULEZ

A summary of the proposed changes is set out below:

Proposal 1: We are proposing an earlier introduction for the ULEZ of 8 April 2019, bringing forward the start date by 17 months from September 2020.

As a result:

- We are proposing to maintain the three-year sunset period for registered residents, so they would need to comply with ULEZ standards from 11 April 2022 or pay a daily charge
- We are proposing to maintain the end of the sunset period for vehicles with a disabled tax class at September 2023, meaning these vehicles will have a sunset period of approximately 4.5 years after which they would need to comply with the ULEZ standards or pay a daily charge (from 11 September 2023)

Proposal 2: We propose to strengthen the ULEZ emissions standards for diesel vehicles to include a Euro 6/VI minimum requirement for PM in addition to the already confirmed NO_x Euro 6/VI requirement. As there are no PM limits within the Euro 4 standard for petrol vehicles, their ULEZ standards will remain as Euro 4 for NO_x emissions only.

Chapter 2: The case for further intervention

2.1 Air pollution and public health

While the Mayor has a duty to help achieve the legal limits for air pollutants in Greater London, the real driver for tackling air pollution is the benefit to public health. Poor air quality affects the health of every Londoner but it is also a social justice issue as deprived communities are more likely to be located in areas with poor air quality¹⁸.

The two pollutants causing the greatest concern for health in the Capital are¹⁹:

- **Nitrogen dioxide (NO₂):** At high concentrations, NO₂ causes inflammation of the airways. Long-term exposure is associated with reduced lung development in children and has been associated with an increase in symptoms of bronchitis in asthmatic children
- **Particulate matter (PM):** Long-term exposure to very small particles increases the risk of early death from diseases of the heart and lung. Research shows that particles with a diameter of 10 microns and smaller (PM₁₀) are likely to be inhaled deep into the respiratory tract. The health impacts of particles with a diameter of 2.5 microns or smaller (PM_{2.5}) are especially significant, as smaller particles can penetrate even deeper and can cross over into the bloodstream

In addition to the long-term impacts, short-term exposure to high levels of air pollution increases the risk of hospital admissions for heart and lung conditions, and worsens the symptoms and severity of asthma.

In 2015, the Greater London Authority (GLA) published an assessment of the combined health impacts of long-term exposure to PM_{2.5} and NO₂²⁰. This assessment found that, on average, if a baby born in London in 2010 was exposed to that same level of air pollution for its life, they would be expected to die around two years earlier than if they had not been exposed to air pollution.

Children are especially sensitive to harm and air pollution can affect their lung development, leading to an increased risk of ill health later in life. A six-year study found that children living in highly polluted parts of London have up to 10 per cent less lung capacity than normal²¹. However, there is also some evidence that damage

¹⁸ <http://www.sciencedirect.com/science/article/pii/S0269749114005144>

¹⁹ <http://www.who.int/mediacentre/factsheets/fs313/en/>

²⁰ <http://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/understanding-health-impacts-air-pollution-london>

²¹ <http://sro.sussex.ac.uk/56496/>

to children's lungs can be reversed if air quality improves²²; strengthening the case for urgent action.

Worldwide, the scientific evidence for other health impacts related to air pollution is growing. A recent study found an association between air pollution and dementia²³ whilst another reported an association between high levels of exposure to NO₂ in pregnancy and a higher risk of birth defects²⁴.

2.2 London's responsibility – air quality

The Air Quality Standards Regulations 2010 set legal limits (called 'limit values') for concentrations of pollutants in outdoor air. These, whilst transposed from European Union directives²⁵ into UK law, will remain in force regardless of the UK leaving the EU, unless specifically repealed.

²² <http://www.nejm.org/doi/full/10.1056/NEJMoa1414123>

²³ [http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(16\)32399-6/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(16)32399-6/abstract)

²⁴ <http://med.stanford.edu/news/all-news/2013/03/air-pollutants-linked-to-higher-risk-of-birth-defects-researchers-find.html>

²⁵ [Ambient Air Quality Directive \(2008/50/EC\)](#) and [Directive 2004/107/EC](#)

Table 3: Legal limits for the pollutants of most concern in London²⁶

Pollutant	Concentration (limit value) Micrograms per cubic metre	Averaging period	Targets and limit values	Number of permitted exceedences each year	Compliance assessment for 2015 in Greater London ²⁷
PM _{2.5}	25 µg/m ³ ²⁸	One year	Target value came into force on 1 January 2010 Limit value came into force on 1 January 2015	n/a	Compliant
PM ₁₀	50 µg/m ³	24 hours	Limit value came into force on 1 January 2005 (time extension granted to June 2011)	35	Compliant ²⁹
	40 µg/m ³	One year	Limit value came into force on 1 January 2005	n/a	Compliant
NO ₂	200 µg/m ³	One hour	Limit value came into force on 1 January 2010	18	Not compliant
	40 µg/m ³	One year	Limit value came into force on 1 January 2010	n/a	Not compliant

The Department for Environment, Food & Rural Affairs (Defra) reported PM compliance limits for 2015 across England and Wales, with most 'non-reportable' sites³⁰ in London falling below the legal limits. However, there are no safe limits for PM_{2.5}, which is more damaging to health than PM₁₀. Health evidence suggests that further emissions reductions will bring about improvements in health for Londoners. Without further action, there is the prospect of PM_{2.5} emissions increasing if traffic

²⁶ Taken from ec.europa.eu/environment/air/quality/standards.htm

²⁷ The Department for Environment, Food & Rural Affairs (Defra) reports on compliance to the European Commission on behalf of the UK, in accordance with the Air Quality Directive. The most recent compliance assessment is for 2015 <http://uk-air.defra.gov.uk/library/annualreport/index>

²⁸ An obligation to reduce exposure to concentrations of fine particles also came into force from 2015

²⁹ Following the subtraction of natural sources in accordance with the Directive

³⁰ 'Non-reportable sites' are air quality monitoring sites that are not part of the official monitoring used to determine compliance with legal limit values for air pollution

levels rise because of the continued contribution of non-exhaust particulate emissions, including brake and tyre wear and road abrasion.

Crucially, large areas of the Capital continue to exceed both the annual mean and hourly legal limits for NO₂ and this is likely to continue beyond 2020, unless more action is taken. Within the first week of 2017, Putney High Street and Brixton Road breached hourly legal limits in terms of the number of times pollution episodes are allowed. Further information on pollutant concentrations in London is provided later in this chapter.

Improving air quality in the Capital is a shared legal responsibility. Under the Greater London Authority (GLA) Act 1999, the Mayor must prepare a London Environment Strategy (LES) looking at, among other things, the Capital's air quality and how it can be enhanced to meet legal limits. The Mayor leads on the implementation of measures in London to tackle pollution emissions, reduce exposure, raise awareness and integrate air quality and public health.

There is a basic framework in place for local air quality management ('LAQM') under the national Air Quality Standards Regulations and Part IV of the Environment Act 1995. This remains in place and is applicable to London's 32 boroughs and the City of London. However, it has been agreed with Defra that the LAQM policy and technical guidance for London should be different from that in the rest of the country, in recognition of the particular challenges London faces. As a result, a bespoke London Local Air Quality Management (LLAQM) system came into force in 2015 under the Mayor to enable an enhanced focus on and coordination of the boroughs' air quality work. Under this system, the Mayor issues policy and technical guidance for London in recognition of his London-wide supervisory role³¹.

The Mayor's Air Quality Strategy

The Mayor is in the process of creating a new LES, which will supersede and incorporate the Mayor's Air Quality Strategy (MAQS). Until this is formally approved and published, following statutory consultation, the current MAQS (published in 2010) continues to apply.

The 2010 MAQS³² sets out policies and proposals for improving the Capital's air quality and therefore the health of Londoners. It was developed in conjunction with the MTS, The London Plan, the Climate Change Mitigation and Energy Strategy, The London Climate Change Adaptation Strategy and The Mayor's Municipal Waste Management Strategy. It includes policies and measures to tackle air pollution from a wide range of sources, such as buildings, not just transport.

Transport policies in the MAQS cover five categories: smarter choices and sustainable travel behaviour; technological change and cleaner vehicles; priority

³¹ https://www.london.gov.uk/sites/default/files/llaqm_policy_guidance_llaqm.pg_16.pdf

³² The MAQS forms part of the London Environment Strategy

locations and local measures; public transport; and emissions control schemes such as the London LEZ.

It is recognised that action through the Mayor's measures alone is not sufficient to achieve compliance with EU legal limits. This is partly down to the fact that London's air quality is affected by emissions from elsewhere, but also because the Mayor has limited powers to influence significant emissions sources such as airports and industry. Therefore, the strategy includes actions to be taken by others including the European Commission, the Government and London boroughs. The boroughs take the MAQS into account when developing their air quality action plans and the Mayor supports borough-specific measures to improve air quality through the Mayor's Air Quality Fund.

The Mayor's Transport Strategy

The Mayor is developing a new Mayor's Transport Strategy (MTS) for London. It is expected that policies to reduce emissions will form part of this. Until the new strategy is formally approved and published, following statutory consultation, the current MTS (published in 2010) continues to apply.

The 2010 MTS contains policies and proposals to tackle poor air quality resulting from transport, and to permit vehicle charging based on exhaust emissions. One of its six goals is to 'enhance the quality of life for all Londoners' with the associated outcome of 'reducing air pollutant emissions from ground-based transport, contributing to EU air quality targets'.

MTS policy 15 states that the Mayor, through TfL, will seek to reduce emissions of air pollutants from transport. This policy is carried forward through (among others) proposals 95 and 129³³ of the MTS.

Proposal 95 of the MTS states that 'the Mayor will consider further tightening of the standards of the current LEZ, as well as the introduction of further emissions control schemes to encourage the use of cleaner vehicles in London'.

Further goals of the 2010 MTS, which the proposed ULEZ changes will assist in achieving, include:

- Supporting economic development through stimulating the low emission vehicle market
- Improving transport opportunities for all through the promotion of sustainable travel with increases in cycling, walking and public transport journeys and reduced congestion
- Reducing transport's contribution to climate change through a reduction in carbon dioxide (CO₂) emissions from ground-based transport, contributing to

³³ Proposal 129 of the 2010 MTS covers the Congestion Charging scheme, and states that the Mayor will keep it under review

a London-wide 60 per cent reduction target by 2025, compared with 1990 levels

The London Plan

At present, the Mayor is preparing for a review of The London Plan. The current plan (published in March 2016 as revised) will apply until a new plan is formally approved and published following the relevant statutory procedures, including public and stakeholder consultation and examination in public.

The London Plan policy 7.14 states that the Mayor will work with strategic partners to ensure that spatial, climate change, transport and design policies support the implementation of his air quality and transport strategies to achieve reductions in pollutant emissions and minimise public exposure to pollution.

2.3 Update on London's air quality

Emissions sources in London

These are calculated using the London Atmospheric Emissions Inventory (LAEI). The varying topographies, traffic flows and compositions across the Capital affect the levels and proportion of emissions on a geographic basis. This section of the report describes the forecast changes in air pollution emissions and concentrations over time, without the changes to the ULEZ proposed by this consultation (ie 'the baseline').

Since the publication of the last LAEI we have updated the road transport emissions for 2013, provided a new baseline for 2019 and updated our baseline forecasts in line with revised vehicle emissions functions issued by Defra. We have also incorporated revised traffic growth forecasts. This is referred to as 'LAEI 2013 update'. It includes the impacts of the ULEZ starting in 2020, which is considered for the purposes of this report as being part of the baseline.

Further details of the changes are set out in Appendices C and D. Appendix B contains LAEI 2013 update baseline emissions sources as pie charts.

NO_x emissions

Vehicle emissions standards refer to total NO_x³⁴ emissions but air quality limit values for human health refer to ambient concentrations and are set for NO₂ and not NO_x as this is the harmful component of NO_x. It is also important to note that diesel engines, by the nature of their design, produce higher engine NO_x emissions than petrol engines.

³⁴ Vehicle emissions are measured in terms of total NO_x. NO_x is made up of nitrogen oxide (NO) and NO₂, although the NO is subsequently converted into additional NO₂ by interaction with ozone in the atmosphere – this reaction being dependent on the availability of ozone

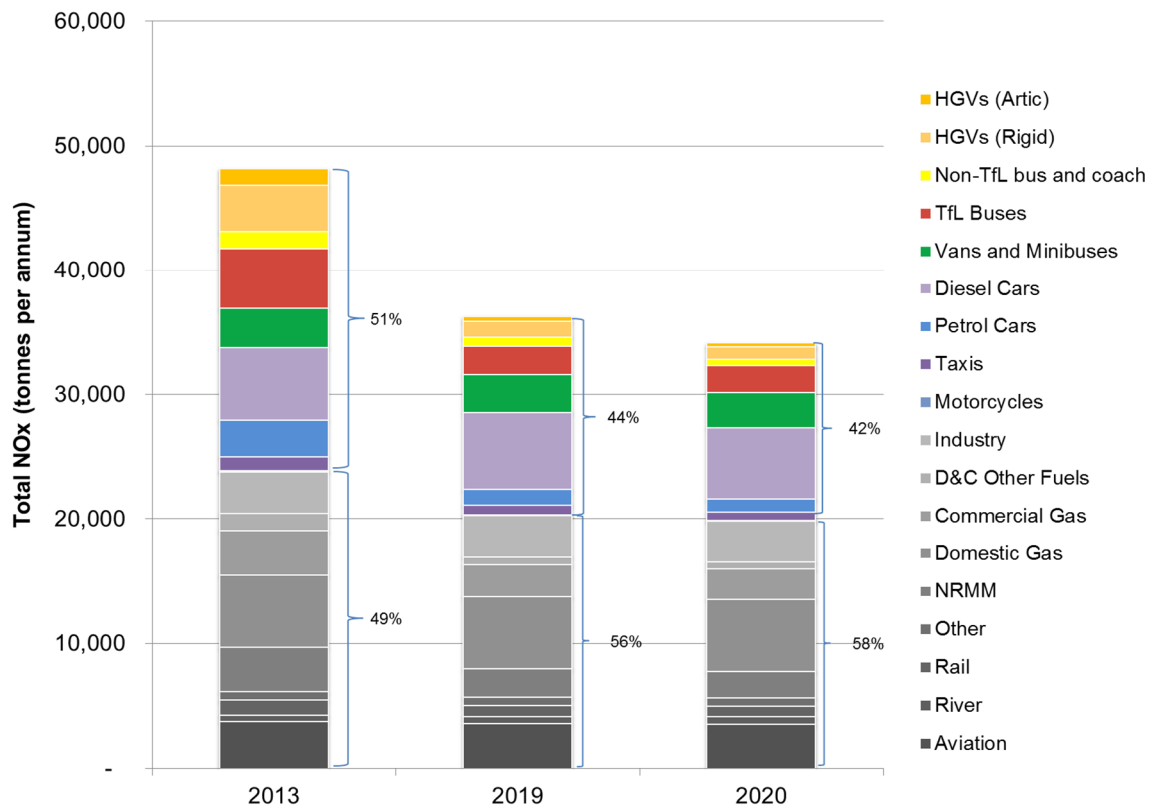
In 2013, road transport was estimated to be responsible for 51 per cent of NO_x emissions in Greater London (Figure 2). Overall, NO_x emissions are forecast to fall by 30 per cent across London by 2020. NO_x emissions from road transport are projected to reduce by around 40 per cent by 2020, with its contribution to all NO_x emissions in 2020 reducing to 42 per cent, partly because of ULEZ. The contribution of road transport emissions is much higher at the roadside and at local hotspots. Looking at the sources, it is clear that diesel vehicles emit a large proportion of road transport NO_x emissions across Greater London.

In central London, road transport was responsible for 52 per cent of NO_x emissions in 2013. Largely owing to the impact of the ULEZ (as currently planned for 2020), this is projected to fall to 30 per cent by 2020. The effect of vehicle owners 'pre-complying' with the ULEZ introduction (upgrading their vehicles ahead of the start of the scheme) has been included in the baseline for 2019. Figure 3 shows that road transport is projected to be responsible for 37 per cent of NO_x emissions in central London in 2019.

It is estimated that PHVs will contribute about 13 per cent of road transport NO_x emissions in central London in 2019.

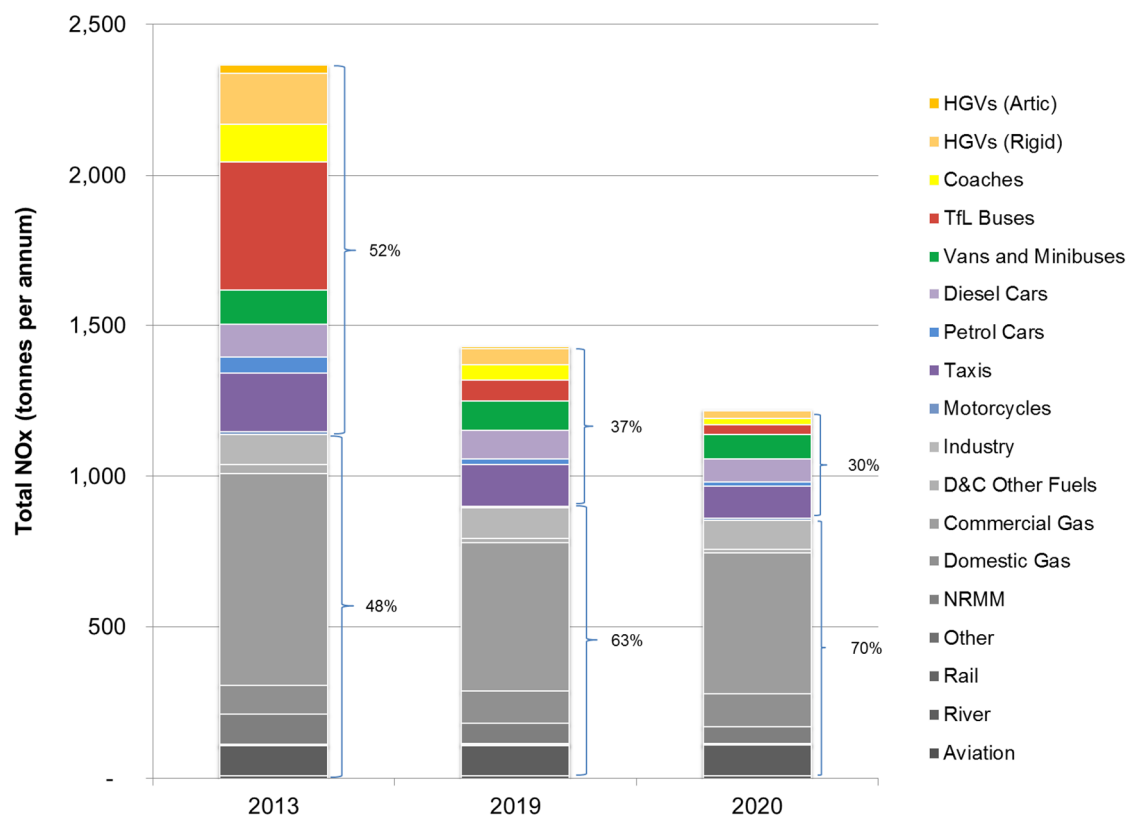
These figures show the impact of the ULEZ in reducing road transport NO_x emissions in central London in 2019 and 2020, and demonstrate that delivering the scheme earlier is likely to bring about wider and more immediate benefits.

Figure 2: NO_x sources in Greater London in 2013, 2019 and 2020 (LAEI 2013 update) ³⁵



³⁵ NRMM is defined as any mobile machine, item of transportable industrial equipment, or vehicle that has a combustion engine and is not intended for carrying passengers or goods on the road. Examples include mobile cranes and forklift trucks. HGV refer to heavy goods vehicles. D&C other fuels is domestic and commercial use of fuels such as coal or oil.

Figure 3: NO_x sources in central London in 2013, 2019 and 2020 (LAEI 2013 update)³⁵



PM₁₀ emissions

In 2013, road transport was estimated to be responsible for half of all PM₁₀ emissions in Greater London. In central London, it was estimated to contribute just over half of all PM₁₀ emissions in 2013, and this is projected to reduce to about 46 per cent by 2020. PM₁₀ emissions from non-transport sources, especially from NRMM, are expected to more than half by 2020 in central London as a result of planning guidance aimed at tackling these sources³⁶. Road transport related emissions of PM₁₀ are projected to reduce by around 30 per cent in central London mainly due to reductions in exhaust emissions.

However, some increases in emissions from vehicle tyre and brake wear (owing to the lack of a technical standard to regulate these emissions) are expected as these are correlated with increased vehicle kilometres as a result of traffic growth. It is also estimated that cars are will be responsible for about 30 per cent of PM₁₀ emissions in central London in 2019, of which approximately 40 per cent is estimated to be due to private hire vehicles.

³⁶ <https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/control-dust-and>

Figure 4: PM₁₀ sources in Greater London in 2013, 2019 and 2020 (LAEI 2013 update) ³⁵

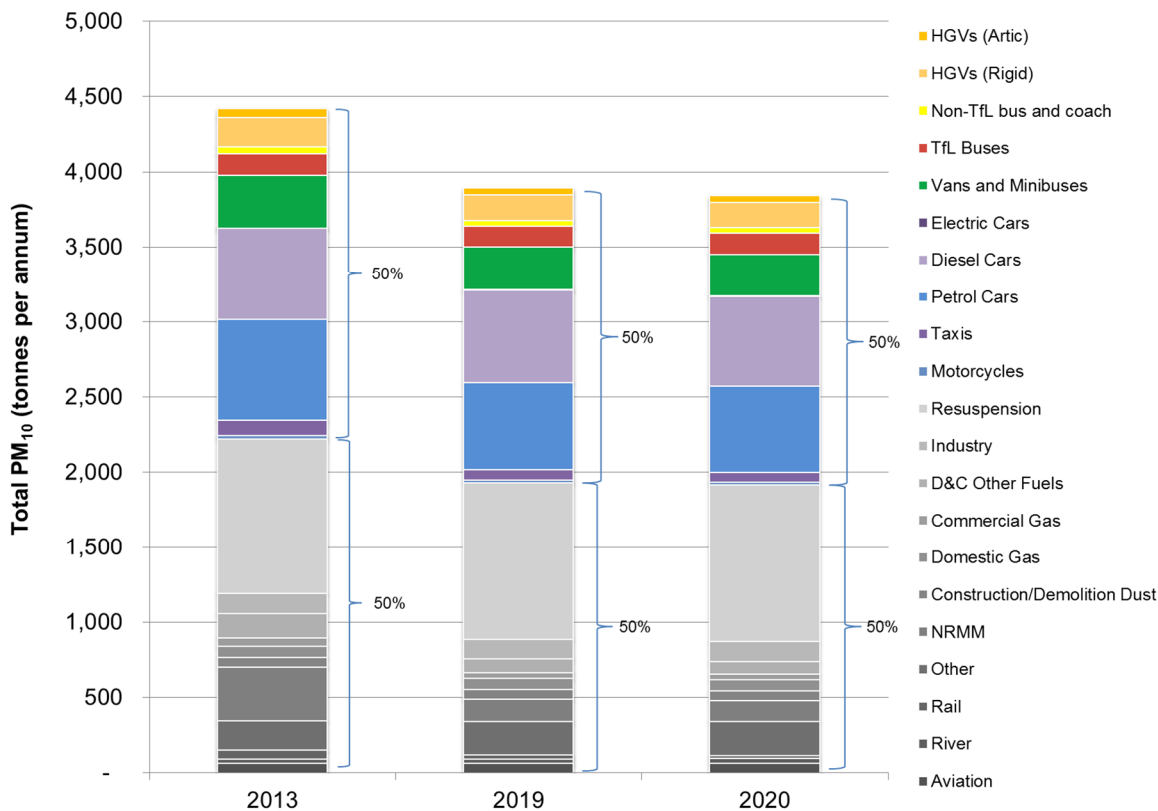
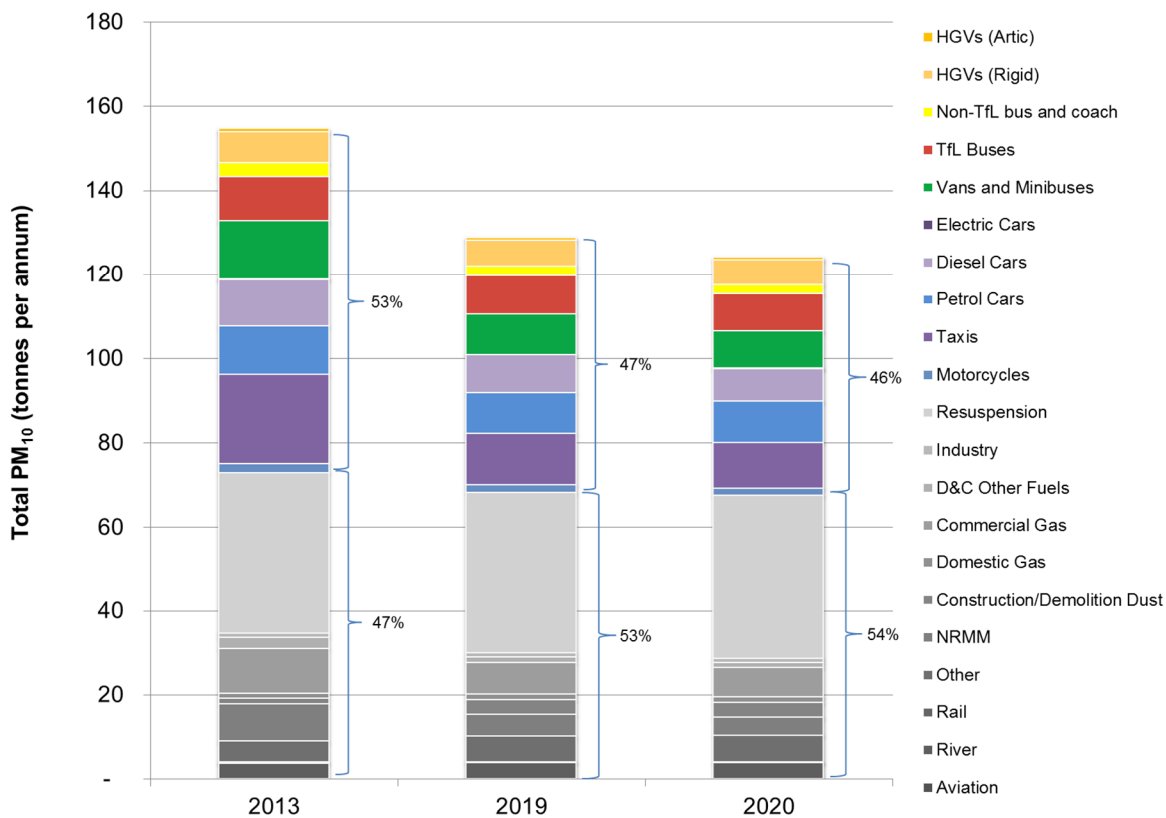


Figure 5: PM₁₀ sources in central London in 2013, 2019 and 2020 (LAEI 2013 update) ³⁵



PM_{2.5} emissions

In 2013, more than half of the Capital's PM_{2.5} emissions were from road transport, with emissions from cars contributing around half of the road transport related emissions. By 2020, total emissions of PM_{2.5} are expected to reduce by over 20 per cent. The contribution of road transport emissions is expected to increase slightly, as other sources, especially those associated with NRMM and construction, are expected to decrease due to implementation of planning policies to reduce these emissions across London. In Greater London in 2020, cars are predicted to make up over 60 per cent of road transport related PM_{2.5} emissions. This is largely as a result of significant reductions in exhaust emissions from larger vehicles. Brake and tyre wear emissions of PM_{2.5} are projected to contribute nearly 60 per cent of road transport PM_{2.5} emissions by 2020.

In central London over 60 per cent of PM_{2.5} emissions were from road transport in 2013; this is predicted to fall to around 55 per cent by 2020. Over the same time period, the contribution of taxis to PM_{2.5} emissions is predicted to fall to about 20 per cent, mainly as a result of the introduction of ZEC requirements for these vehicles. Cars and vans are predicted to contribute around 50 per cent of central London's road transport PM_{2.5} emissions.

Figure 6: PM_{2.5} sources in Greater London in 2013, 2019 and 2020 (LAEI 2013 update) ³⁵

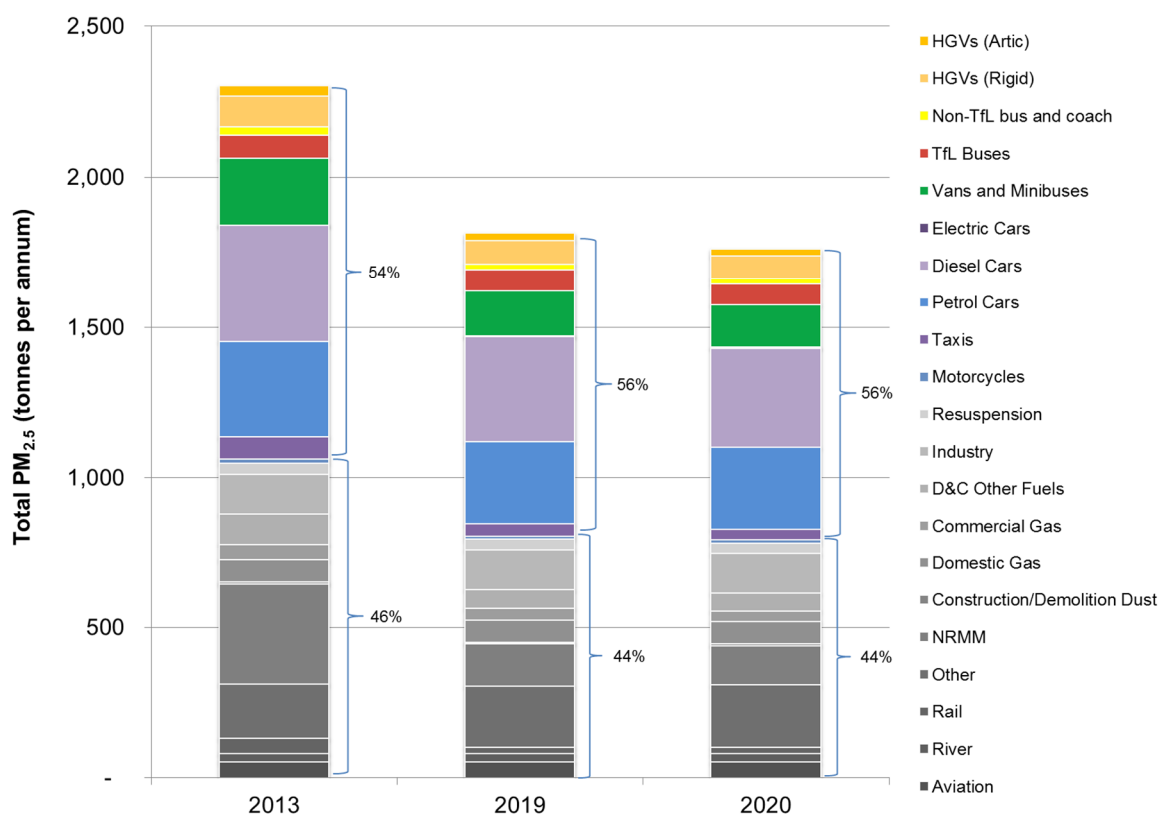
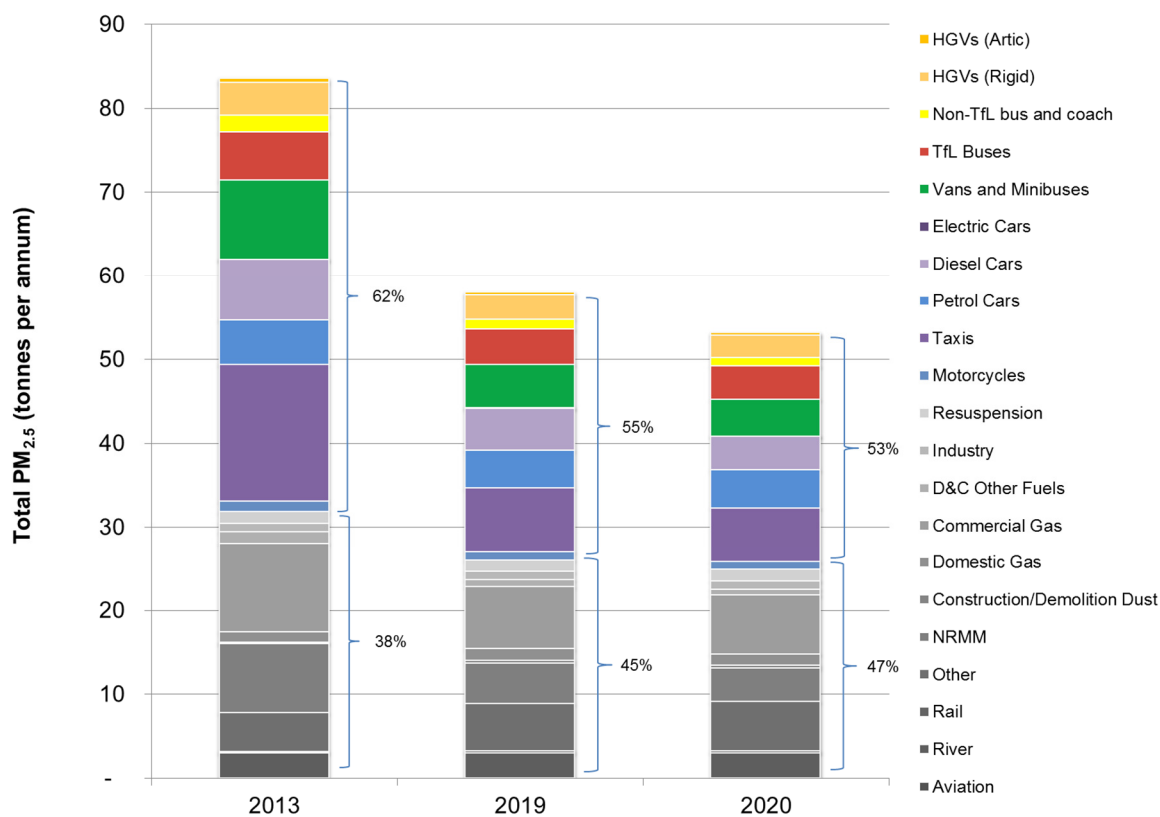


Figure 7: PM_{2.5} sources in central London in 2013, 2019 and 2020 (LAEI 2013 update)³⁵



Current air quality in London

The emissions data within the LAEI 2013 update have been used to forecast concentrations across London taking into account dispersion of pollutants³⁷.

London is now broadly compliant with legal limits for PM. However, further reductions are needed (especially to PM_{2.5} levels) to protect human health.

Annual average PM₁₀ concentrations are considered within the legal limits, however modelling (see Figure 9 on page 31) still indicates some locations where the daily average value for PM₁₀ will be exceeded (for example kerbside locations in central London, or within the road space itself, and in the vicinity of some industrial sites). Annual mean concentrations of PM_{2.5} are also well within the legal limit value of 25ug/m³. However, although compliance has officially been achieved, reducing PM concentrations even more will bring about further health benefits. For comparison, over 90 per cent of the UK population is currently exposed to particulate matter levels (PM_{2.5}) that exceed safe limits set by the World Health Organization.³⁸

³⁷ Methodology documents for the LAEI 2013 modelling are provided at <https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory-2013>

³⁸ <http://www.bath.ac.uk/research/news/2016/09/21/air-pollution/>

In contrast, annual average NO₂ concentrations still exceed legal limits across much of inner London, as well as in the vicinity of Heathrow and near major roads in outer London (see Figure 8 on page 28).

The number of kilometres of major road network across London that currently exceeds the NO₂ annual limit value has been estimated from the results of the concentrations modelling across London using the LAEI 2013 update. In central London in 2013, concentrations within a few metres of the edge of all main roads were forecast to exceed the legal limit value. For inner London (the area between the central London ULEZ and the North and South Circular Roads) concentrations within a few metres of the edge of around 90 per cent of main roads exceeded the legal limit value. For outer London (the area between, and including, the North and South Circular Roads and the rest of Greater London) the equivalent measure was 50 per cent.

Concentrations of NO₂ are highest close to roads and drop off rapidly the further away from the road, towards levels of background concentrations. Currently, 100 per cent of the central London area is forecast to exceed the limit value for NO₂, whilst this is 30 per cent and 5 per cent for inner and outer London respectively (see Table 4). More details about exposure to air pollution in London are provided in section 2.4 starting on page 32.

Table 4 Proportion of road kilometres and area of London exceeding NO₂ limit value in 2013

	Proportion of road kilometres exceeding the NO ₂ limit value at roadside in 2013 ³⁹	Proportion of area exceeding the NO ₂ limit value in 2013
Central	100%	100%
Inner	90%	30%
Outer	50%	5%
Londonwide	65%	12%

Meeting NO₂ limits poses a huge challenge for many cities in the UK and across Europe. Two of the key reasons why ambient levels of NO₂ remain higher than had been previously expected are the driving conditions in urban areas and concerns over the performance of the more recent Euro emissions standards for some diesel vehicles (see Appendix A for more information on Euro standards). In general, Euro standards have failed to reduce NO_x emissions from light-duty diesel vehicles (eg cars and vans) sufficiently in the real world, despite tightening emissions standards for NO_x. However, Euro VI (for heavy vehicles) is performing well and the Euro 6 standard for light vehicles is still bringing about a significant reduction compared to previous Euro standards.

³⁹ Based on estimated length of main roads in the LAEI major road network. This excludes distances measured at roundabouts, junctions and slip roads. "at roadside" means at a distance approximately 4 metres from the edge of roads.

A study commissioned by the GLA identified that, based on 2013 data, over 800 schools⁴⁰ in London were in areas that exceed legal limits for NO₂ concentrations⁴¹. The Mayor has announced £250,000 of funding for 50 'air quality' audits for primary schools located in areas exceeding legal limits NO₂ concentrations⁴².

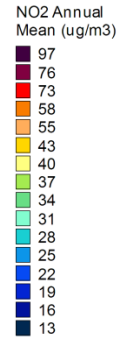
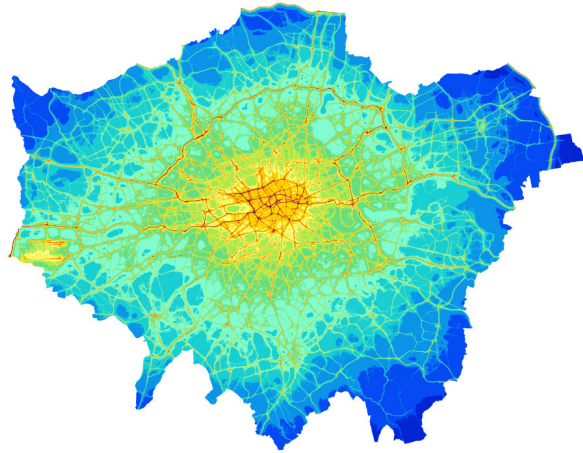
⁴⁰ Based on EduBase – The Department for Education's register of educational establishments in England and Wales

⁴¹ <https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/updated-analysis-air-pollution-exposure-london>

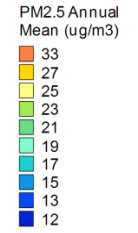
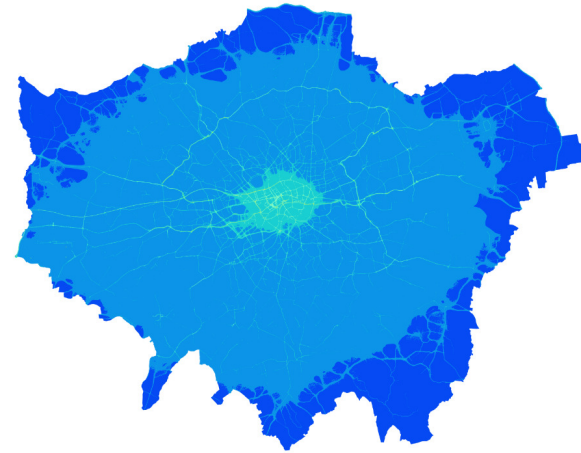
⁴² <https://www.london.gov.uk/press-releases/mayoral/air-quality-audits-to-protect-school-kids>

Figure 8: Concentrations of annual average NO₂ and PM_{2.5} in 2013 and 2019 (LAEI 2013 update)

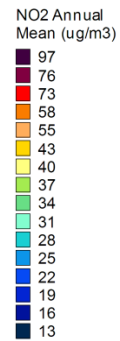
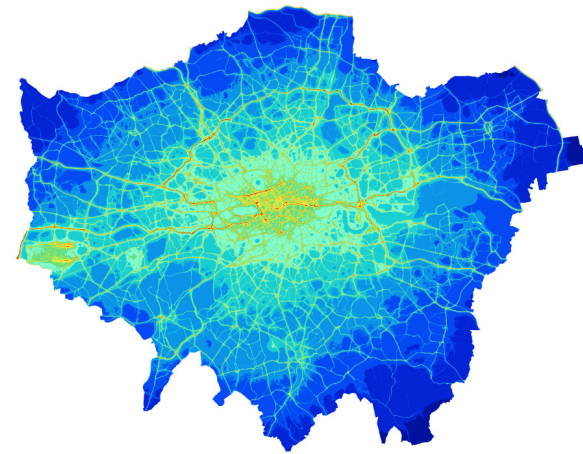
NO₂ annual mean – 2013



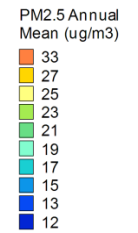
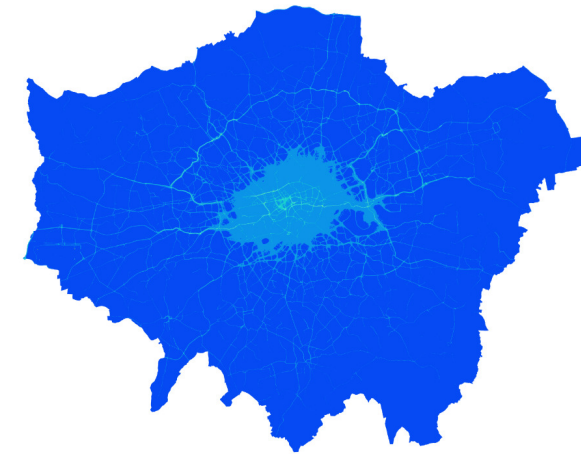
PM_{2.5} annual mean – 2013



NO₂ annual mean – 2019



PM_{2.5} annual mean – 2019



Future year estimates of London's air quality

The Capital's air quality is expected to improve by 2019, thanks in part to vehicle owners upgrading their vehicles in preparation for the ULEZ in 2020, but concentrations are still expected to be well above the annual mean limit value for NO₂. Therefore, further and more urgent action is required to accelerate this improvement. Emissions are projected to decrease due to technological advances in vehicle design, as well as policies and legislation already in place to reduce emissions across London, the UK and Europe. Specifically, the phased roll-out of a new Euro 6 emissions standard⁴³ is anticipated to be more successful at reducing pollutants in urban driving conditions compared to previous standards.

Although PM concentrations in London are compliant with European legal limits, it is anticipated that by 2019, levels of NO₂ will continue to exceed limits in some areas in central London and close to main roads across the rest of London, even with the ULEZ in place in 2019 or 2020.

Further PM₁₀ and PM_{2.5} reductions by 2019 will mean that annual average concentrations should actually remain well below the legal limits. However, there is a strong case to continue cutting PM concentrations to bring about further health benefits, and a compelling need to accelerate the pace of change to achieve the health benefits as quickly as possible.

The proportion of the Capital where annual average NO₂ concentrations exceed the legal limit is also expected to decrease by 2019. Table 5 shows that 30 per cent of central London, eight per cent of inner and two per cent of outer London are expected to exceed legal limits for concentrations of NO₂ in 2019, in part due to the introduction of the ULEZ (currently agreed for 2020).

Table 5: Proportion of road kilometres and area of London exceeding NO₂ limit value in 2013 and 2019³⁹

	Proportion of road kilometres exceeding the NO ₂ limit value at roadside		Proportion of area exceeding the NO ₂ limit value	
	2013	2019	2013	2019
Central	100%	82%	100%	30%
Inner	90%	55%	30%	8%
Outer	50%	24%	5%	2%
Londonwide	65%	36%	12%	4%

The Government produced a revised NO₂ action plan in late 2015 in response to a UK Supreme Court ruling earlier this year⁴⁴. The revised plan brought forward the projected date of compliance with legal air pollution limits to 2025 (from after 2030) in

⁴³ <http://ec.europa.eu/environment/air/transport/road.htm>

⁴⁴ The Supreme Court ruling on the case of ClientEarth v Secretary of State for the Environment, Food and Rural Affairs, www.supremecourt.uk/cases/uksc-2012-0179.html

the Capital and to 2020 for the rest of the UK. It also includes a framework for Clean Air Zones to be implemented in several UK cities, including London.

Defra is currently revising that action plan as a result of a second legal challenge in the High Court in November 2016⁴⁵ on the grounds that its revised plan did not put forward measures for compliance with legal limits for NO₂, which could have been achieved earlier, and that the Government had not taken all reasonable steps to ensure this in its revised plan.

The Government has until 24 April 2017 to publish a second version of its revised action plan for public consultation, and a final version must be submitted to the European Commission by 31 July 2017. (At the date of writing this document the publication of Defra's consultation draft plan is awaited.)

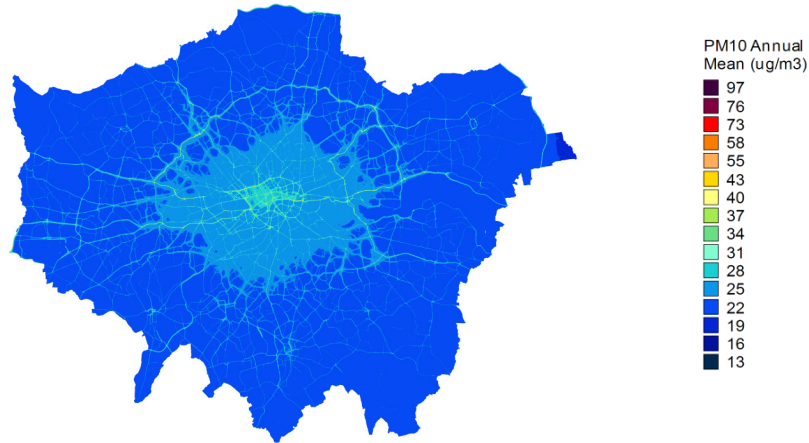
The Mayor does not believe it is appropriate to wait until 2025 to reach compliance. Strong measures in the Capital, as proposed within this consultation, and decisive action at national Government level are needed to further reduce exposure in areas that are currently compliant, so as to realise the health benefits as soon as possible.

The Mayor wants to bring forward the benefits of the ULEZ to 2019. This will bring forward the emissions reductions and reduce overall exposure to pollution.

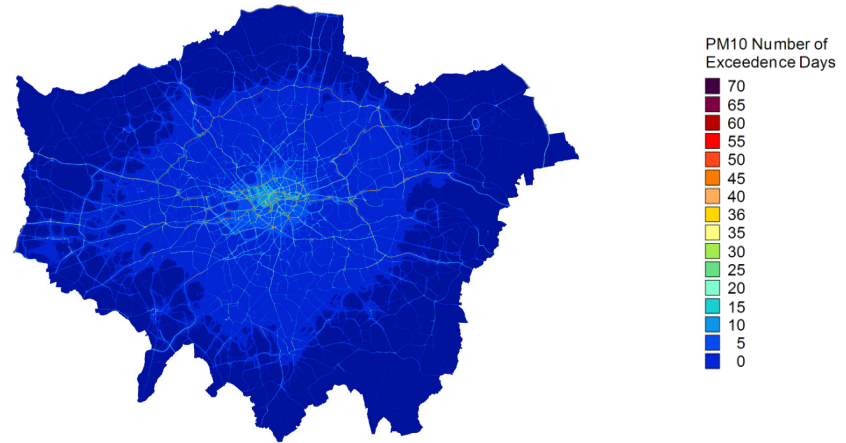
⁴⁵ Clientearth (No 2) v Secretary of State for Environment Food and Rural Affairs, <https://www.judiciary.gov.uk/judgments/clientearth-v-secretary-of-state-for-the-environment-food-and-rural-affairs/>, in which the Mayor appeared as an Interested Party

Figure 9: Concentrations of annual average and numbers of exceedence days for PM₁₀ in 2013 and 2019 (LAEI 2013 update)

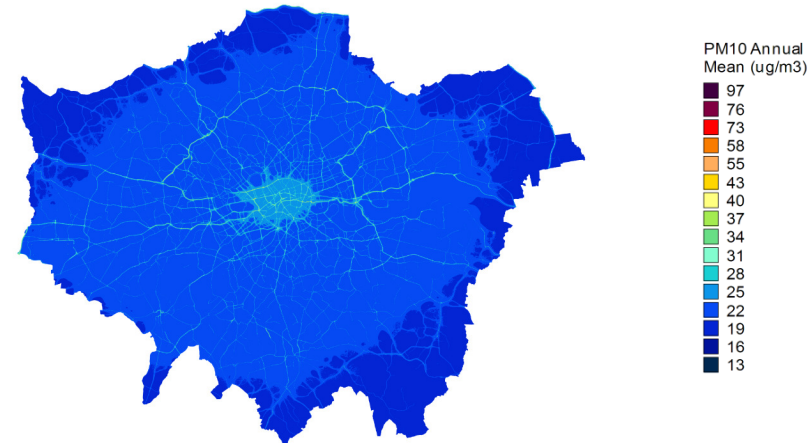
PM₁₀ annual mean – 2013



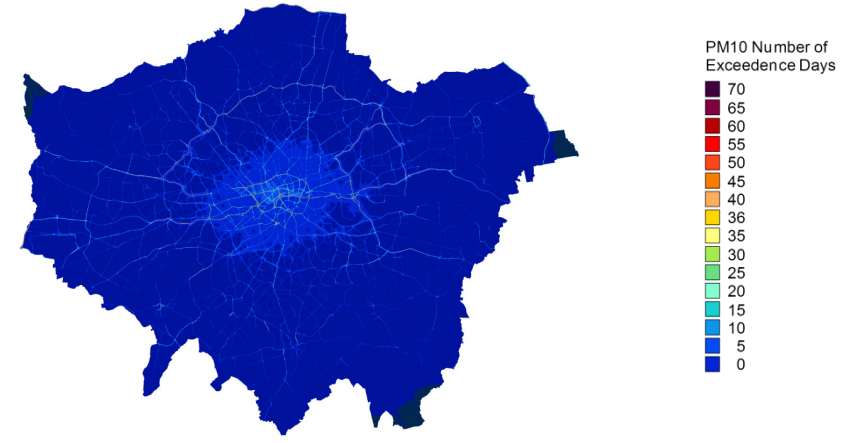
PM₁₀ number of exceedence days – 2013



PM₁₀ annual mean – 2019



PM₁₀ number of exceedence days – 2019



2.4 Exposure to air pollution

As described above, pollution levels across Greater and central London are improving so that the proportion of the Capital exceeding limit values for NO₂ is expected to significantly reduce by 2019. The modelled NO₂ concentrations shown in Figure 8 have been used to derive the average concentrations in Output Areas⁴⁶. Table 6 shows the estimated population living in areas exceeding NO₂ limit values in 2013 and 2019, and Figure 10 shows a map of these areas in 2019.

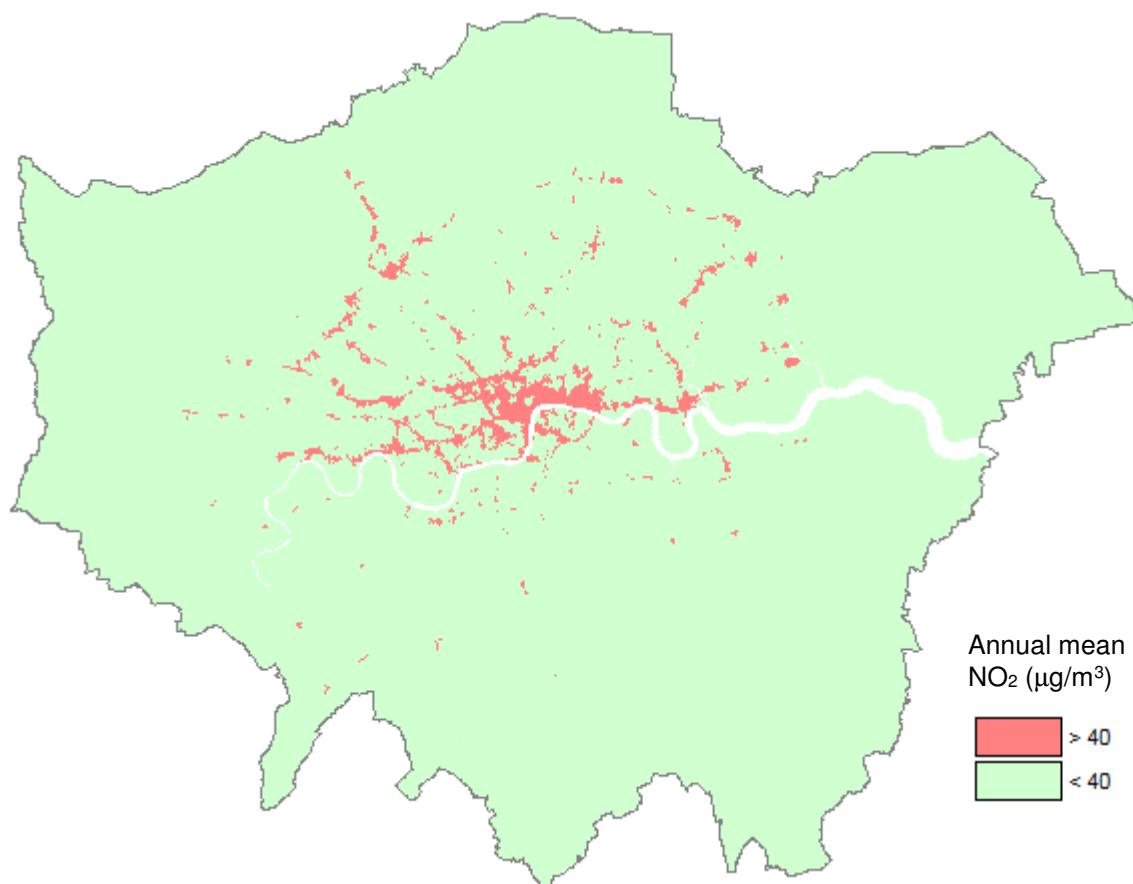
The concentrations for 2019 include the expected benefits of the ULEZ in 2020 as owners pre-comply with the required vehicle standards (adopt cleaner vehicles to get ready for the ULEZ). This shows that by 2019, 65 per cent less people would be exposed to illegal air pollution in central London and a third less people in inner and outer London compared to 2013. But more can be done to improve this further.

Table 6: Proportion of the population living in areas that will exceed NO₂ limits in 2019

	Estimated population		Total population in Output Areas exceeding the NO ₂ limit value		Proportion of the population living in areas exceeding the NO ₂ limit value		
	2013	2019	Baseline 2013	Baseline 2019	Baseline 2013	Baseline 2019	Percentage change (2019 compared to 2013)
Central London	181,000	205,000	181,000	72,000	100%	35%	-65%
Inner London	3,443,000	3,729,000	1,554,000	270,000	45%	7%	-84%
Outer London	4,767,000	5,032,000	255,000	38,000	5%	1%	-86%
London-wide	8,391,000	8,966,000	1,990,000	380,000	24%	4%	-82%

⁴⁶ 'Output Areas' are the lowest geographical level at which census estimates are provided. Output Areas have populations of between 100 and 625 people or between 40 and 250 households.

Figure 10: Areas that will exceed NO₂ limit values in 2019 (based on Output Area)



Population weighted average concentrations represent the average concentrations that people are exposed to, taking into account population variations and concentrations at the Output Area level across London. The London-wide concentrations are presented in Table 7 below.

Table 7: Population weighted average concentrations for 2019

Area	NO ₂ annual mean concentration (µg/m ³)	PM ₁₀ annual mean concentration (µg/m ³)	PM _{2.5} annual mean concentration (µg/m ³)	Days with average PM ₁₀ concentrations > 50 µg/m ³
Central London	39	26	16	16
Inner London	34	24	15	11
Outer London	28	23	14	8
London-wide	31	24	15	10

In 2019, the highest population weighted average concentrations are still forecast to be in central London. In this area, whilst average air quality for the population is marginally below the limit value for NO₂, it is important to reduce these concentrations to ensure greater health benefits can be delivered. Continuing improvements in air pollution including reducing concentrations of particulates like PM₁₀ and PM_{2.5} are an essential part of ensuring a healthy city.

Sensitive locations, such as schools, hospitals and care homes are also often located in areas of poor air quality. Table 8 shows the number of these predicted to be in areas exceeding the limit values for NO₂. The locations of these are also shown in Figure 11.

A high proportion of schools, especially in central London, exceed limit values. As described in section 2.1, there is emerging evidence showing that the impact of high levels of NO₂ concentrations on children's lung function is reversible, therefore any action to help drive these improvements as soon as possible is important for improving the health of London's children.

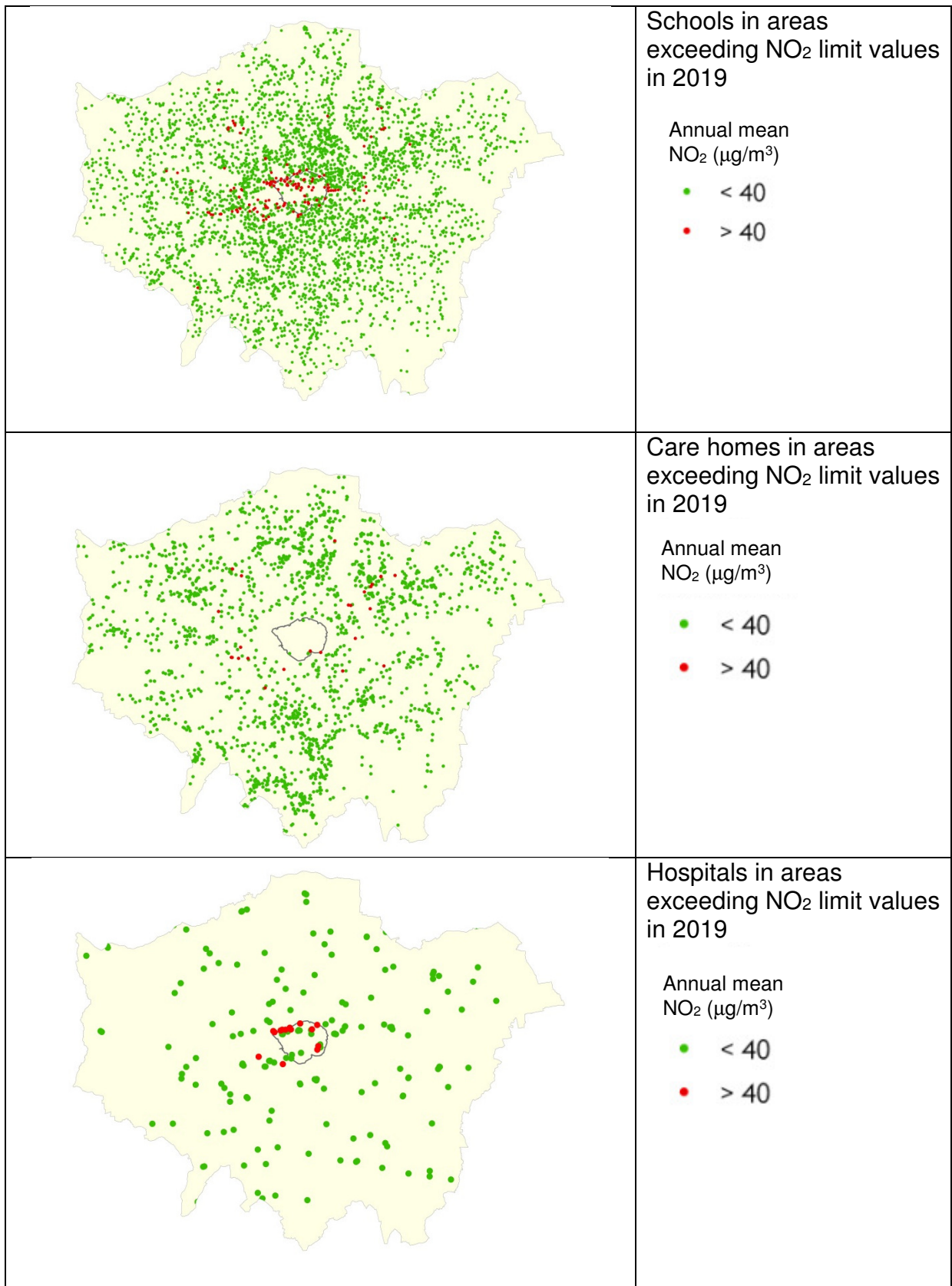
Table 8: Schools, hospitals and care homes expected to be in areas exceeding NO₂ limits in 2019

Area	Schools		Hospitals		Care homes	
	Number of sites ⁴⁷	Number exceeding (%)	Number of sites	Number exceeding (%)	Number of sites	Number exceeding (%)
Central London	160	64 (40%)	28	12 (43%)	6	2 (33%)
Inner London	1797	92 (5%)	57	2 (4%)	581	22 (4%)
Outer London	2354	14 (1%)	89	(0%)	1377	2 (0%)
London-wide	4311	170 (4%)	174	14 (8%)	1964	26 (1%)

Borough factsheets at Appendix F provide a summary of exposure information in each borough.

⁴⁷ Based on Ordnance Survey address point data

Figure 11: Locations of schools, hospitals and care homes expected to be in areas exceeding NO₂ limit values in 2019



Chapter 3: Existing air quality initiatives

In line with the current MAQS and MTS, a number of measures are in place to lower emissions from road traffic, by reducing overall vehicle numbers and cleaning up the fleet.

3.1 The Congestion Charge

Although the Congestion Charge is primarily intended to reduce traffic congestion, it also has an important role to play in improving air quality in central London. By lowering overall traffic levels in the zone, it has contributed to a decrease in emissions.

The £11.50 daily Congestion Charge is paid by those driving a vehicle within the specified zone between 07:00 and 18:00, Monday to Friday (the zone is shown in Figure 1 on page 7). The Ultra Low Emission Discount is a 100 per cent discount on the Congestion Charge for low emission vehicles⁴⁸.

3.2 Emissions Surcharge ('T-Charge')

On 17 February 2017, the Mayor announced the implementation of the T-Charge (officially called the 'Emissions Surcharge') in the Congestion Charging zone.

From 23 October 2017, cars, vans, minibuses, buses, coaches and HGVs travelling in central London during Congestion Charging hours (Monday to Friday, 07:00–18:00) will need to meet minimum exhaust emissions standards, or pay a daily £10 Emissions Surcharge. This will be in addition to the Congestion Charge. Table 9 sets out the required standards and charges for vehicles.

⁴⁸ Cars and vans (not exceeding 3.5 tonnes gross vehicle weight) which emit 75g/km or less of CO₂ and that meet the Euro 5 standard for air quality, and electric vehicles registered with the DVLA with fuel type "electric", qualify for a 100 per cent discount on the Congestion Charge.

Table 9: Emissions Surcharge (T-Charge) standards and charges

Vehicle type (includes hybrid vehicles)	Minimum emissions standard	Congestion Charge amount	Emissions Surcharge amount (if emissions standard not met)	Total daily payment (if emissions standard not met)
Motorised tricycles and quadricycles	Euro 3	£11.50 (£10.50 Auto Pay)	£10	£21.50 (£20.50 Auto Pay)
Cars, and small vans not exceeding 1,205kg unladen weight and not exceeding 3,500kg gross vehicle weight (GVW)	Euro 4	£11.50 (£10.50 Auto Pay)	£10	£21.50 (£20.50 Auto Pay)
Vans (exceeding 1,205kg unladen weight and not exceeding 3,500kg GVW) and minibuses (not exceeding 5,000kg GVW) ⁴⁹	Euro 4	£11.50 (£10.50 Auto Pay)	£10	£21.50 (£20.50 Auto Pay)
HGVs (exceeding 3,500kg GVW)	Euro IV	£11.50 (£10.50 Auto Pay)	£10	£21.50 (£20.50 Auto Pay)
Coaches and buses (exceeding 5,000kg GVW)	Euro IV	£nil ⁵⁰	£10	£10
Vehicles registered for residents' discount	As above depending on vehicle type	£1.05 (Auto Pay)	£1	£2.05 (Auto Pay)

The discounts and exemptions for the Emissions Surcharge are broadly in line with those for the Congestion Charge and the London-wide Low Emission Zone (LEZ) and are outlined in Table 10.

⁴⁹ Includes motorised caravans, motorised horse boxes, breakdown and recovery vehicles, private ambulances, motor hearses, dual purpose vehicles and other specialist types fitting the weight criteria

⁵⁰ Vehicles with nine or more seats are eligible for a 100 per cent discount from the Congestion Charge

Table 10: Discounts and exemptions from the Emissions Surcharge

Vehicle	Discount/exemption
Two-wheeled motorbikes (and sidecars) and mopeds	Exempt
Emergency service vehicles, such as ambulances and fire engines	Exempt
NHS vehicles that are exempt from VED	Exempt
Vehicles used by disabled people that have a disabled taxation class, eg Dial-a-Ride and modified vehicles	Exempt
Specialist off-road vehicles, eg tractors and mobile cranes	Exempt
Vehicles with a historic tax class (40 years and older)	Exempt
Commercial vehicles constructed before 1973	Exempt
Taxis	Exempt
Ministry of Defence vehicles	Exempt
Private hire vehicles	Exempt
Specially constructed or modified Showman's vehicles	100% discount
Accredited breakdown vehicles	100% discount
Roadside recovery vehicles	100% discount
Motorised tricycles <1m in width and <2m in length	100% discount
Blue Badge holders	100% discount
Registered residents living in the Congestion Charging zone or in a designated area next to the zone	90% discount

3.3 The London Low Emission Zone (LEZ)

The LEZ is an existing scheme, introduced in phases from 2008, that aims to reduce PM emissions from heavy diesel vehicles. It covers most of Greater London and operates 24 hours a day, every day of the year including weekends and public and Bank Holidays.

Vehicles need to meet minimum emissions standards or pay a daily charge of between £100 and £200. Table 11 lists the vehicles affected by the LEZ.

Table 11: LEZ emissions standards and charges

Vehicle	Weight	Emissions standard	Charge	Implementation
HGVs, horseboxes, motor caravans and other specialist vehicles	>3.5T	Euro IV for PM	£200	February 2008 – Euro III for HGVs >12T July 2008 – Euro III for other vehicles January 2012 – Euro IV
Buses and coaches with 9+ seats	>5T	Euro IV for PM	£200	July 2008 – Euro III January 2012 – Euro IV
Large vans, and other specialist vehicles	1.2–3.5T	Euro 3 for PM	£100	January 2012
Motor caravans and ambulances	2.5–3.5T	Euro 3 for PM	£100	January 2012
Minibuses with 9+ seats	<5T	Euro 3 for PM	£100	January 2012

If the standards are not met and a LEZ charge is not paid, a penalty is payable – £1,000 for HGVs, buses and coaches, and £500 for large vans, motor caravans and minibuses (reduced to £500 and £250 respectively if paid within 14 days).

Figure 12: The area covered by the LEZ



According to the most recent monitoring data, 99 per cent of heavy vehicles and 98 per cent of large vans and minibuses driving within the Capital are compliant with the current LEZ standards, and this is helping to remove the oldest, more polluting vehicles from Greater London.

3.4 Key additional action on air pollution

Some of the additional actions and measures in place to reduce air pollution are outlined in this section. They do not form part of this consultation, but the information is provided for context.

The bus fleet

Buses operating TfL services accounted for an estimated 10 per cent of total NO_x and 20 per cent of road transport NO_x in Greater London in 2013. In central London, they were responsible for 18 per cent of total NO_x and 35 per cent of road transport NO_x.

All buses in Greater London currently meet a minimum Euro IV standard for NO_x and PM and in many instances, they exceed this.

The ULEZ requirements for buses are set out in section 1.2.

The Mayor has asked TfL to introduce further improvements to reduce emissions from buses. These include:

- Implementing up to 12 'Low Emission Bus Zones' across London – tackling the worst pollution hotspots by concentrating cleaner buses on the dirtiest routes. The first zone has been delivered in Putney High Street and Brixton/Streatham will follow later in 2017
- Expanding an innovative Euro VI bus retrofit programme to have a Euro VI standard fleet by 2020
- Ensuring all new double-decker buses delivered from 2018 are hybrid⁹ or zero emission¹⁰

Taxis (black cabs)

Every licensed taxi is fully accessible for wheelchair users, so offers a vital travel option for passengers with accessibility needs or heavy luggage, or when public transport is not suitable. They are also designed specifically for London's streets. As they are specialist vehicles, drivers have a limited choice of models.

Currently, nearly all taxis in London are diesel vehicles and are heavy compared to similarly sized vehicles. We now know they are a significant contributor to poor air quality, particularly in central London. They were responsible for an estimated two per cent of total NO_x and four per cent of road transport NO_x in Greater London in 2013. In central London, they accounted for eight per cent of total NO_x and 16 per cent of road transport NO_x.

This is why the Mayor is committed to supporting the trade in phasing out diesel vehicles and establishing the Capital's taxi fleet as the greenest in the world.

The Taxi and Private Hire Action Plan⁵¹, which the Mayor launched in September 2016, includes the following measures to support licensed taxi drivers and improve London's air quality:

- From 1 January 2018, no more new diesel taxis will be licensed in London and all newly registered taxis must be zero emission capable (ZEC)⁵²
- A purchase grant of up to £7,500 is available to help reduce the cost for drivers, under the Government's plug-in taxi grant scheme
- A rapid charging network from 2017 so drivers can maximise fuel savings and operate mostly in zero emission mode, with locations dedicated to the trade

⁵¹ tfl.gov.uk/corporate/publications-and-reports/taxi-and-private-hire

⁵² A maximum 15-year age limit remains in place for all taxis. The ZEC requirement for taxis is ≤50 g/km CO₂ and a minimum zero emission range of 30 miles

- A delicensing scheme for the oldest taxis from 2017. Up to £5,000 will be available to drivers who choose not to license their vehicle in London, with the exact amount depending on the age of the taxi
- Recognising that the newest taxis today will be the last remaining diesel vehicles in the fleet and exploring options to convert them to a cleaner fuel, such as liquid petroleum gas
- Rewarding drivers who pioneer green technology by offering exclusive access to certain facilities, for example, 'zero emission' ranks, and working with boroughs to explore areas where taxis and other vehicles must operate in zero emission mode

Private hire vehicles (PHVs)

All PHVs will need to comply with the ULEZ standards and are subject to a maximum 10-year age limit for licensing, with limited exemptions for specialist and adapted vehicles.

Several milestones will ensure that London's PHVs reduce their emissions:

- From 2018 all PHVs presented for licensing for the first time must meet either:
 - Euro 6 (diesel/petrol) standards, or
 - At least Euro 4 (petrol-hybrids) emissions standards
- From 2020:
 - All newly manufactured PHVs (less than 18 months old) presented for licensing for the first time must be ZEC⁵³
- From 2023:
 - All PHVs presented for licensing for the first time must be ZEC

The requirement for ZEC PHVs starts later than for Taxis in recognition of the limited availability of suitable PHV vehicles with six or more seats. As a result of the policies for taxis and PHVs, all these vehicles will be ZEC by 2033 at the latest.

Freight emissions

We are dedicated to encouraging the uptake of low emission freight vehicles through improving vehicle choice, availability and servicing by working with manufacturers and operators, and through the LoCITY programme.

LoCITY is an initiative that aims to lower emissions caused by London's commercial vehicles. It is an industry-led, collaborative programme that encourages early compliance with the ULEZ standards and encourages the uptake of alternatively fuelled vans and HGVs. Further information can be found at locity.org.uk

⁵³ For PHVs the ZEC requirement is ≤50 g/km CO₂ with a minimum zero emission range of 10 miles or ≤75 g/km CO₂ and 20 miles minimum zero emission range. This aligns with the Office for Low Emission Vehicles (OLEV) criteria for their plug in car grant

As part of our current freight programme, we are working with a range of partners in industry and a number of London boroughs through an 'out-of-hours consortium' to better understand how deliveries can be retimed to quieter periods of the day. This has included a series of research trials to investigate noise-reducing technology and working practices, how local timing restrictions imposed by local authority planning conditions can be addressed and whether changes to delivery practices can be sustained in the longer term.

We are undertaking research into city-wide freight consolidation operating models that could be feasible for London. At the same time, we are delivering a number of small scale practical projects to test different consolidation techniques. This work will enable us to make recommendations regarding the most effective techniques that could be implemented in London and help us to identify barriers to the adoption of consolidation.

Ultra low emission vehicles (ULEV)

In July 2015, we published an Ultra Low Emission Vehicle Delivery Plan for London which sets out 15 actions needed to overcome London's specific barriers to ULEV uptake. We are working with the boroughs, the GLA and other stakeholders to implement this plan, including on a number of actions to improve the Capital's electric vehicle charging infrastructure to enable more drivers to switch from fossil fuels to electric vehicles.

TfL, the GLA and the boroughs are working together to invest in this new charging infrastructure to support a major expansion in electric vehicles. Using £13m of Government funding from the Go Ultra Low Cities scheme, we will deliver much-needed new charge points for residents, commercial users and car clubs by 2020. This scheme will also create new Neighbourhoods of the Future, which will promote innovative charging infrastructures, and policies and initiatives to support the switch to electric vehicles across different fleets.

Working with the private sector, we will also deliver 150 rapid charge points by the end of 2018 to support high mileage users, such as the freight, taxi and private hire industries, to switch to electric vehicles. The first rapid charge points will be available in summer 2017.

We are working with the GLA to develop new policies for the Mayor's London Plan to ensure that, where appropriate, new developments provide suitable electric vehicle charging infrastructure to support the future uptake of these vehicles. We are also working with the GLA to develop new policies for the MTS and LES to support electric vehicles.

Low Emission Neighbourhoods

Five 'Low Emission Neighbourhoods' are being set up across eight boroughs, with pollution-busting measures including strict new penalties for more polluting vehicles, car-free days, green taxi ranks for ZEC taxis and parking reserved for the cleanest vehicles. More information about Low Emission Neighbourhoods is available here: <https://www.london.gov.uk/press-releases/mayoral/pollution-fund-to-tackle-london-toxic-air-hotspots>

Healthy Streets

We are investing to make London's streets healthy, safe and attractive places to walk and cycle. Enabling more journeys to be made on foot or by bike can help reduce private vehicle use and associated emissions. Our approach to this is set out in our Healthy Streets for London document, available at: www.tfl.gov.uk/healthy-streets-for-london

Our Healthy Streets initiative will make London a more attractive place to walk by delivering improvements to the TfL Road Network (TLRN) and providing funding for borough-led improvements on local streets. We also promote walking through Legible London, the Walk London Network, and engagement with schools and businesses.

We provide funding to boroughs to deliver improvements to local streets as part of their Local Implementation Plans. The Healthy Routes initiative will encourage investment in walking routes to schools and other local destinations, making streets safer, more accessible and more attractive places to walk.

We are investing a record £154m per year in cycling over the next five years to make cycling safer and easier and to help deliver the Healthy Streets approach across London. This investment includes continued funding for the completion of initiatives such as the Mini-Holland programme, which is currently transforming the environment for pedestrians and cyclists in three outer London boroughs, and the ongoing delivery of more Quietway cycle routes across London, with more than 20 routes to be planned or rolled-out during this Mayoral term.

We will complete the extensions of the North-South and East-West Cycle Superhighways, and work to deliver Cycle Superhighway 11 from Swiss Cottage to the West End. Consultations will begin next year on Cycle Superhighway 4 from Tower Bridge to Greenwich and Cycle Superhighway 9 from Olympia towards Hounslow, with each route tackling a number of traffic-dominated junctions.

Through increasing investment, we will also provide funding to London's boroughs via a new Liveable Neighbourhoods programme to make town centres and neighbourhoods attractive places in which to walk, cycle and spend time.

Further proposals will be developed as part of the forthcoming draft revised MTS.

Car clubs

We have worked with the car club industry, representative bodies, London Councils and other partners to form the 'Car Club Coalition', with the aim of supporting car clubs as an alternative to private vehicle ownership.

The coalition jointly developed and published the Car Club Strategy for London in May 2015⁵⁴. This set out an ambition to grow the Capital's car club industry by achieving a million members, served by 10,000 vehicles, by 2025. The Ultra Low

⁵⁴ <http://tfl.gov.uk/modes/driving/car-clubs/how-car-clubs-work>

Emission Vehicle Delivery Plan later outlined a target for half of London's car club fleet to be ULEVs by 2025. These targets have been agreed across all car club models (back-to-base, floating and point-to-point).

Increasing public transport capacity

We continue to invest in enhancing rail capacity across London to support a rising number of journeys made by public transport, and this includes the opening of the Elizabeth line in 2019. The Four Lines Modernisation programme will increase capacity on the Metropolitan, District, Circle and Hammersmith & City lines by 33 per cent in 2023, and Jubilee line services will reach frequencies of up to 32 trains per hour by the end of 2020. Electrification of the Gospel Oak to Barking line will boost capacity on the route by 90 per cent. London Trams will see significant improvements with upgraded vehicles, 'double-tracking' and a new platform at Wimbledon by 2020.

We are committed to reducing emissions across London by encouraging a shift towards public transport. This will be explored as part of the development of the Mayor's new draft MTS and LES, which are intended to be taken forward for consultation this spring.

Diesel scrappage

Diesel vehicles are a major contributor to poor air quality. London-wide, diesel cars and vans alone contributed nearly 20 per cent of all London's NO_x emissions, and just under 40 per cent of road transport emissions. The contribution of these diesel cars and vans to London-wide emissions is expected to increase to 25 per cent of all NO_x emissions, and 60 per cent of road transport emissions, even with the ULEZ in place, in 2020. The Mayor has published a detailed proposal for a Government-funded national diesel scrappage fund⁵⁵. He believes this is a national problem that requires a central Government-led solution.

Vehicle Excise Duty devolution and reform

The Mayor is calling on the Government for a national reform of Vehicle Excise Duty (VED), which is sometimes referred to as 'road tax', to do more to incentivise low emission vehicles. He is also asking for devolved powers to set VED in the Capital. This would enable him to introduce different rates that take into account air pollutants as well as CO₂ emissions. It would also remove the current inequity, whereby VED is ring-fenced for trunk roads outside London.

Other emissions sources

Improving London's air quality cannot be done through a reduction in road transport emissions alone – non-transport sources account for a high percentage of the total. While the ULEZ will focus on transport emissions, the GLA family will continue to work closely together, and with stakeholders, on further initiatives that address other emissions sources including buildings, construction sites and energy and waste

⁵⁵ <https://www.london.gov.uk/press-releases/mayoral/mayor-urges-government-over-diesel-scrappage-fund>

facilities. This includes measures such as further retrofitting homes and buildings, Combined Heat and Power (CHP)/biomass emissions standards, and providing guidance on the application of 'air quality neutral' in the planning system, ensuring that new developments do not worsen air quality.

The Mayor plans to use his other powers to complement the introduction of the ULEZ. For example, in 2015 the GLA introduced new standards to reduce emissions from construction sites and equipment (non-road mobile machinery). These will be strengthened in 2020. More information on this is available at <http://nrmm.london/>

Non-road emissions sources are less well understood than traffic emissions and the Mayor is supporting a number of research projects to close this evidence gap. These include the London Low Emission Construction Partnership (<http://www.llecp.org.uk/>) which works with industry to identify best practice on construction sites, academic research into the local and regional impacts of CHP and working with the Port of London to understand the impacts of river traffic on pollution.

He also recognises the importance of working with other cities and the EU. A report published by the GLA⁵⁶ estimated that external sources from continental Europe are responsible for just under half of the deaths associated with NO₂. It also estimated that 75 per cent of the cardiovascular hospital admissions associated with PM_{2.5} result from sources outside London.

Further detail on policies and proposals to reduce emissions (from both road transport and other emissions sources) will be explored as part of the development of the Mayor's new draft MTS and LES, which are intended to be taken forward for consultation this spring.

⁵⁶ www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/understanding-health-impacts-air-pollution-london

Chapter 4: Overview of the consultation process

4.1 Consultation stages

This consultation is part of a series relating to the Mayor's new proposals to tackle air quality. It is Stage 3a (a summary of the expected stages is shown below).

Stage 1 (5–29 July 2016): A consultation hosted on the Talk London website on initial ideas to tackle air quality. The results are now here: http://data.london.gov.uk/dataset/clean-air-consultation-july-2016	COMPLETE
Stage 2 (10 October–18 December 2016): A process incorporating a statutory consultation to introduce the Emissions Surcharge, and a non-statutory consultation on ideas for how the ULEZ could be improved. The results are now here: https://consultations.tfl.gov.uk/environment/air-quality-consultation-phase-2016	COMPLETE
Stage 3a (4 April–25 June 2017): A statutory consultation on the proposal to introduce the ULEZ early in central London on 8 April 2019 and to strengthen the emissions standards to include particulate matter. The Mayor will then make a decision on whether or not to confirm this proposal, with or without modifications.	THIS CONSULTATION
Stage 3b: A statutory consultation on the proposal to expand the ULEZ boundary beyond central London.	EXPECTED IN AUTUMN 2017

4.2 Stage 1 consultation results

Londoners were able to share their views via the online Talk London portal and a representative poll (the 'TNS poll'). The results are summarised in Table 12. A more detailed report is available at <http://data.london.gov.uk/dataset/clean-air-consultation-july-2016>

Table 12: High level summary of results

	Talk London	TNS poll
Number of responses	14,800	1,650 (fixed)
Agree London has a pollution problem	75%	67%
Agreed the ULEZ should be brought forward to 2019	79%	58%
Agreed with the ULEZ expansion	71%	63%

The response to the Stage 1 consultation showed strong support for more action on air quality and raised some issues that respondents felt needed further clarity and explanation. These are addressed within this document and have been used to inform the development of the proposals.

Responses relating to the Emissions Surcharge and alterations to the ULEZ were considered during the development of the Stage 2 consultation.

4.3 Stage 2 consultation results

The Stage 2 consultation was hosted by TfL. It focused primarily on the Emissions Surcharge, but also included a policy consultation on changes to the ULEZ that has helped to inform this consultation. A full detailed report on the consultation is available here tfl.gov.uk/airquality-consultation. The results regarding the proposals for the central London ULEZ are summarised below.

A total of 15,480 responses were received from the public and businesses with 131 stakeholder responses. Sixty-three per cent of respondents supported the principle of implementing the ULEZ in central London in 2019 with 29 per cent of respondents in opposition. Four per cent of respondents didn't have a view either way and four per cent either didn't know or didn't respond.

Table 13: Stage 2 consultation responses to the proposal to implement the ULEZ in central London in 2019 instead of 2020

Response	Count	%
Strongly support	8,413	54%
Support	1,347	9%
Neither support or oppose	611	4%
Oppose	1,076	7%
Strongly oppose	3,377	22%
Don't know	92	0.5%
Not answered	564	3.5%
Total	15,480	100%

There was stronger support amongst residents that live in the central London ULEZ area (the CCZ area) than amongst non-residents and stronger support amongst those who stated they never drive in the CCZ, compared to those who do (see Figure 13 and Figure 14).

Figure 13: Stage 2 consultation responses regarding the early implementation of the ULEZ in central London by whether the respondent lives in the CCZ (the ULEZ central London area)⁵⁷

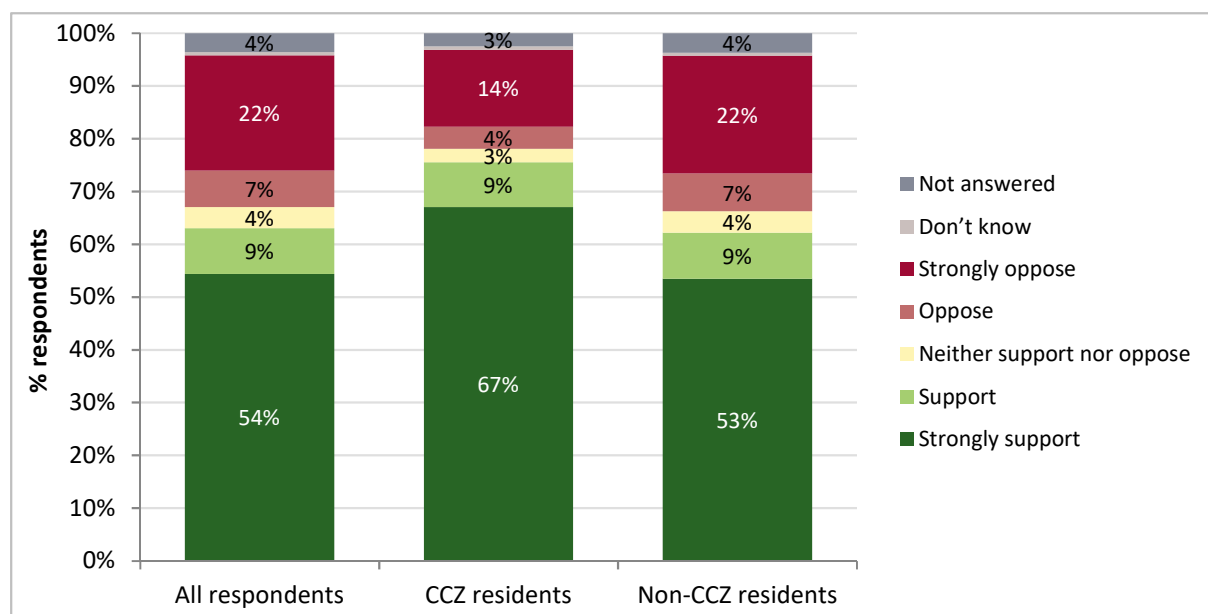
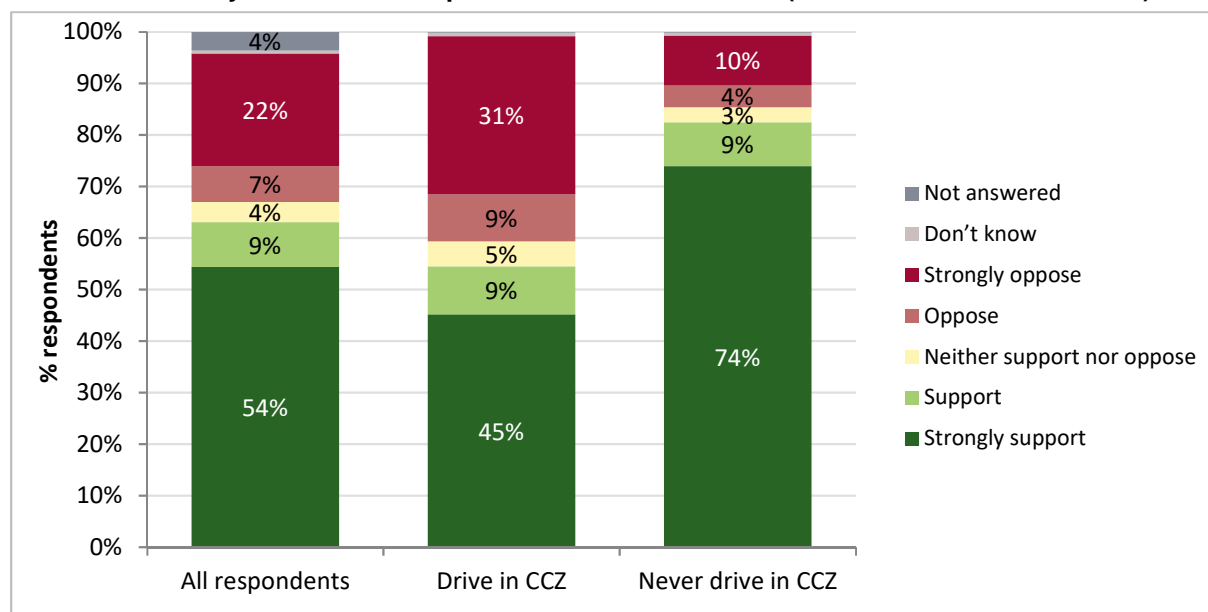


Figure 14: Stage 2 consultation responses regarding the early implementation of the ULEZ in central London by whether the respondent drives in the CCZ (the ULEZ in central London) ⁵⁷



There was overall stakeholder support for an earlier implementation of the ULEZ, particularly amongst boroughs, environmental groups and health charities. Concerns were raised amongst business groups, particularly those representing operators of fleet vehicles.

⁵⁷ Percentages may not add up to 100 per cent due to rounding errors

4.4 Consultation on a Direct Vision Standard for heavy goods vehicles

Three years ago, we began engagement with the freight industry and its clients on the principles of using direct vision to improve HGV safety. This engagement is particularly important as the Mayor has also signalled that he wants to examine expanding and speeding up the introduction of the ULEZ for HGVs. With both of these proposed changes, some freight operators are likely to need to modernise their fleet to address safety and emissions. TfL and the Mayor will work to ensure the implications of both schemes are communicated to freight operators, to ensure they only upgrade once to minimise the overall cost.

In January 2017, the Mayor launched TfL's Direct Vision Standard for consultation along with proposals for how it might be applied, including potentially banning or restricting the most dangerous 'off-road' lorries, with low direct vision, from the Capital's roads by January 2020⁵⁸. The standard assesses and rates how much an HGV driver can see directly from their cab in relation to other road users.

The standard will categorise HGVs using a five star rating system, ranging from zero stars for vehicles with the lowest direct vision, three stars for good levels of vision, to five stars for the highest levels. The plan is that only HGVs meeting three stars under the new standard will be allowed on London's roads by 2024.

The Direct Vision Standard consultation began in January and ends on 18 April 2017 and is available at: www.tfl.gov.uk/roads/direct-vision-standard-phase-1. We will continue to work with vehicle manufacturers, regulators, the Department for Transport and freight operators to ensure that the proposed Direct Vision Standard is as effective as possible within current legislation. The proposed standard is the key to getting ever greater numbers of safer lorries on the streets of London.

The Direct Vision Standard should be borne in mind when considering the air quality proposals set out in this consultation as it has relevant implications for decisions about vehicle and fleet replacement.

⁵⁸ <https://tfl.gov.uk/info-for/deliveries-in-london/delivering-safely/direct-vision-in-heavy-goods-vehicles>

Chapter 5: Impact of the proposals

5.1 Impact of the proposal to strengthen the ULEZ emissions standards to include particulate matter

The approved ULEZ arrangements set emissions standards for NO_x only. The Mayor is proposing that the standard is strengthened to include a requirement for diesel vehicles to meet Euro 6/VI PM emissions standards as well as NO_x.

This is primarily to bring the ULEZ standards in line with the Government's retrofit certification standards for heavy duty vehicles and the Clean Air Zone Framework, which require vehicles to meet NO_x and PM standards in order to be certified.

There is no PM limit set for petrol Euro 4 standard vehicles, so this standard will not apply to these vehicle types. Although London is compliant with legal limits for concentrations of PM, it is important that more is done to further reduce levels and bring about further health benefits.

We have developed an online compliance checker tool¹¹ to enable drivers to check whether or not their vehicles are compliant with the ULEZ

Currently there are three models of diesel car types approved at Euro 3 and 4 that meet the Euro 6 NO_x emissions limit but emit up to six times the Euro 6 PM limit. We estimate up to 430 of these vehicles are currently registered in London, accounting for 0.02 per cent of total car registrations in London.

Diesel vehicles that have been type approved as Euro 6/VI already meet ULEZ emissions standards for both pollutants and will not be affected by this change.

5.2 Projected impact of the currently approved ULEZ (starting in 2020) in terms of the LAEI update (ie the new baseline)

Since analysis was undertaken to estimate the impacts of the original ULEZ scheme, the London Atmospheric Emissions Inventory (LAEI) has been updated using new emissions functions (COPERT 5)⁵⁹. Appendix C discusses the updated modelling used to estimate the impacts of the current proposals to introduce ULEZ earlier, in 2019. Under the new emissions functions, it is still anticipated that the ULEZ will nearly halve NO_x emissions from transport in central London in 2020 and significantly reduce the proportion of the population living in areas exceeding legal air quality limits. However, more still needs to be done.

⁵⁹ COPERT is a software tool used world-wide to calculate air pollutant and greenhouse gas emissions from road transport. The emissions functions it contains are used to model the emissions of different types of vehicles under different driving conditions (eg speed). COPERT has recently been updated and the latest version is COPERT 5.

5.3 Responses of vehicle users

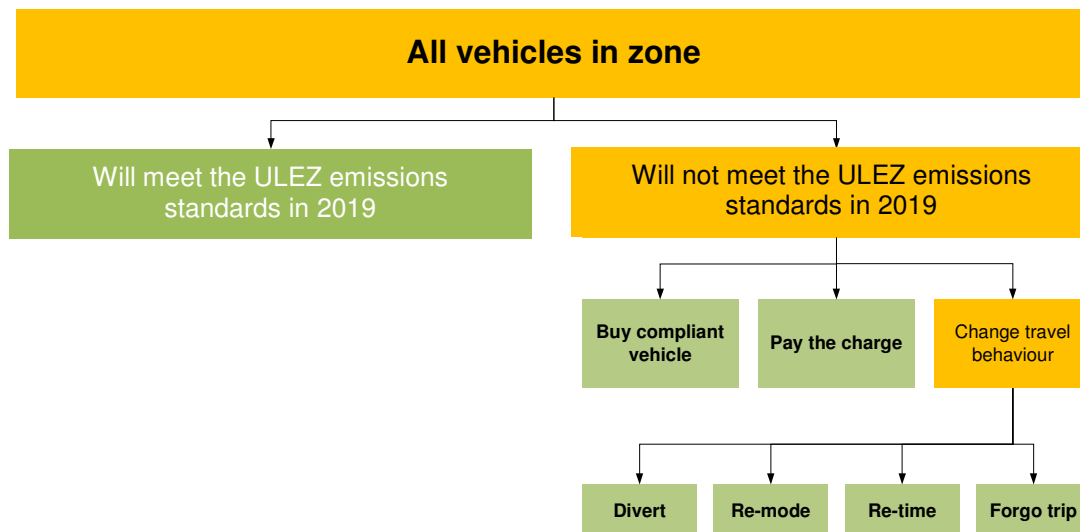
A key part of the assessment is predicting how users of the zone will respond to the scheme. This enables the estimation of impacts, such as changes to traffic volumes and emissions, to be made. The number of users that are already compliant with a given emissions standard can be estimated using the LAEI, which includes projected vehicle fleet compositions.

Drivers of vehicles that do not meet the ULEZ emissions standards would need to pay a daily charge if they choose to continue to drive within the ULEZ. This would result in differing responses amongst drivers of non-compliant vehicles:

- Change vehicle to one that does not incur the charge
- Continue to drive within the zone and pay a charge
- Change route of journey to avoid the zone
- Change destination
- Change mode of travel
- No longer make some trips

Once 'already compliant' users are identified, additional analysis can be undertaken to assess the response of non-compliant users (see Figure 15). In the original assessment of the ULEZ from 2014 the estimation of response used response modelling, surveys and TfL's traffic models. More information can be found in Appendix G.

Figure 15: Schematic diagram of possible responses to the ULEZ emissions standards



5.4 Estimating 'non-compliance' and behavioural response in 2019

For those who drive in the ULEZ, bringing the start date forward 17 months will mean different things depending on how they were going to respond to the original 2020 start date. The following scenarios illustrate what an earlier start date could mean:

- If their current vehicle is already compliant, or vehicle replacement schedule mean they will driving a compliant vehicle by April 2019 anyway, then there is no impact from the change in start date
- If their current vehicle is non-compliant and they planned to upgrade by September 2020 (but after April 2019) they will now have to upgrade sooner. In this scenario, any second-hand vehicles (where available) will be slightly more expensive. Therefore, any purchasing and financing will need to be arranged earlier, and they may need to break existing lease agreements early. Where an earlier upgrade cannot be arranged, they might need to pay the daily charge or change their travel behaviour, even though the start date is being brought forward 17 months they will still have at least 18 months from the policy being confirmed to make these arrangements (if, for example, the Mayor confirms the proposal by October 2017)
- If their current vehicle is non-compliant and they planned to pay the daily charge because they enter the zone infrequently, they will now be doing this over an additional 17-month period

The key difference, in model terms, between the 2019 and 2020 start date is the underlying assumption about compliance in the baseline and the difference between the value of the existing non-compliant vehicle and the cost of the alternative. If the compliant vehicle is more expensive, then some infrequent users of the zone are more likely to consider to 'stay and pay' rather than upgrade. This is on top of the baseline compliance in 2019 being lower than in 2020 due to the natural churn (people upgrading to cleaner vehicles anyway) in the fleet that would happen over the 17 months.

To assess how users would respond to the scheme commencing 17 months sooner, the same response model that was used in the original assessment was updated with the latest input data. The proportion of the fleet determined to be compliant without the ULEZ starting in 2019 was based on LAEI data. Because the ULEZ is assumed to commence in 2020 in the latest LAEI, the 2019 fleet baseline included an element of pre-compliance with the 2020 scheme.

Table 12 below summarises the difference in the proportion of vehicles driving in ULEZ that would comply with the ULEZ emissions standards in the first year of operation for the ULEZ starting in 2019 and 2020. Whilst with a 2019 start date the 'year one' compliance is lower than under a 2020 scenario, compliance is anticipated to increase to the 2020 levels and is substantially higher than it would be if the start date of the ULEZ wasn't brought forward.

Table 14: Compliance in the first year of the ULEZ, 2019 start compared to 2020 alongside the baseline 2019 compliance estimates

	Baseline 2019 (with starting ULEZ in 2020)	Compliance for year one of the scheme	
		April 2019 start date	September 2020 start date
Non-TfL buses and coaches	68%	84%	94%
HGVs	80%	97%	98%
Vans	57%	73%	83%
Cars	74%	89%	93%

5.5 Impact on emissions

NO_x impacts

An earlier introduction of the ULEZ would mean Londoners experience its emissions and health benefits sooner. As a result of implementing the ULEZ in central London sooner, road transport emissions in the area are expected to reduce by an additional 20 per cent in 2019 (this is in addition to reduction in emissions already forecast in the baseline for 2019 as a result of people pre-complying with the original ULEZ starting in 2020).

As the ZEC taxi programme is already planned from the beginning of 2018, no additional reductions from taxis have been included in the assessment of bringing the ULEZ forward. Excluding taxis from the road transport emissions totals means that NO_x emissions savings would be nearly 30 per cent in central London in 2019.

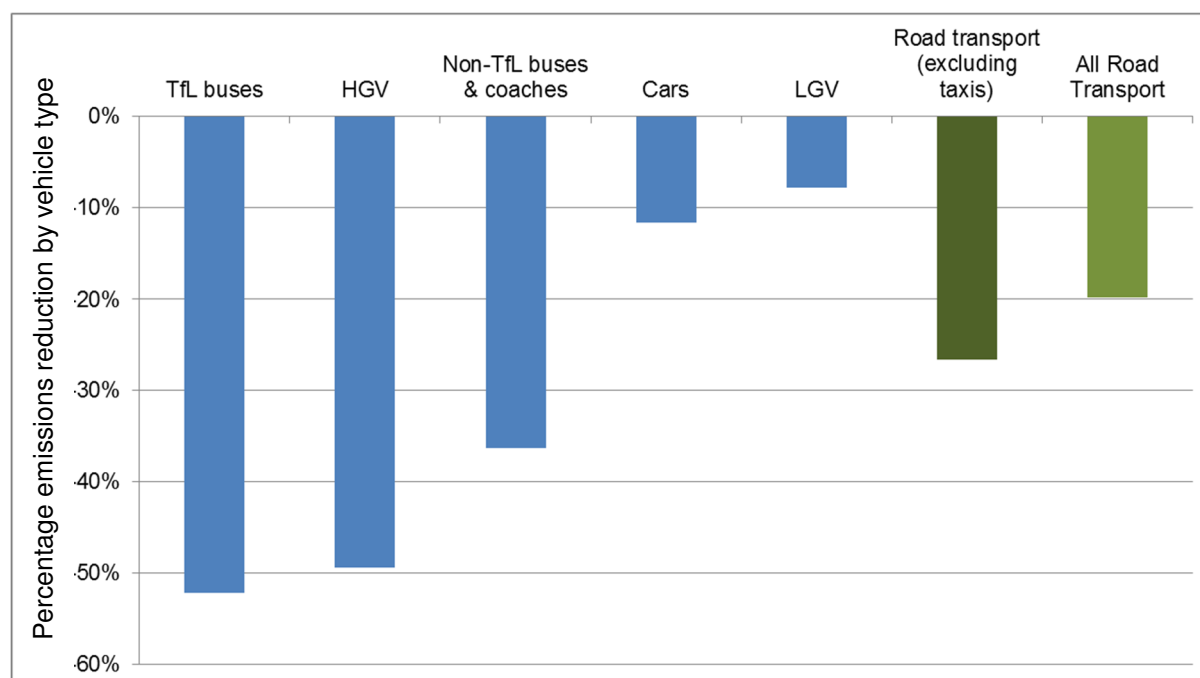
NO_x emissions from HGVs are expected to reduce by nearly 50 per cent, whilst coach and non-TfL bus emissions will reduce by over a third. Emissions from cars and vans are expected to reduce by eight and 12 per cent respectively, and, whilst the reduction in emissions is smaller than for larger vehicles, their savings make up nearly one third of the emissions reductions of chargeable vehicles in central London.

By bringing forward the commitments for cleaner buses (to 2019 from 2020) across central London as part of the ULEZ, a further 50 per cent reduction in their emissions is expected. Areas outside of the ULEZ will also benefit from its earlier introduction, especially due to the large reductions in emissions from buses, coaches and heavy goods vehicles as a result of the much more stringent requirements needed to meet the ULEZ Euro standard of Euro VI.

Table 15: NO_x emissions benefits in 2019 due to an earlier introduction of the ULEZ

	Savings in tonnes				% reduction			
	Central	Inner	Outer	GLA	Central	Inner	Outer	GLA
Total	105	345	339	789	20%	7%	3%	5%
TfL buses	36	104	11	151	52%	12%	1%	7%
HGVs	30	136	191	357	49%	23%	18%	21%
Coaches and non-TfL buses	18	20	18	57	36%	8%	5%	8%
Vans and minibuses	8	22	38	68	8%	2%	2%	2%
Cars motorcycles and other L-Category vehicles	14	62	80	157	12%	3%	1%	2%
% that cars and vans contribute to savings	31%	37%	35%	35%				

Figure 16: NO_x emissions savings in Central London in 2019 by vehicle type due to an earlier introduction of the ULEZ



PM₁₀ and PM_{2.5} impacts

As a result of introducing ULEZ in 2019 instead of 2020, emissions of PM₁₀ and PM_{2.5} from road transport are forecast to reduce by around three and six per cent respectively in central London, or around one to two per cent across London. The majority of the emissions reductions are from cars and vans as PM₁₀ standards come into force for Euro 5 and 6 petrol cars, alongside diesel cars. The estimated impacts for PM do not include consideration of any potential vehicle kilometre

reductions within the ULEZ area which were assessed to be around five per cent for the original ULEZ scheme. Any vehicle kilometre reductions within the zone would reduce PM₁₀ and PM_{2.5} further due to less brake and tyre wear emissions.

Whilst the impacts on PM emissions of an earlier introduction of the ULEZ in 2019 are comparatively smaller than for NO₂, any reductions in PM₁₀ and PM_{2.5} emissions are important for bringing forward health benefits for Londoners by improving air quality.

Table 16: PM₁₀ emissions benefits in 2019 due to an earlier introduction of the ULEZ

	Savings in tonnes				% reduction			
	Central	Inner	Outer	GLA	Central	Inner	Outer	GLA
Total	1.9	8.1	9.9	19.8	3%	1%	1%	1%
TfL buses	0.3	0.8	0.1	1.2	3%	1%	0%	1%
HGVs	0.2	1.1	1.7	3.0	3%	2%	1%	1%
Coaches and non-TfL buses	0.1	0.2	0.2	0.4	5%	1%	1%	1%
Vans and minibuses	0.5	1.0	1.6	3.1	5%	1%	1%	1%
Cars motorcycles and other L-Category vehicles	0.8	5.0	6.3	12.1	4%	1%	1%	1%
% that cars and vans contribute to savings	78%	83%	81%	82%				

Table 17: PM_{2.5} emissions benefits in 2019 due to an earlier introduction of the ULEZ

	Savings in tonnes				% reduction			
	Central	Inner	Outer	GLA	Central	Inner	Outer	GLA
Total	1.8	7.7	9.4	18.8	6%	2%	1%	2%
TfL buses	0.3	0.8	0.1	1.1	6%	3%	0%	2%
HGVs	0.2	1.0	1.6	2.9	7%	3%	2%	3%
Coaches and non-TfL buses	0.1	0.1	0.1	0.4	10%	2%	1%	2%
Vans and minibuses	0.4	1.0	1.5	3.0	8%	2%	2%	2%
Cars, motorcycles and other L-Category vehicles	0.8	4.7	6.0	11.5	7%	3%	1%	2%
% that cars and vans contribute to savings	78%	83%	81%	82%				

CO₂ impacts

Overall, CO₂ emissions from road transport are forecast to reduce by two per cent in central London and one per cent Londonwide. CO₂ emissions from larger vehicles such as buses and HGVs are predicted to increase slightly. This is because the increased testing requirements to reach the Euro VI standard for NO_x and PM₁₀ mean there is a small increase in fuel consumption.

However, these must be viewed alongside the much more significant emissions reductions in NO_x and PM₁₀ that are achieved through the Euro VI vehicle standards. Through the requirements of the ULEZ to include cars and vans, the small increase in CO₂ from larger vehicles will be more than offset; thereby CO₂ is still expected to reduce slightly as a result of bringing forward the introduction of the ULEZ. Over time, as technology and fuel quality (such as increasing biofuels proportions) evolve, CO₂ from HGVs will reduce. The requirement for all TfL double decker buses in the ULEZ area and all new TfL double decker buses anywhere in London from 2018 to be hybrid or better means that CO₂ emissions from these vehicles will still reduce.

Table 18: CO₂ emissions benefits in 2019

	Savings in tonnes				% reduction			
	Central	Inner	Outer	GLA	Central	Inner	Outer	GLA
Total	3,790	26,278	31,828	61,895	2%	1%	1%	1%
TfL buses	2,162	5,911	673	8,746	5%	2%	0%	1%
HGVs	-4	6	42	44	0%	0%	0%	0%
Coaches and non-TfL buses	-4	-4	-5	-13	0%	0%	0%	0%
Vans and minibuses	41	159	301	500	0%	0%	0%	0%
Cars, motorcycles and other L-Category vehicles	1,594	20,206	30,817	52,617	2%	2%	1%	1%
% that cars and vans contribute to savings	100%	100%	100%	100%				

Damage costs

Damage costs have been calculated by Defra to represent the monetary value of the changes in air pollution and are based on an estimate of costs to society as a whole (including environmental, social and economic impacts). These were issued in 2015⁶⁰ and have been used to monetise the emissions savings of NO_x and PM as a result of bringing the ULEZ forward to 2019.

⁶⁰ www.gov.uk/guidance/air-quality-economic-analysis

Figure 17: Damage costs savings (£millions) as a result of the earlier introduction of the ULEZ

	Central estimate	Low estimate	High estimate
Central	10.0	4.2	15.8
Inner	34.3	14.5	53.9
Outer	22.3	9.6	34.9
GLA	66.6	28.3	104.6

5.6 Impact on concentrations

An earlier implementation of the ULEZ would see concentrations of NO₂ and PM reduce. The area of central London exceeding legal limit values for NO₂ would reduce from 30 per cent to 22 per cent. This is equivalent to a reduction in the area that is currently exceeding the limit value of nearly 30 per cent (see Table 19). Inner and outer London are also expected to benefit from the reductions in vehicle emissions as a result of introducing the ULEZ sooner in 2019 instead of 2020, equating to a reduction in the exceedence area by over 10 and five per cent respectively.

Table 19: Impact of bringing the ULEZ forward to 2019 on area exceeding NO₂ limit values in 2019

	% of area exceeding the NO ₂ limit values		% reduction in the area exceeding the NO ₂ limit values (impact of the earlier introduction of the ULEZ in 2019)
	Baseline 2019	ULEZ 2019	
Central London	30%	22%	28%
Inner London	8%	7%	13%
Outer London	2%	2%	6%
London-wide	4%	4%	11%

Figure 18 and Figure 19 show maps of the predicted concentrations across London in 2019 with the introduction of the ULEZ in 2020 and in 2019 respectively. Figure 20 and Figure 21 show the same, but with the map focused in on central London. Figure 22 and Figure 23 show the difference in concentrations as a result of bringing forward the ULEZ to 2019.

Figure 18: Baseline 2019 concentrations of NO₂ (with the ULEZ in 2020)

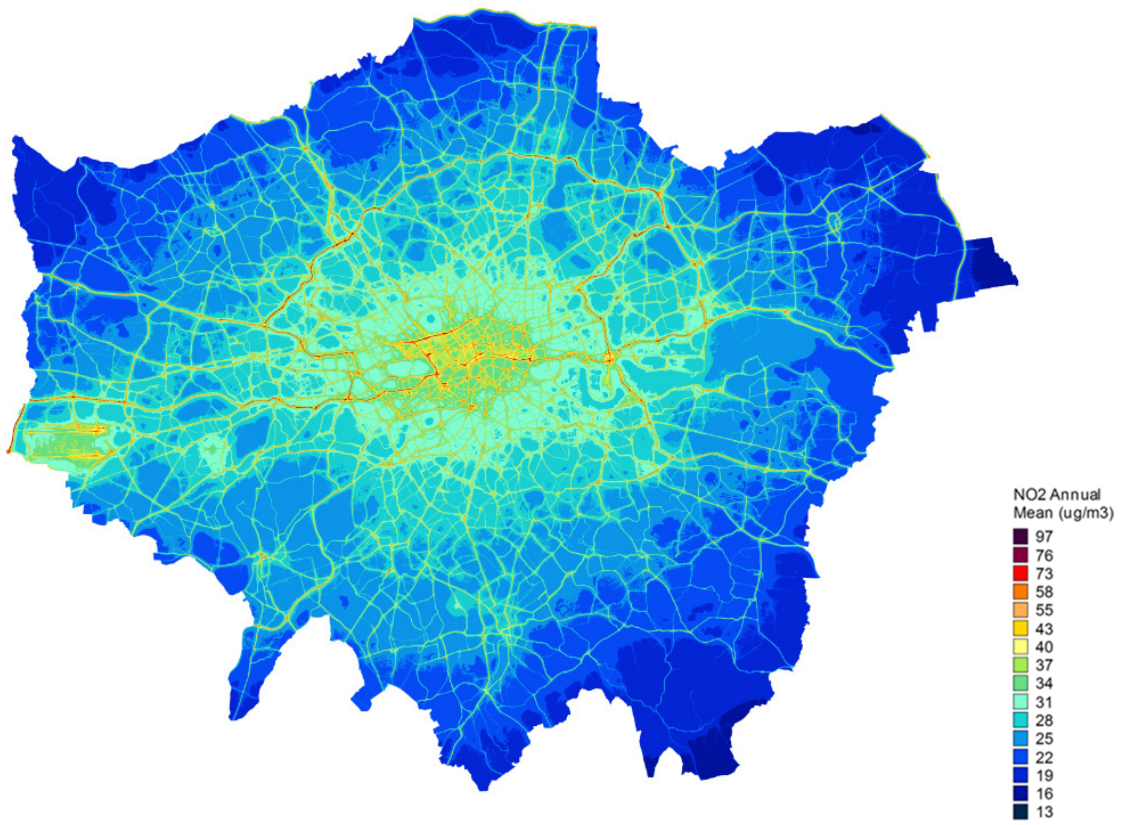


Figure 19: 2019 concentrations of NO₂ (with the ULEZ in 2019)

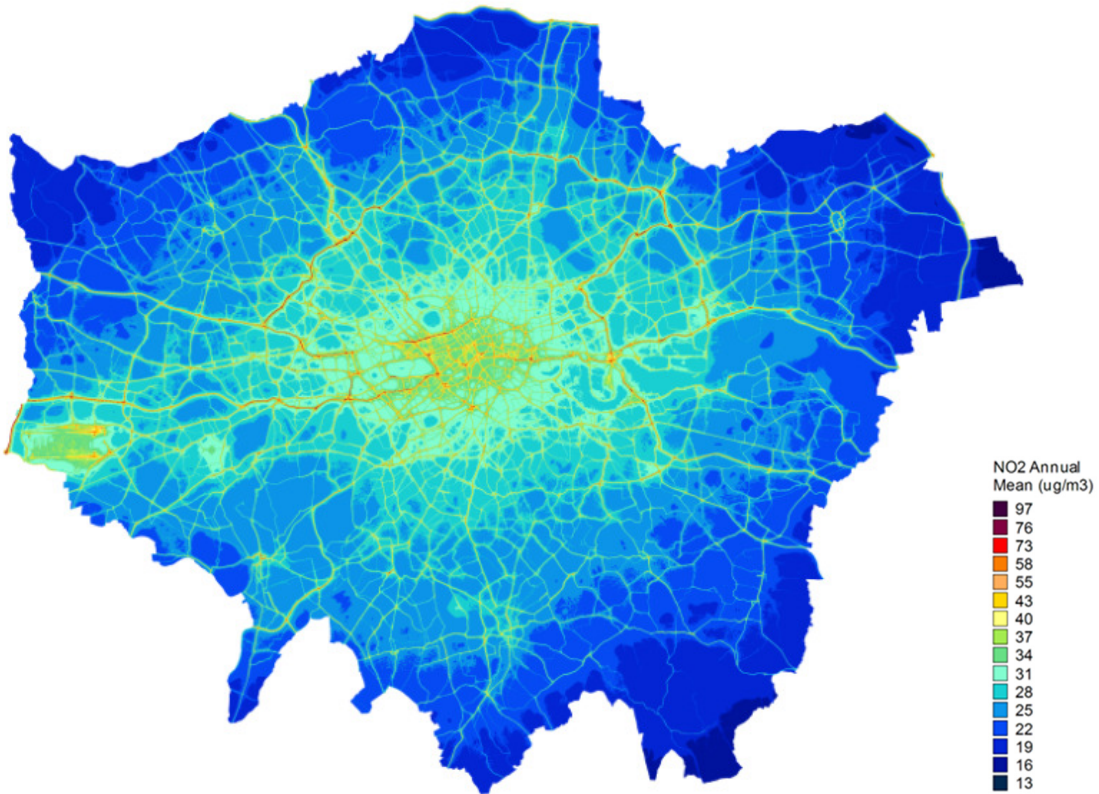


Figure 20: Baseline 2019 concentrations of NO₂ in central London (with the ULEZ in 2020)



Figure 21: 2019 concentrations of NO₂ in central London (with ULEZ in 2019)



Figure 22: Impact of the ULEZ being brought forward to 2019 on predicted NO₂ concentrations across Greater London

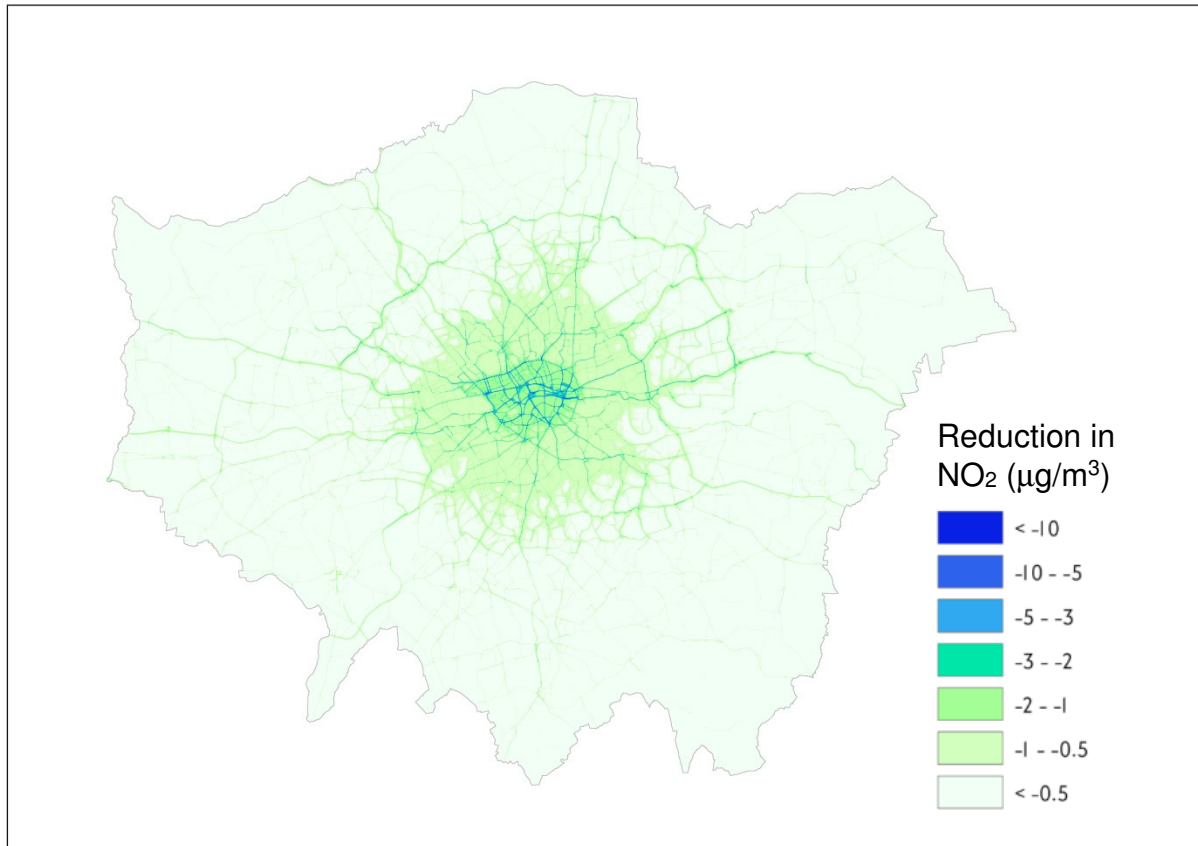


Figure 23: Impact of ULEZ brought forward in 2019 on predicted NO₂ concentrations



Bringing the ULEZ forward is forecast to reduce roadside concentrations in central London by between three to five $\mu\text{g}/\text{m}^3$ (around a five per cent reduction), but some roads are forecast to have reductions in the order of five to 10 $\mu\text{g}/\text{m}^3$ (equivalent to about a 10 per cent reduction in concentrations). Background concentrations are forecast to reduce by between one to two $\mu\text{g}/\text{m}^3$ in central London, which is a reduction of around three to five per cent.

In inner London, background concentrations are forecast to reduce by around 0.5 to one $\mu\text{g}/\text{m}^3$, which is a reduction of about two per cent. Roadside concentrations in inner London are forecast to reduce by between two to three $\mu\text{g}/\text{m}^3$, which is about a two to four per cent reduction.

In outer London, small reductions in background concentrations of NO_2 are predicted (less than 0.5 $\mu\text{g}/\text{m}^3$, which is about a one per cent reduction), whilst roadside concentrations are predicted to reduce by one to two $\mu\text{g}/\text{m}^3$ for example on roads such as the North and South Circular Roads, which represents about a one to two per cent reduction.

Table 20 shows the impact of introducing the ULEZ earlier in 2019 on the number of road kilometres exceeding NO_2 concentration limit values. Main roads in London are still predicted to exceed the NO_2 annual limit value, even with the ULEZ brought forward, and more action is needed to reduce concentrations in central, inner and outer London to below legal limits.

Table 20: Impact of the ULEZ being brought forward on road kilometres exceeding NO_2 concentration limit values

	Proportion of road kilometres exceeding NO_2 limit values at roadside in 2019 ³⁹		Reduction in road kilometres exceeding NO_2 limit values due to the ULEZ being brought forward to 2019
	Baseline 2019	With ULEZ in 2019	
Central	82%	70%	15%
Inner	55%	49%	11%
Outer	24%	22%	10%
Londonwide	36%	32%	11%

It is clear that implementing the ULEZ earlier has knock-on benefits outside the ULEZ area (as described above) and this is an important factor when considering options for expanding the ULEZ.

5.7 Impact on population exposure

Reducing NO₂ concentrations across London will mean that the number of people exposed to high pollution levels will reduce, and in many areas fewer people will be exposed to pollution levels above the legal limit values. As a result, the general population and sensitive groups like children, the elderly and those with underlying conditions will benefit from better air quality earlier.

The number of people living in areas exceeding the NO₂ limit value is projected to decrease across London, with the most dramatic effect seen in central London. This is presented in Table 21 and Figure 24 below. Bringing the ULEZ forward to 2019 will mean that over 30,000 people in central London, and 100,000 people across London, will no longer live in areas exceeding the NO₂ limit values (based on population weighted concentrations). This is a 40 per cent reduction in the number of people living in areas exceeding limit values in central London.

Table 21: Impact of bringing the ULEZ forward to 2019 on populations living in areas exceeding NO₂ limit values in 2019⁶¹

	Estimated total population	Total population in Output Areas exceeding NO ₂ limit values	
	2019	Baseline 2019	ULEZ 2019
Central London	205,200	72,000	41,900
Inner London	3,728,900	270,000	203,400
Outer London	5,031,700	38,000	28,800
London-wide	8,965,800	380,000	274,100
		Proportion of the population living in areas exceeding NO ₂ limits	
		Baseline 2019	ULEZ 2019
Central London		35%	20%
Inner London		7%	5%
Outer London		1%	1%
London-wide		4%	3%
		Impact of bringing the ULEZ forward to 2019	
		Population no longer living in areas exceeding the limit value	% reduction in the population living in areas exceeding limit value
Central London		30,100	42%
Inner London		66,600	25%
Outer London		9,200	24%
London-wide		105,900	28%

⁶¹ Population estimates are rounded.

Figure 24: Areas exceeding the NO₂ limit value in 2019 (based on Output Areas)

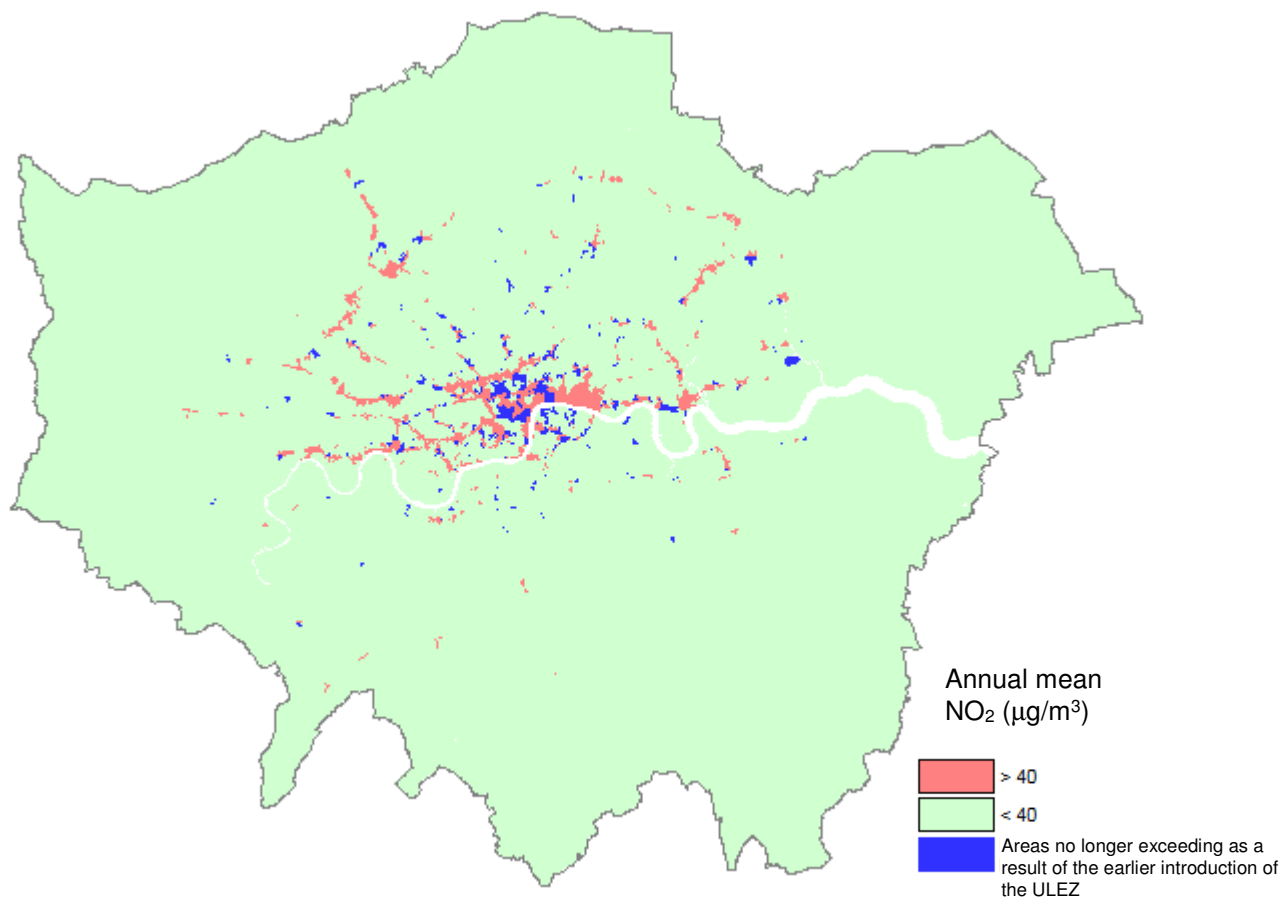


Table 22 provides a summary of population weighted average concentrations across London. Appendix F provides further details of concentrations and changes in exposure for each London borough. Bringing the ULEZ forward will improve air quality, particularly in central London, but it is clear that more action is needed to help reduce the number of people, over around 230,000 in 2019 (see Table 21), who are exposed to poor air quality in both inner and outer London.

Table 22: Population weighted average concentrations in 2019

Area	NO ₂ annual mean concentrations (µg/m ³)			PM ₁₀ annual mean concentrations (µg/m ³)			PM _{2.5} annual mean concentrations (µg/m ³)			Days with average PM ₁₀ concentrations > 50 µg/m ³		
	Baseline 2019	ULEZ 2019	% change	Baseline 2019	ULEZ 2019	% change	Baseline 2019	ULEZ 2019	% change	Baseline 2019	ULEZ 2019	% change
Central London	39	37.5	4%	26.5	26.4	0.2%	16.2	16.2	0.3%	16.3	16.1	0.9%
Inner London	34	33.0	2%	24.4	24.4	0.1%	15.0	15.0	0.2%	11.3	11.3	0.5%
Outer London	28	27.7	1%	22.9	22.9	0.1%	14.2	14.2	0.1%	8.2	8.2	0.3%
London-wide	31	30.1	2%	23.6	23.6	0.1%	14.6	14.6	0.1%	9.7	9.6	0.4%

The number of sensitive locations (schools, hospitals and care homes) in areas exceeding the NO₂ limit value is forecast to decrease in the ULEZ (see Table 23).

Table 23: Sensitive locations (schools, hospitals and care homes) in areas exceeding NO₂ limits in 2019 with ULEZ in 2019

Area	Schools		Hospitals		Care homes	
	Number of sites	Number exceeding (%)	Number of sites	Number exceeding (%)	Number of sites	Number exceeding (%)
Central London	160	45 (28%)	28	9 (32%)	6	0 (0%)
Inner London	1797	74 (4%)	57	1 (2%)	581	19 (3%)
Outer London	2354	9 (0%)	89	0 (0%)	1377	2 (0%)
London-wide	4311	128 (3%)	174	10 (6%)	1964	21 (1%)

Figure 25: Number of sensitive locations (schools, hospitals and care homes) in areas of exceedence (NO₂) in 2019 with the ULEZ in 2020 (baseline 2019) and with the ULEZ in 2019

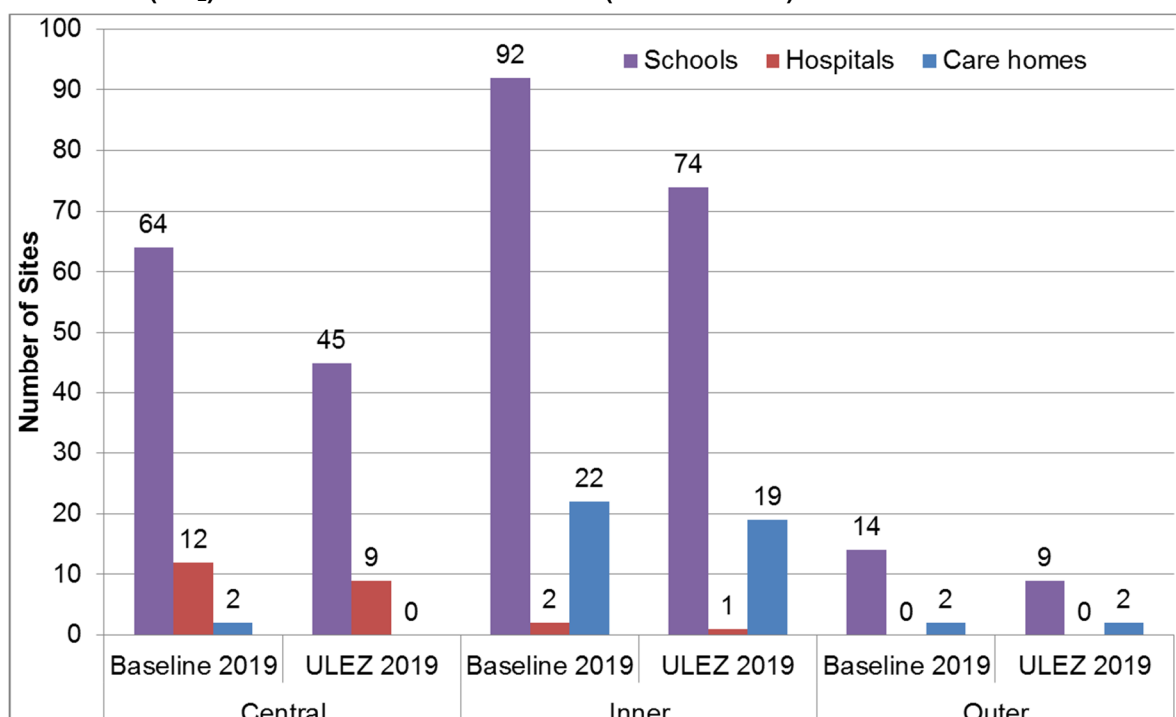


Figure 26: Schools, hospitals and care homes that have been improved and/or are no longer in exceedence due to the ULEZ being brought forward

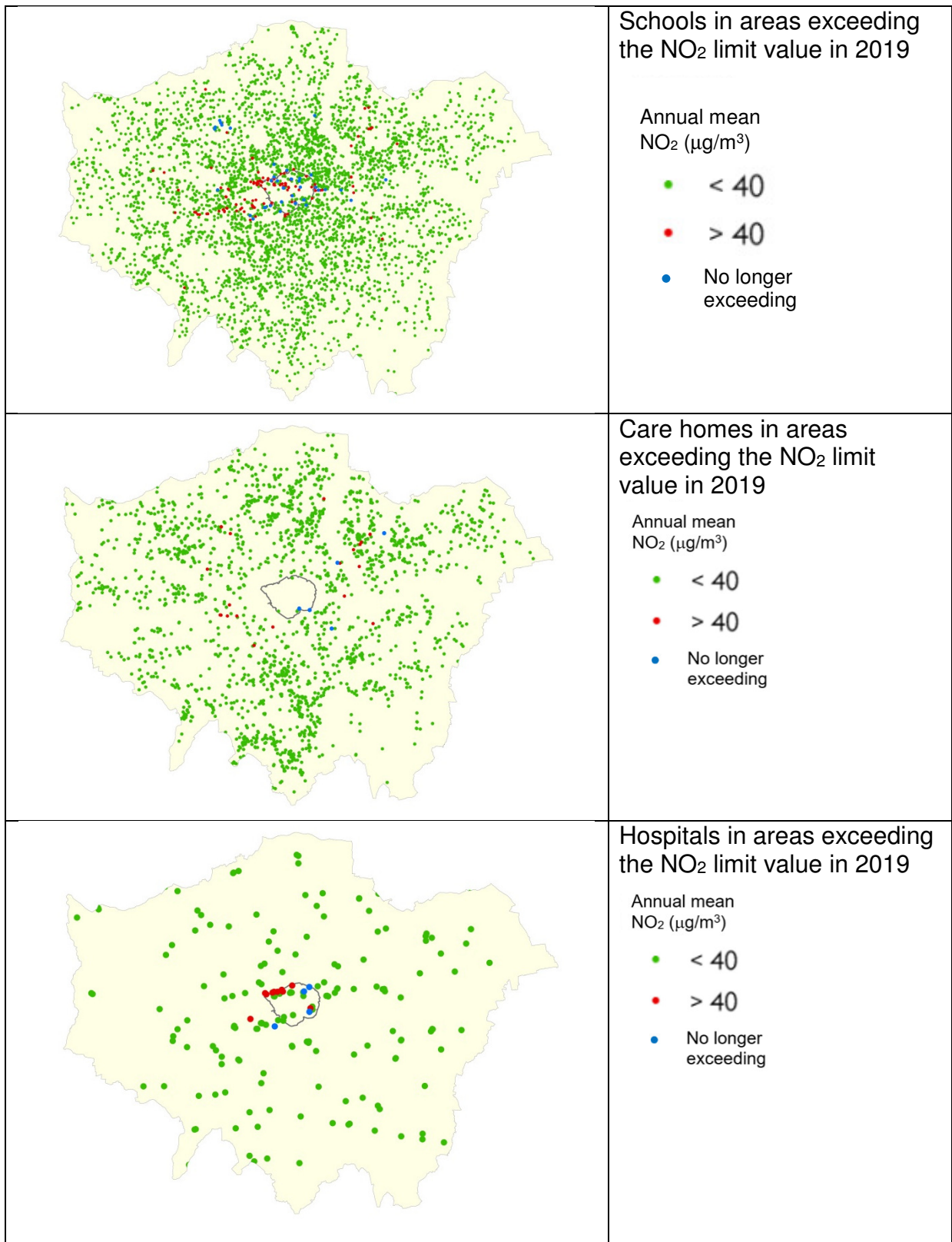
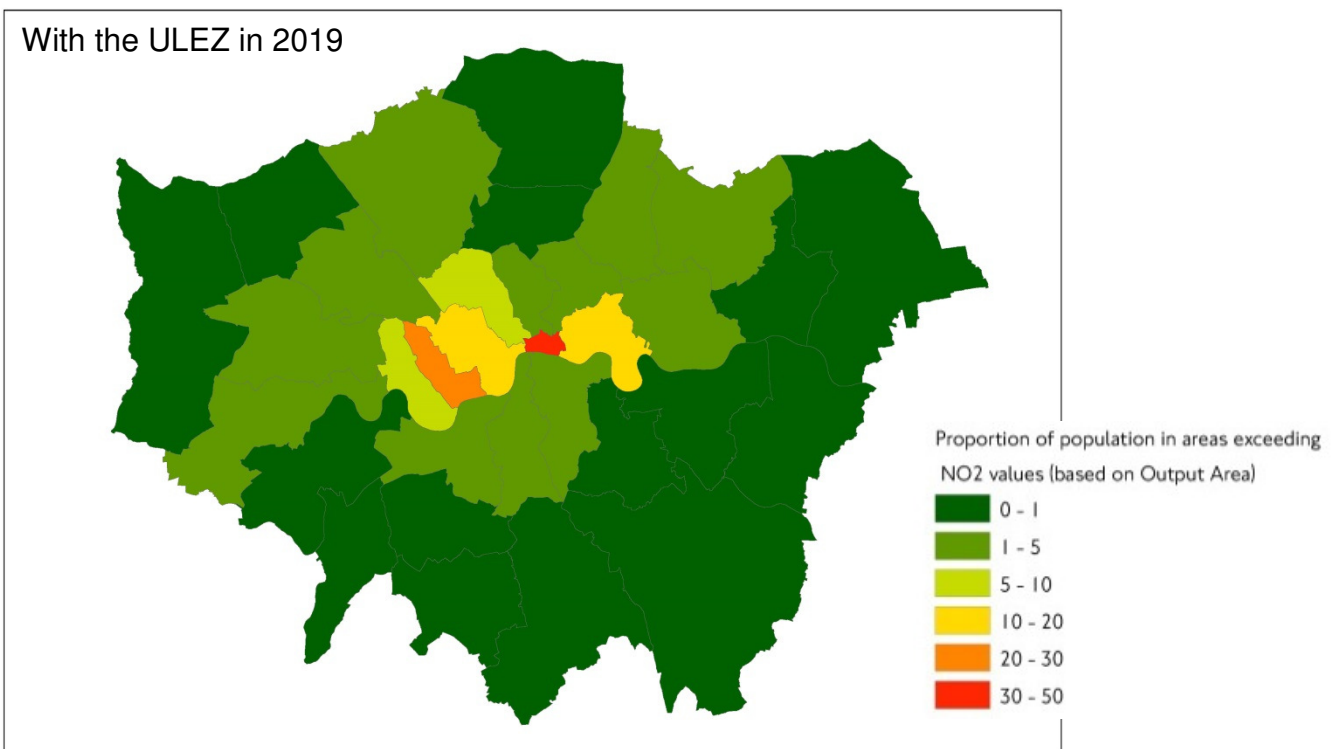
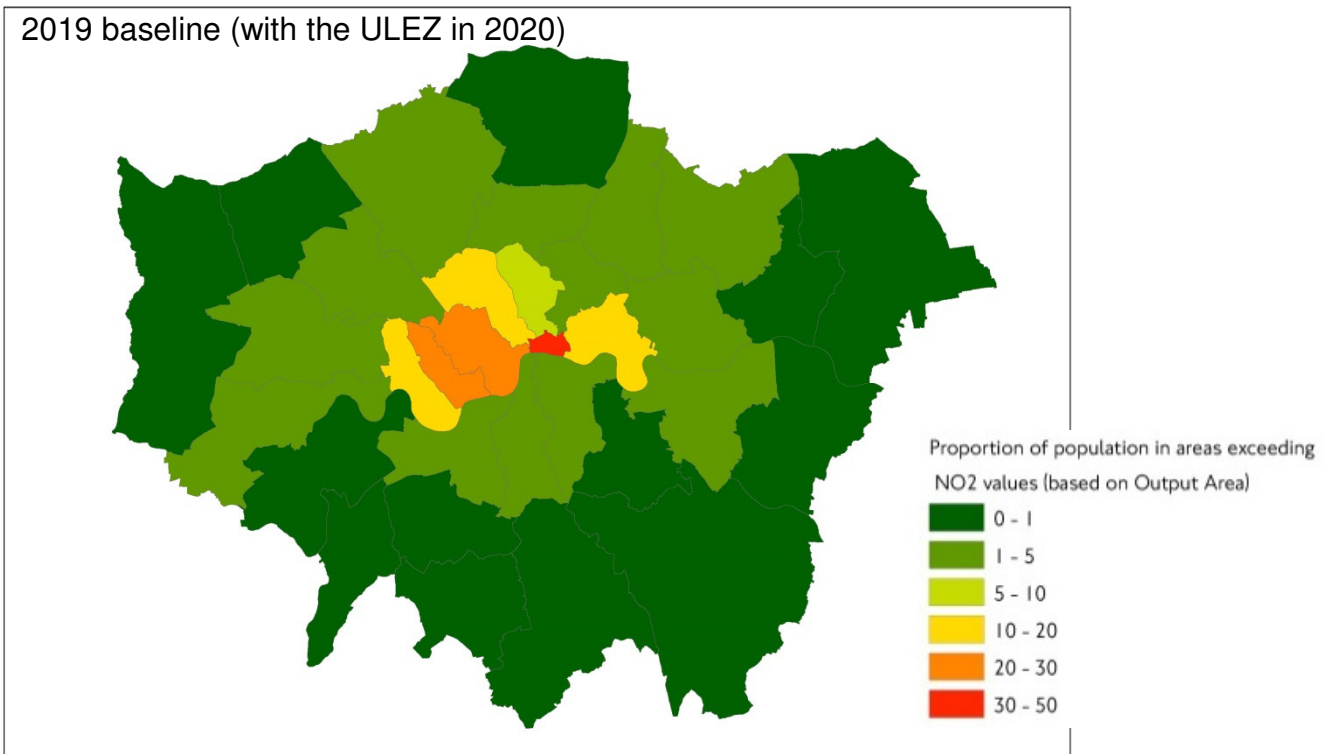


Figure 27: Percentage of the population living in areas of NO₂ exceedence in 2019 (with baseline and with the ULEZ proposal being brought forward)



5.8 Number of vehicles affected

Using the Automatic Number Plate Recognition (ANPR) cameras located around, and within, the congestion charge zone, we are able to estimate the number of unique vehicles that enter the zone on an average day. Taking these totals, from March 2017 data, and combining them with our forecast estimates for the vehicle fleet in 2019 from the LAEI 2013, we can show the expected number of vehicles, per day, that will need to take action as a result of the earlier introduction of the ULEZ in 2019.

Our most recent estimate of the fleet indicates that, on average, around 60,000 vehicles driving within the Congestion Charging zone (the area of the ULEZ in central London) per day would not meet the emissions standards in 2019. However, with a 2020 implementation date, owners of vehicles would start to prepare and there would be an element of pre-compliance with the standards. Taking this into account it is expected that just over 40,000 vehicles per day would be affected by the start date of the ULEZ moving forward to April 2019. Table 24 summarises these figures by vehicle type.

Table 24: Approximate number of vehicles in 2019 affected by the ULEZ

Vehicle type	Number of vehicles in the ULEZ on an average day	Number expected to be non-compliant in 2019 (with no ULEZ in place)	Number expected to be non-compliant in 2019 (with ULEZ starting in 2020)
Car (including PHVs ⁶²)	100,000	40,000	25,000
Van and minibus	30,000	19,000	14,000
HGV	6,000	2,000	1,000
Non-TfL bus and coach	1,500	700	500

5.9 Cost of compliance for the ULEZ

Whilst many vehicles will already be compliant owing to natural fleet turnover and preparation for the 2020 ULEZ, the proposal to commence the ULEZ in 2019 would accelerate this process. It also means that people upgrading their vehicles will on average be buying newer, and therefore more expensive, vehicles in order to comply. Table 25 below shows the compliance levels with the scheme (in terms of vehicle km) and the difference in cost, of the oldest compliant vehicle for each category. The costs are indicative of the average across the vehicle type category. Clearly large variations exist within each vehicle category especially where there are a variety of different sizes of vehicle. These figures are just to give an indication of the difference in cost as a result of the start date being brought forward.

⁶² PHVs account for around a third of the cars seen on an average day

The Mayor and TfL appreciate the impacts in terms of the cost for owners of non-compliant vehicles having to upgrade their vehicles sooner or pay the ULEZ charge for up to an additional 17 months. However, it is considered that, on balance, this cost is more than offset but by the need to urgently improve air quality and accelerate the health benefits of the ULEZ by introducing it sooner.

Table 25: Estimated compliance cost in 2019 with the ULEZ starting in 2020 and in 2019

Type of vehicle	ULEZ emissions standard	Percentage of annual km driven by compliant vehicles in 2019 (baseline with ULEZ starting in 2020)	Percentage of annual km driven by compliant vehicles in 2019 (with ULEZ starting in 2019)	Average cost of oldest compliant vehicle (if ULEZ started in 2020)	Average cost of oldest compliant vehicle (if ULEZ started in 2019)
HGV	Euro VI	80%	97%	£16k	£19k
Coach/ other bus	Euro VI	68%	84%	£60k	£75k
Van	Euro 6 (diesel) Euro 4 (petrol)	59%	73%	£11k	£13k
Car (including PHVs)	Euro 6 (diesel) Euro 4 (petrol)	75%	89%	£8k diesel £1.4k petrol	£9.5k diesel £1.6k petrol

5.10 Traffic and transport effects

The reduction of traffic or congestion is not an aim of the ULEZ. However, introducing an emissions requirement for vehicles is likely to deter a small proportion of trips. For drivers who make only infrequent trips in the zone (of which there is a high level), it would not be economically rational to upgrade their vehicle specifically to comply with the ULEZ standards and so these users are more likely to ‘stay and pay’ the ULEZ charge. Those who visit more frequently are more likely to upgrade their vehicle. In both cases, there will be a small number of users unwilling to pay either the ULEZ charge or the cost of upgrading their vehicles and so will be deterred from using their vehicle in the ULEZ.

Through the behavioural analysis and traffic modelling undertaken for the original ULEZ proposal in 2014, we estimated a 5 per cent reduction in car and van kilometres, a 4 per cent reduction in coach kilometres and a 2 per cent reduction in HGV kilometres. Exploring how users of the zone would respond differently to a 2019 start date we found that these reductions could be increased by around one per cent to reflect the increased costs associated with compliance.

Trips diverting around the ULEZ could use the Inner Ring Road⁶³. Assignment modelling for the original ULEZ proposal showed vehicle kilometres on the Inner Ring Road would reduce by one to two per cent due to the knock-on impact of the lower trip rate to central London offsetting the small amount of re-routing expected to occur. This is expected to hold true for the ULEZ starting earlier in April 2019.

This mirrors the experience with the Congestion Charge where 'new' trips diverting onto the Inner Ring Road were counterbalanced by capacity 'freed up' by other deterred trips. Additionally, given that the Congestion Charge is already a deterrent, the number of 'through trips' during weekday daytime hours is small. Other traffic deterred from the ULEZ could be reflected in less traffic in inner and outer London, as the legs of these trips in these areas are also not being made.

5.11 Integrated Impact Assessment (IIA)

We commissioned Jacobs Consultancy to undertake an IIA for bringing forward the commencement of the ULEZ to April 2019 from September 2020 to examine the likely significant impacts of the proposal on the environment, health, equalities and the economy.

Rather than repeat a full IIA, the impacts identified in the IIA for the ULEZ in 2020 have been considered in terms of whether they have changed as a result of bringing the ULEZ forward to 2019. Consideration was also given to whether there are further, additional impacts owing to the earlier introduction.

The full assessment is attached as Appendix H. It concluded that the proposed change to the implementation date of the ULEZ from autumn 2020 to spring 2019 is anticipated to result in short term additional impacts including:

- Moderate air quality benefits London-wide due to reduced NO₂ concentrations in 2019
- Health benefits associated with an additional year of air quality benefits
- Minor adverse impacts on commuter coaches, tourist coaches and sightseeing bus operators entering London and tradespeople, market traders and some independent retailers due to costs associated with either complying earlier with ULEZ or paying the charge
- Minor beneficial impacts associated with an earlier reduction in the average exposure to NO₂ in deprived areas
- Moderate beneficial impacts associated with an earlier reduction in the number of school age children, older people and pregnant women exposed to exceedences of legal limits for NO₂ concentrations
- Minor adverse impacts on some equality groups including:

⁶³ Inner Ring Road is the unofficial term often used to describe the roads (see Figure 1) that bound the Congestion Charging zone

- BAME⁶⁴ retail and wholesale industry businesses regularly using vans (light goods vehicles) in central London
- School children from low income families due to the increased cost of school trips by coach
- BAME drivers of PHVs who are self-employed
- Groups reliant on charitable or voluntary minibus services (eg disabled, older people, faith groups)

Whilst there will be additional impacts between the period Spring 2019 and Autumn 2020, the proposed change to the implementation year of the ULEZ is not anticipated to result in any materially different long term impacts to those previously reported in the 2014/2015 IIA.

⁶⁴ British, Black, Asian, and minority ethnic (used to refer to members of non-white communities in the UK)

Appendix A: Explanation of vehicle emissions standards

The Euro standards are a range of successively tightening emissions controls founded in European directives that set limits for air quality pollutants from petrol, gas and diesel engines. Compliance with these limits must be demonstrated as part of the European type approval process for new vehicles and road vehicle engines. There are also 'durability' requirements to demonstrate continued compliance in service.

Light duty vehicles (cars and vans) are subject to whole vehicle emissions testing, whereas engines for heavy duty vehicles (HGVs and buses) are emissions tested on a test bench, prior to installation in any vehicle. They may subsequently be fitted to a variety of different vehicle types. For the latest Euro 6/VI emissions standards, these laboratory based tests are verified by an on-highway emissions testing of a completed vehicle.

The limit values are different for each vehicle type, and to indicate which is being referred to, there is a convention that, for instance, Euro 6 refers to cars and vans (whole vehicle emissions testing), while Euro VI refers to goods vehicles and buses (engine only emissions testing). In each case, the Euro standards set out emissions limits for type approval testing that control four 'legislated' emissions – carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NO_x) and particulate matter (PM).

Euro 1 appeared in 1992 and the standards have progressed to the current Euro 6/VI⁶⁵. This became mandatory for all new heavy duty engines for goods vehicles and buses from January 2014, September 2015 for cars and light vans, and September 2016 for larger vans up to 3,500kg gross vehicle weight.

Euro standards for motorcycles, mopeds, tricycles and quadricycles (collectively known as L-Category vehicles) were introduced later than for larger vehicles, with the current standard being Euro 3. In 2017, Euro 4 for L-Category vehicles will come into force.

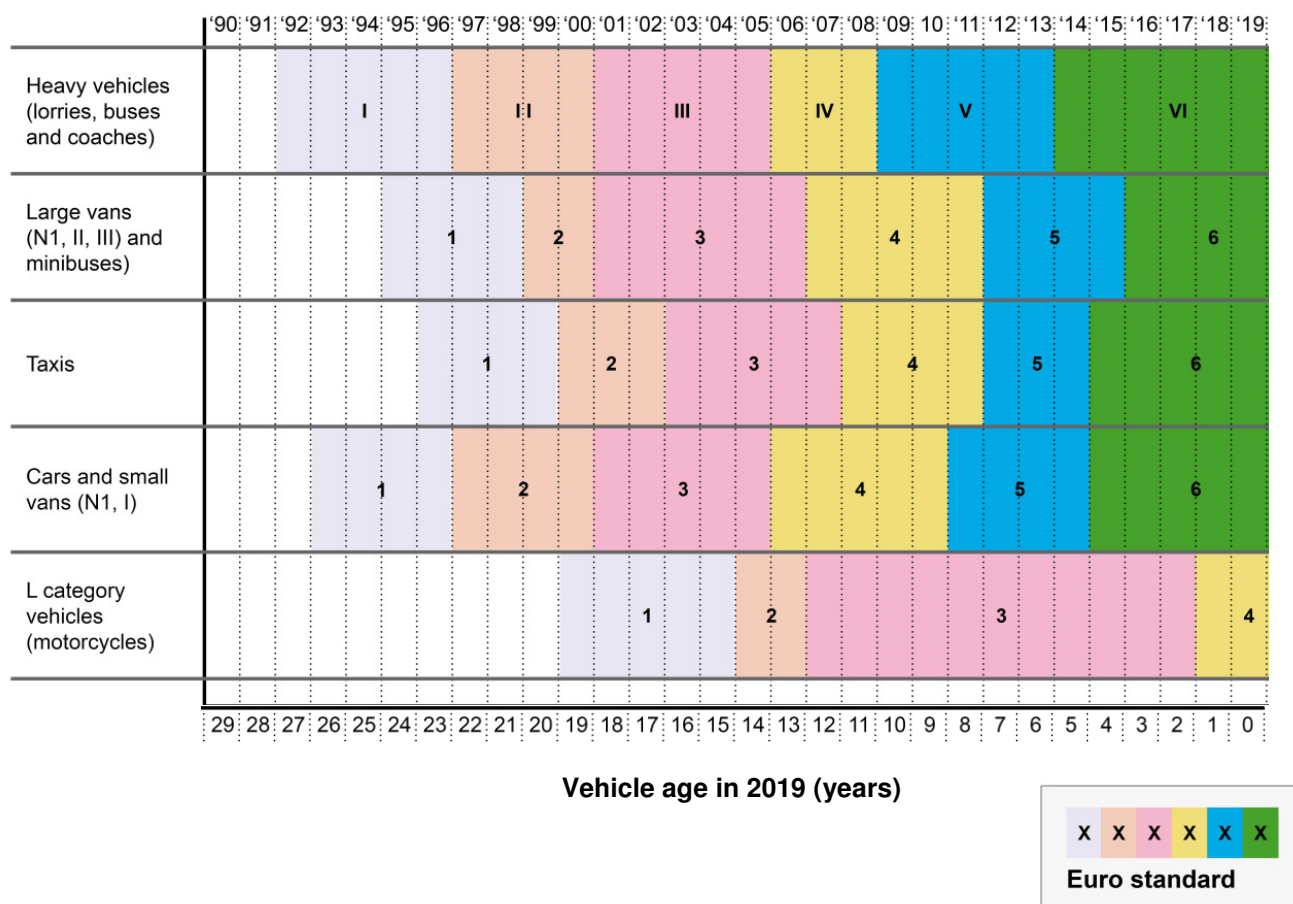
Detailed information about emissions standards for light duty vehicles can be found at <https://www.dieselnet.com/standards/eu/ld.php> and for heavy vehicles at <https://www.dieselnet.com/standards/eu/hd.php>

The table below sets out the implementation dates for each Euro standard, which differ according to vehicle type, between 1990 and 2020.

⁶⁵ Euro standards for heavy duty diesel engines use Roman numerals (I–VI) and light duty vehicle standards use Arabic numerals (1–6)

Figure 28: Euro standards over time

Year Euro standard introduced (1990 - 2020)



For NO_x emissions, light duty vehicles (eg cars and vans) use grams per kilometre (g/km) and heavy duty vehicles use grams per kilowatt hour (g/kwh) because of the different ways these vehicles are tested. In addition, heavy vehicles have both a 'steady state limit' and a 'transient limit'. These vehicles would need to comply with both limits for the ULEZ.

For certain vehicle types, some early Euro standards did not set limits for all pollutants. In this case n/a is entered in the table below. This would mean that a vehicle is effectively compliant in terms of the ULEZ for that pollutant. For example, Euro 4 petrol vehicles do not have PM limits, therefore vehicle owners only need to check that NO_x emissions meet the ULEZ standard to know whether the vehicle is compliant. As stated in the main document, we will provide a means of checking vehicles, by entering a registration number, on the TfL website well before the schemes start. In the interim we have provided a question based compliance checker tool on the TfL website¹¹.

The NO_x and PM limits for Euro 4/IV and Euro 6/VI vehicles are summarised in the tables below. The vehicle weights included in brackets are the reference mass of the vehicle at the time of type approval testing. An LGV category N1 is a light goods vehicle not exceeding 3,500kg maximum mass. An N2 LGV is a light goods vehicle

not exceeding 12,000kg maximum mass. A heavy duty vehicle is a goods vehicle, bus or coach with a maximum mass greater than 3,500kg.

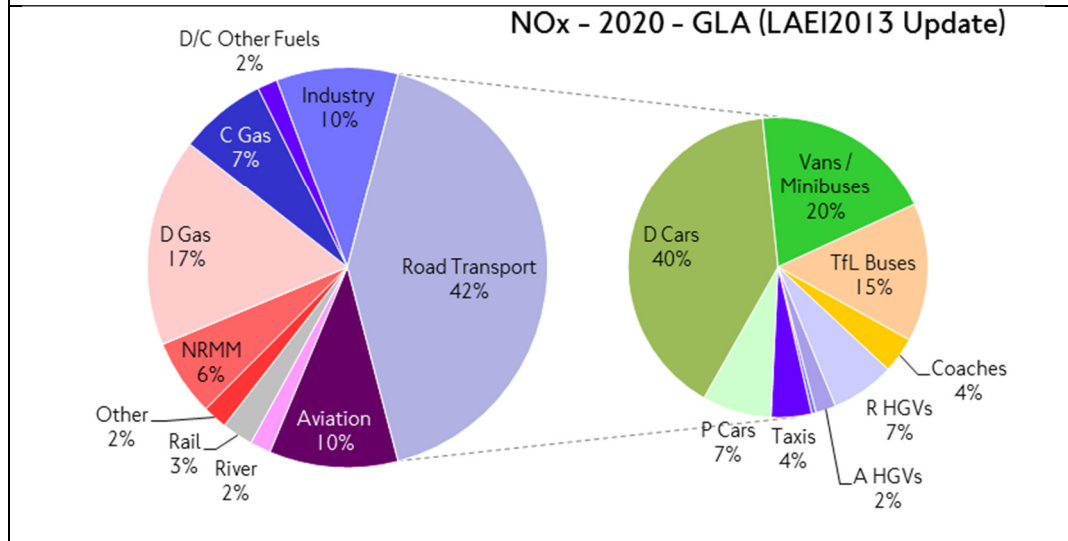
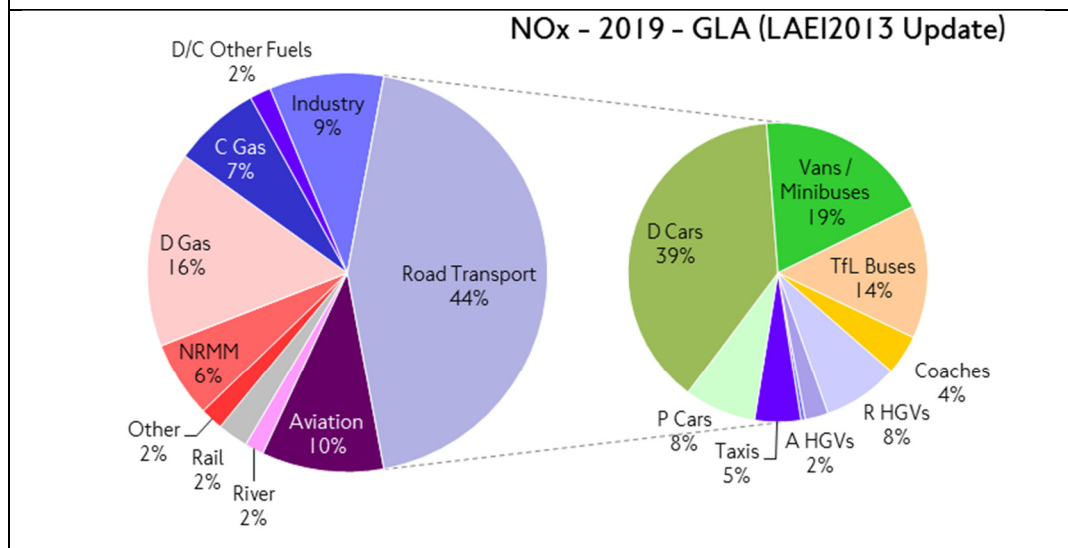
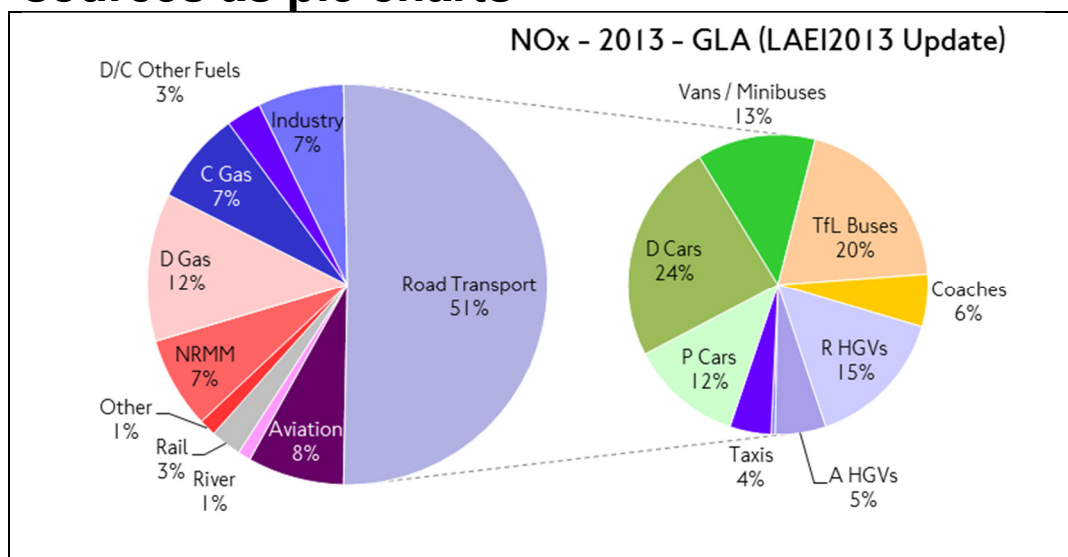
Figure 29: Euro 4 and 6 emissions limits for light duty vehicles (g/km)

	NO _x	PM
Euro 4 petrol (cars and LGV category N1 Class 1 ≤ 1,305kg)	0.08	n/a
Euro 4 petrol (LGV category N1 Class II 1,305-1,760 kg)	0.10	n/a
Euro 4 petrol (LGV category N1 Class III > 1,760kg)	0.11	n/a
Euro 4 petrol (LGV category N2)	n/a	n/a
Euro 6 diesel (cars and LGV category N1 Class 1 ≤ 1,305kg)	0.08	0.005
Euro 6 diesel (LGV category N1 Class II 1,305-1,760 kg)	0.105	0.005
Euro 6 diesel (LGV category N1 Class III > 1,760kg)	0.125	0.005
Euro 6 diesel (LGV category N2)	0.125	0.005

Figure 30: Euro VI emissions limits for heavy duty vehicles (g/kwh)

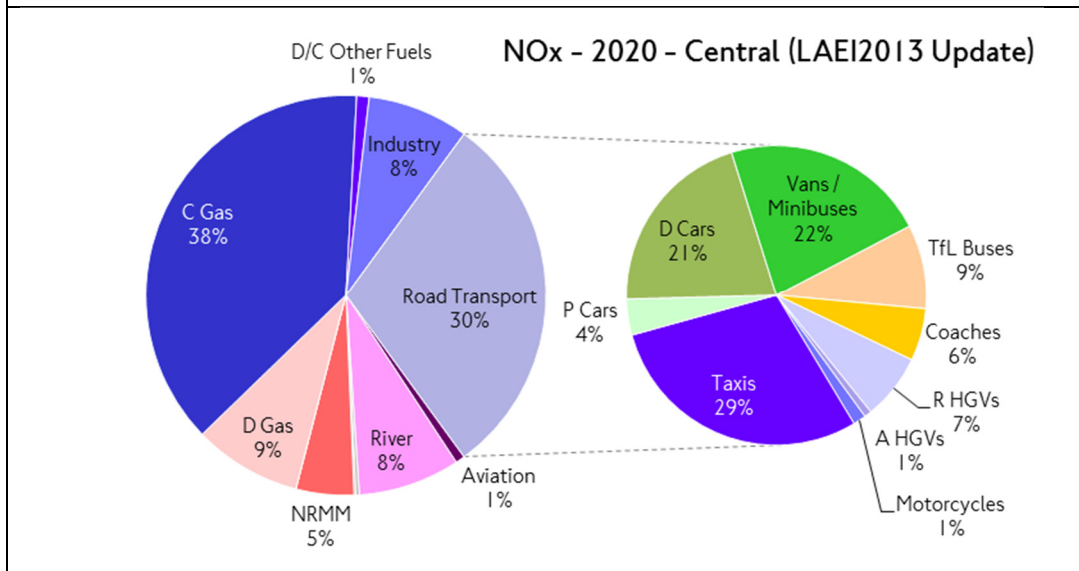
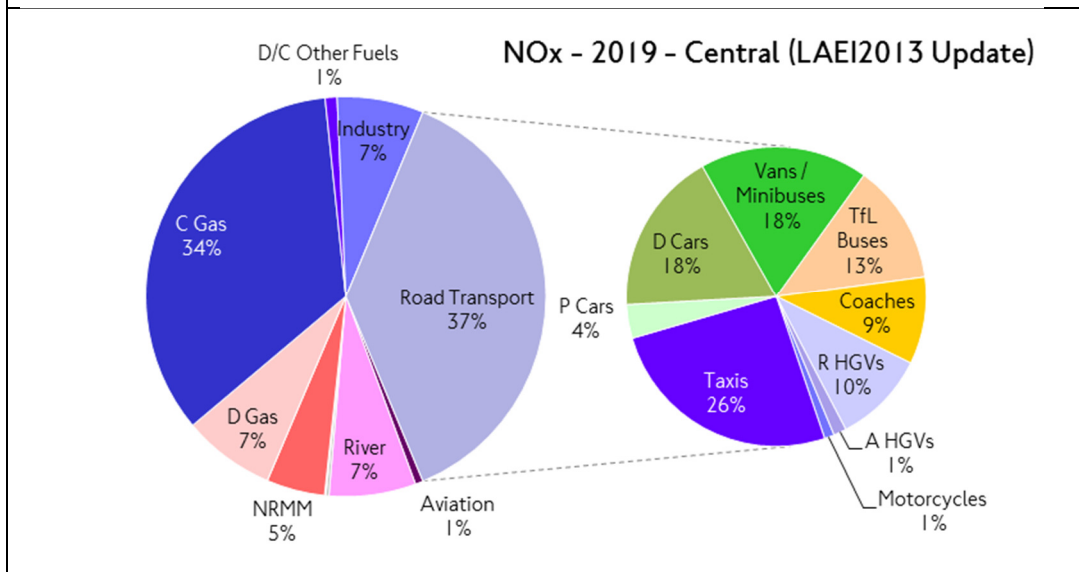
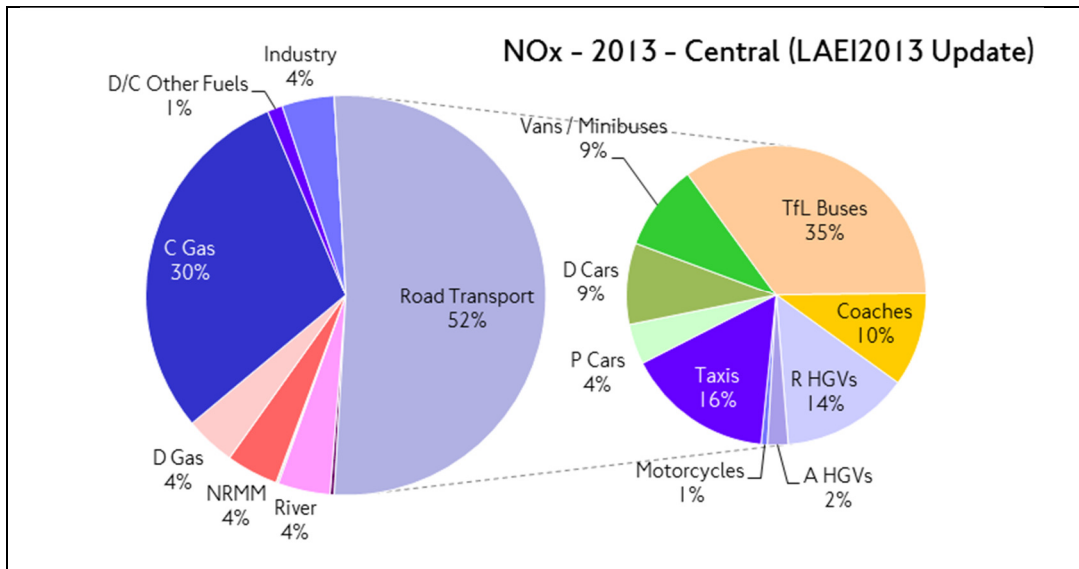
	Steady state		Transient	
	NO _x	PM	NO _x	PM
Euro VI	0.4	0.01	0.46	0.01

Appendix B: LAEI2013 update baseline emissions sources as pie charts



Legend:

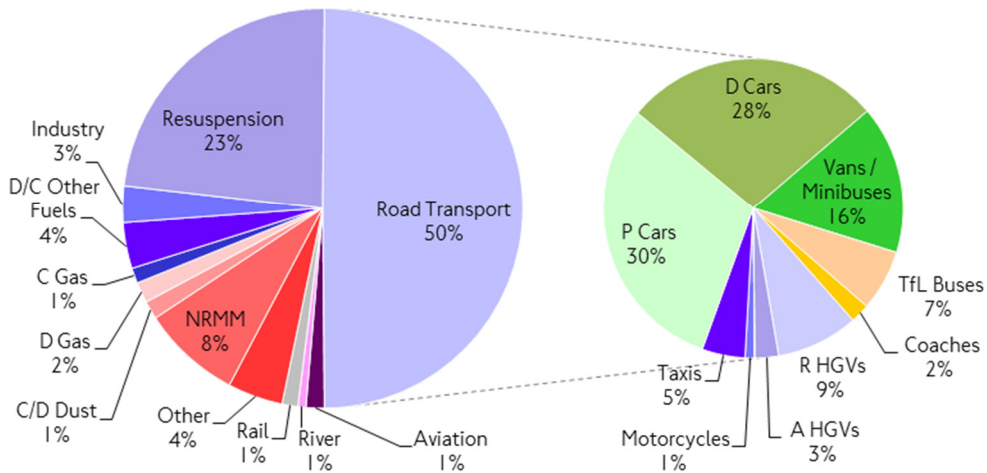
A HGVs = Articulated HGVs	C Gas = Commercial Gas
P Cars = Petrol Cars	D/C Other Fuels = Domestic/Commercial Other Fuels
D Cars = Diesel Cars	D Gas = Domestic Gas
R HGVs = Rigid HGVs	C/D Dust = Construction / Demolition Dust



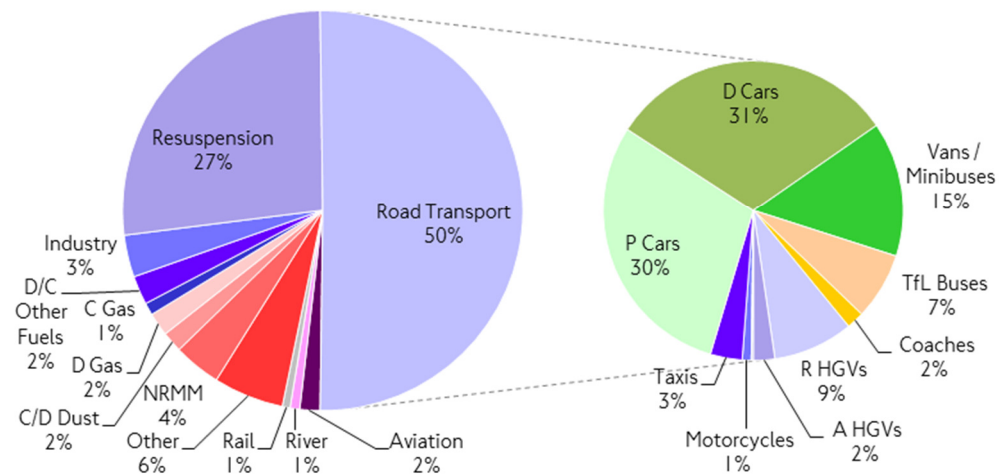
Legend:

A HGVs = Articulated HGVs	C Gas = Commercial Gas
P Cars = Petrol Cars	R HGVs = Rigid HGVs
D Cars = Diesel Cars	D Gas = Domestic Gas
	D/C Other Fuels = Domestic/Commercial Other Fuels
	C/D Dust = Construction / Demolition Dust

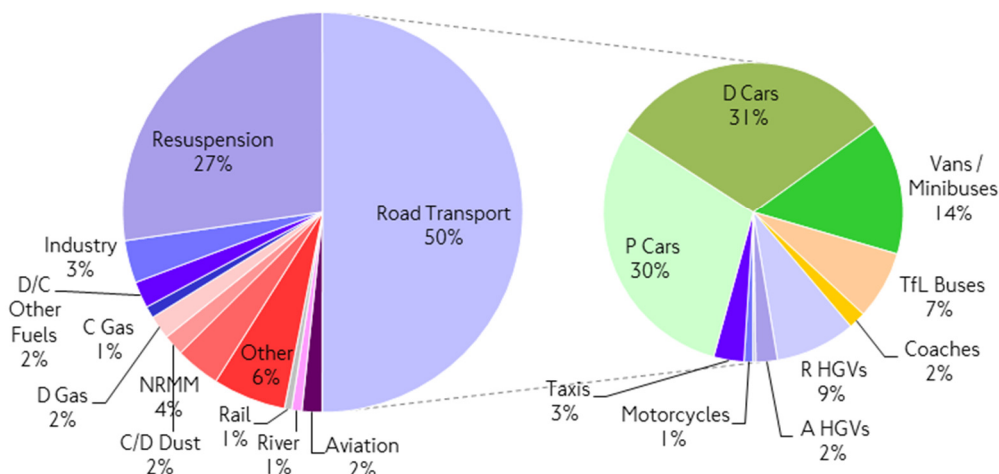
PM10 - 2013 - GLA (LAEI2013 Update)



PM10 - 2019 - GLA (LAEI2013 Update)

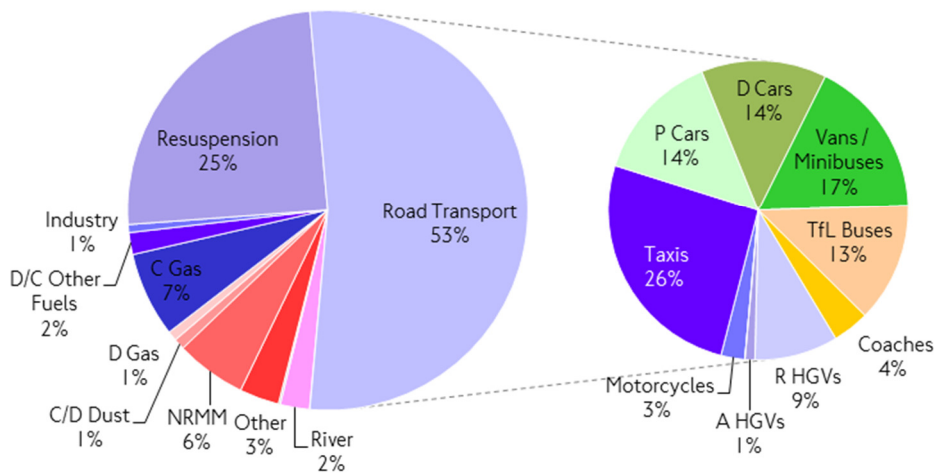


PM10 - 2020 - GLA (LAEI2013 Update)

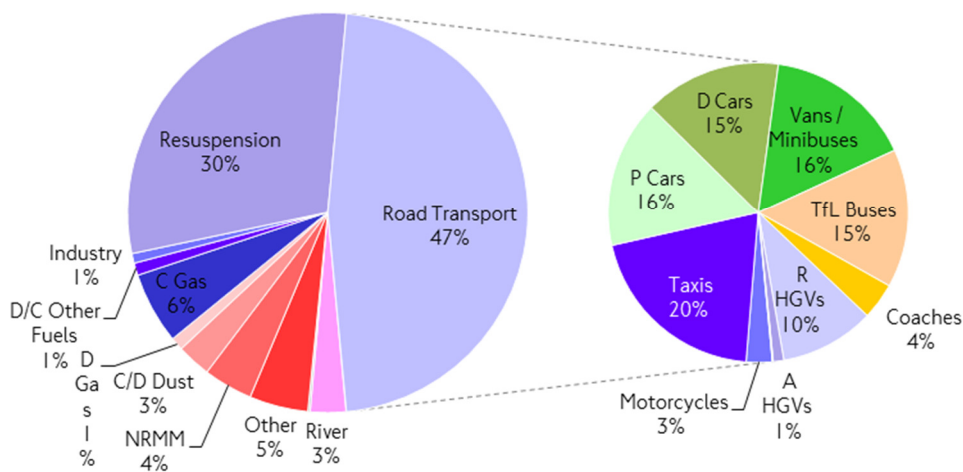


Legend:
 A HGVs = Articulated HGVs C Gas = Commercial Gas
 P Cars = Petrol Cars R HGVs = Rigid HGVs D/C Other Fuels = Domestic/Commercial Other Fuels
 D Cars = Diesel Cars D Gas = Domestic Gas C/D Dust = Construction / Demolition Dust

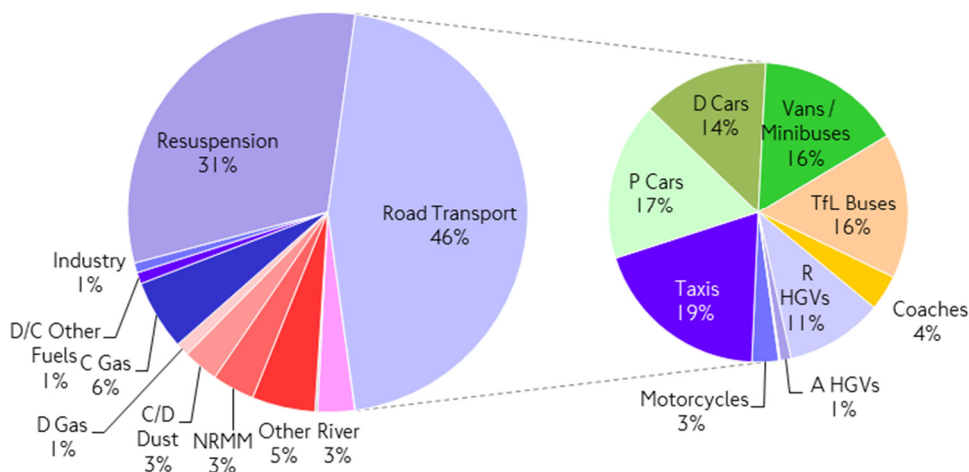
PM10 - 2013 - Central (LAEI2013 Update)



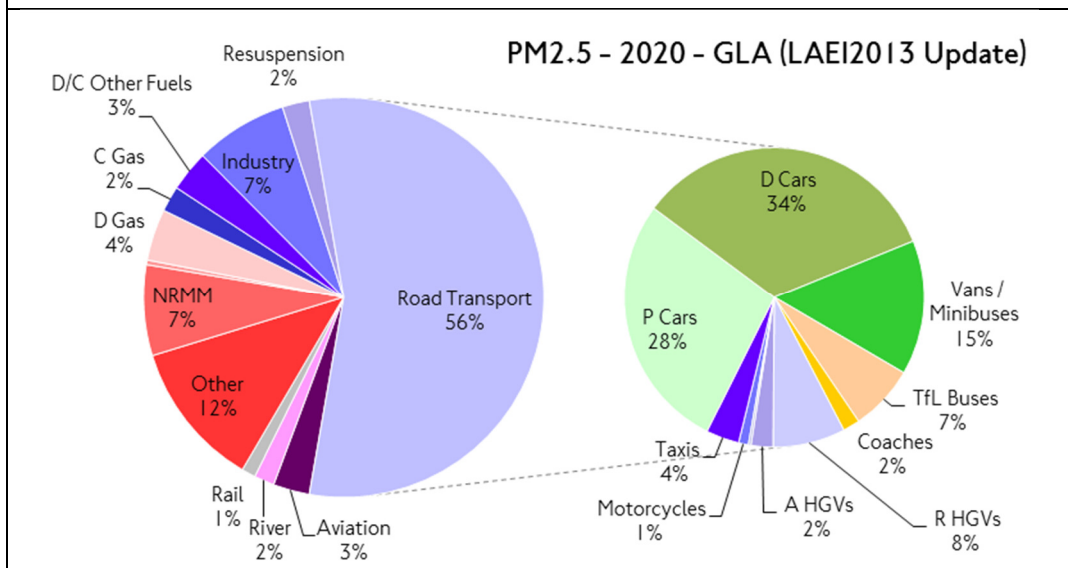
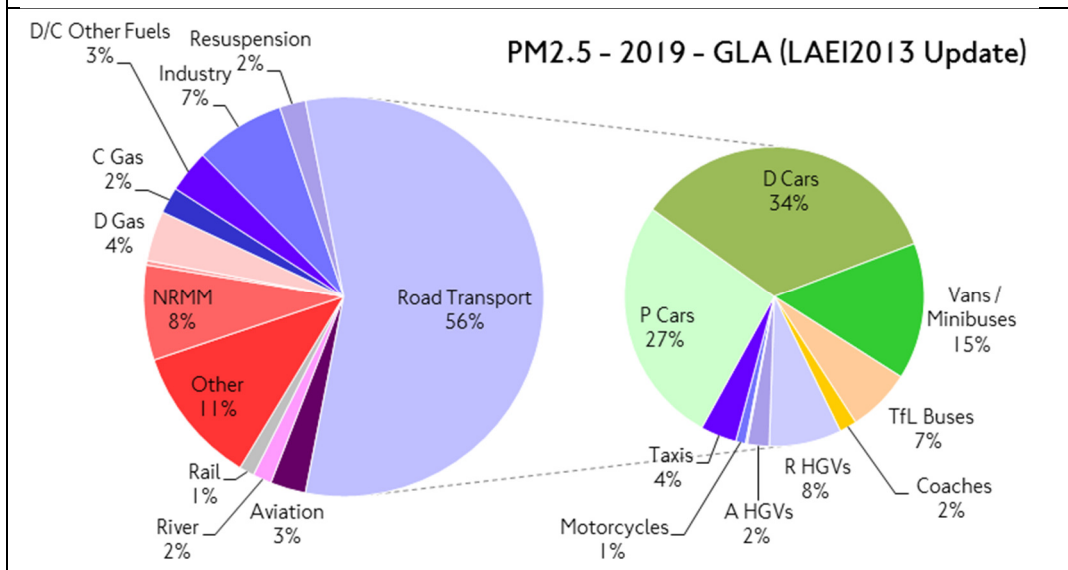
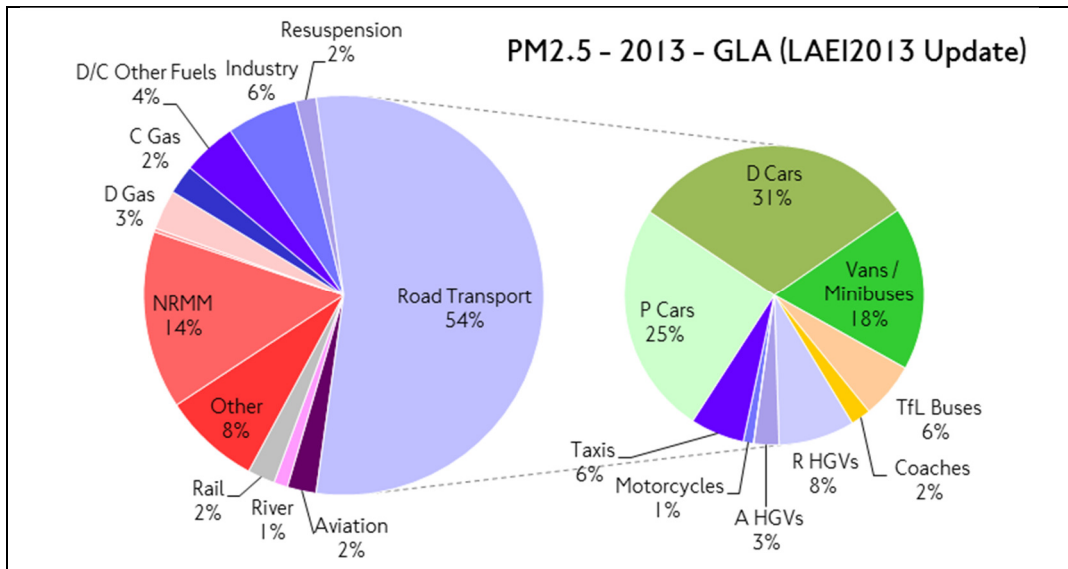
PM10 - 2019 - Central (LAEI2013 Update)



PM10 - 2020 - Central (LAEI2013 Update)

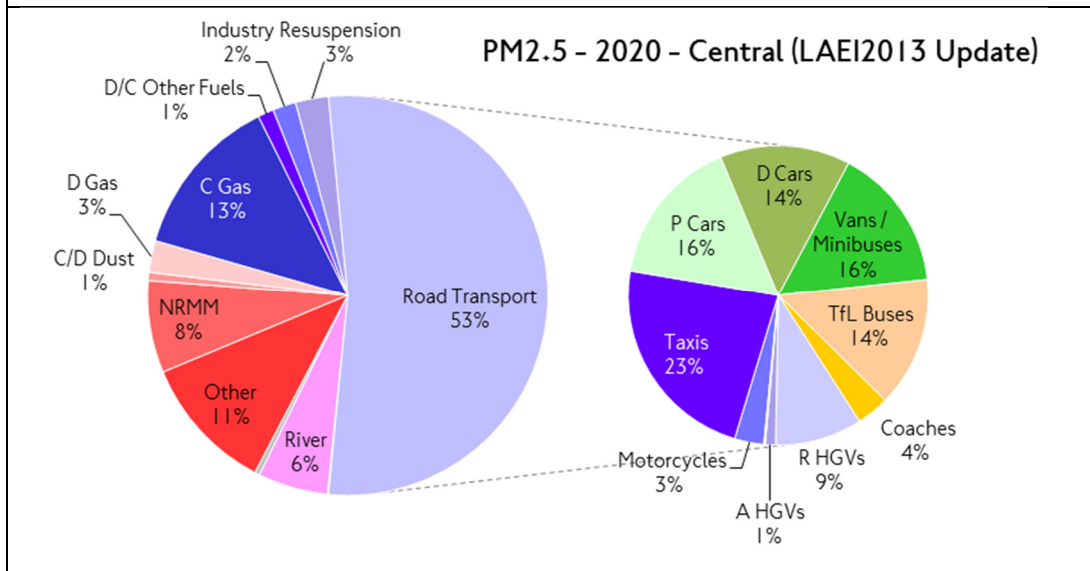
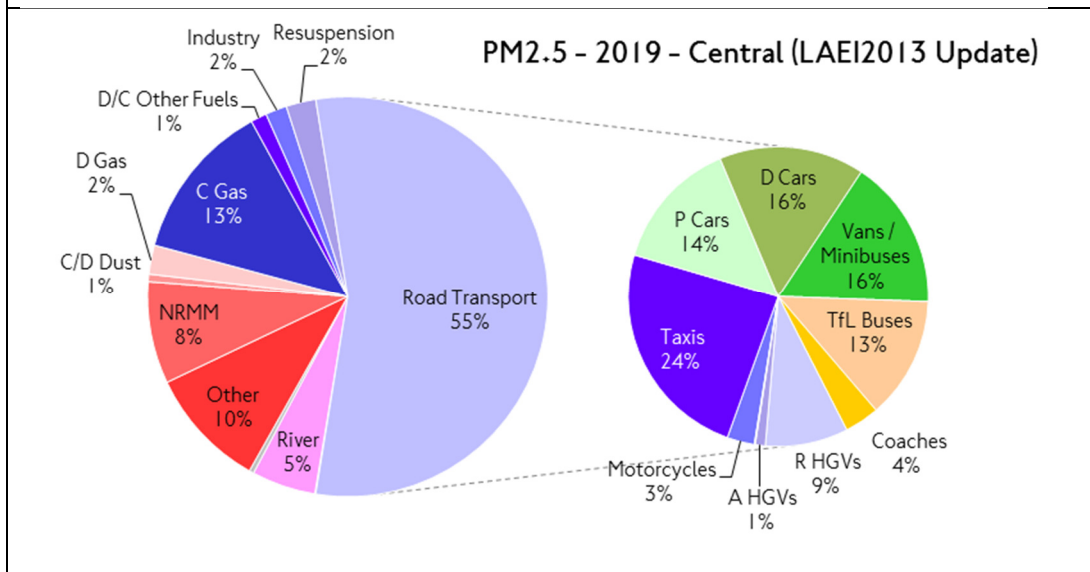
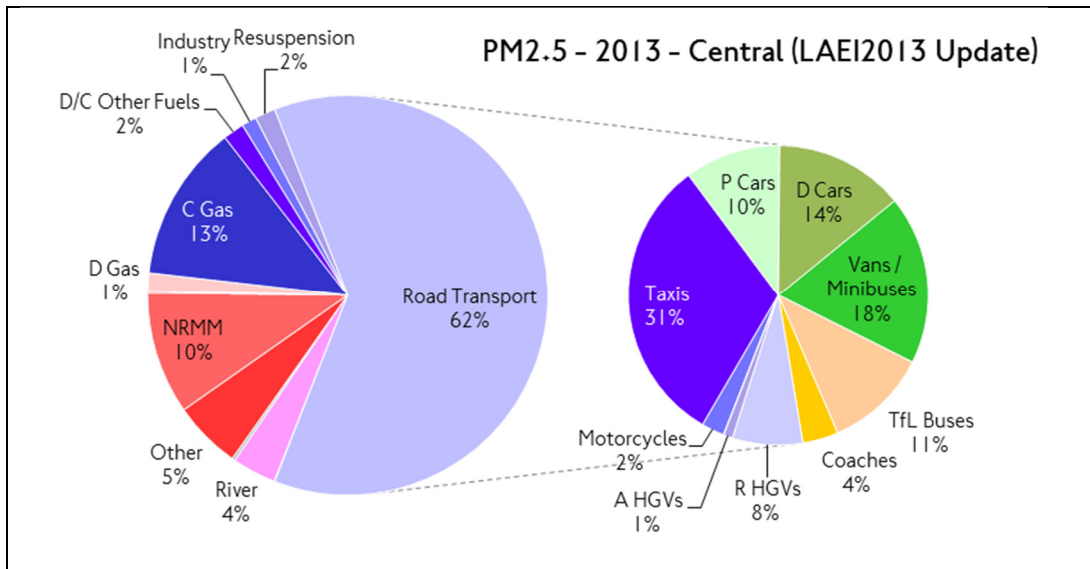


Legend:
 A HGVs = Articulated HGVs C Gas = Commercial Gas
 P Cars = Petrol Cars R HGVs = Rigid HGVs D/C Other Fuels = Domestic/Commercial Other Fuels
 D Cars = Diesel Cars D Gas = Domestic Gas C/D Dust = Construction / Demolition Dust



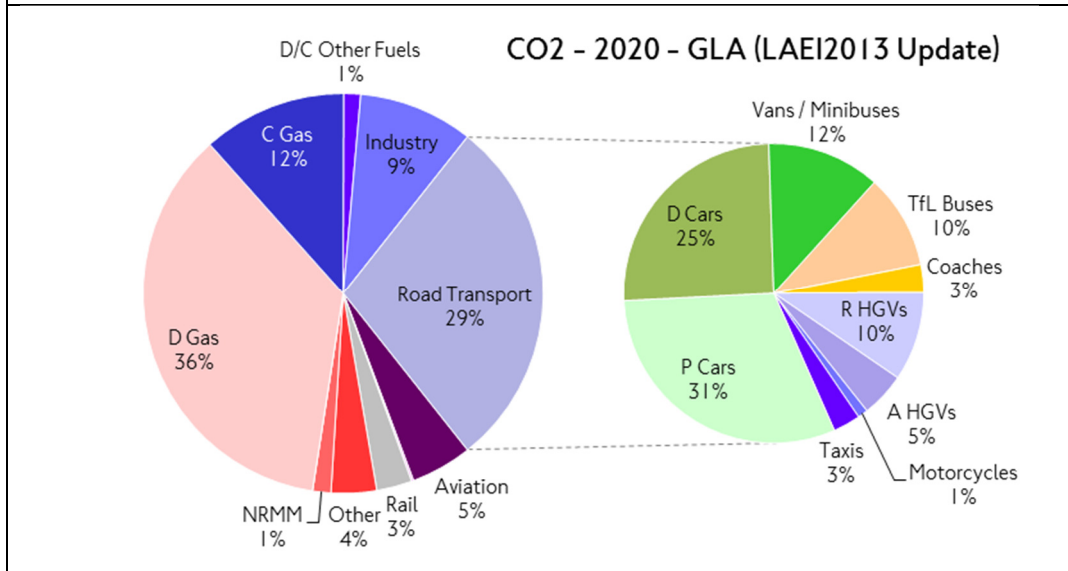
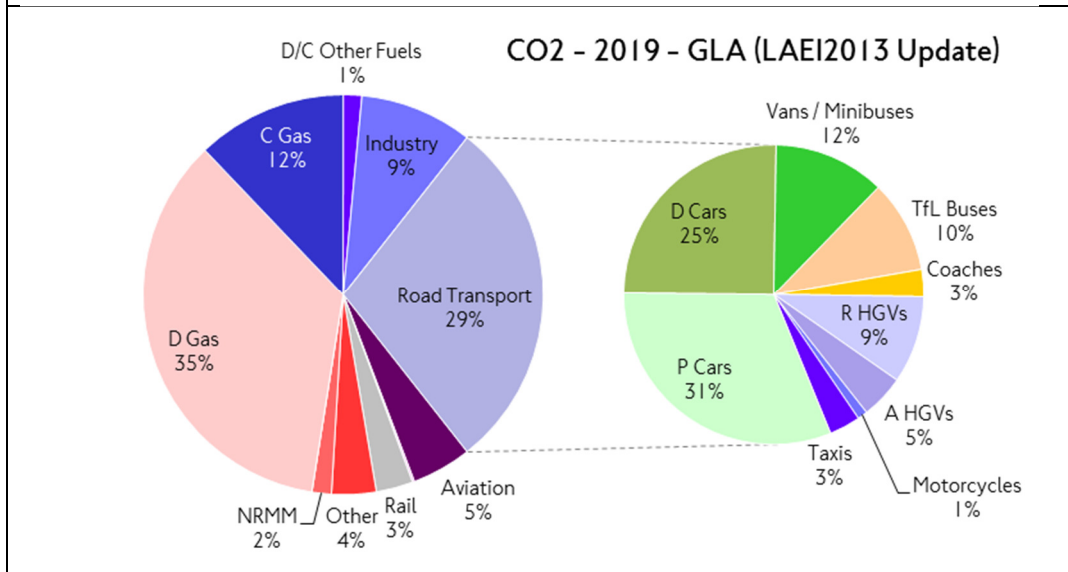
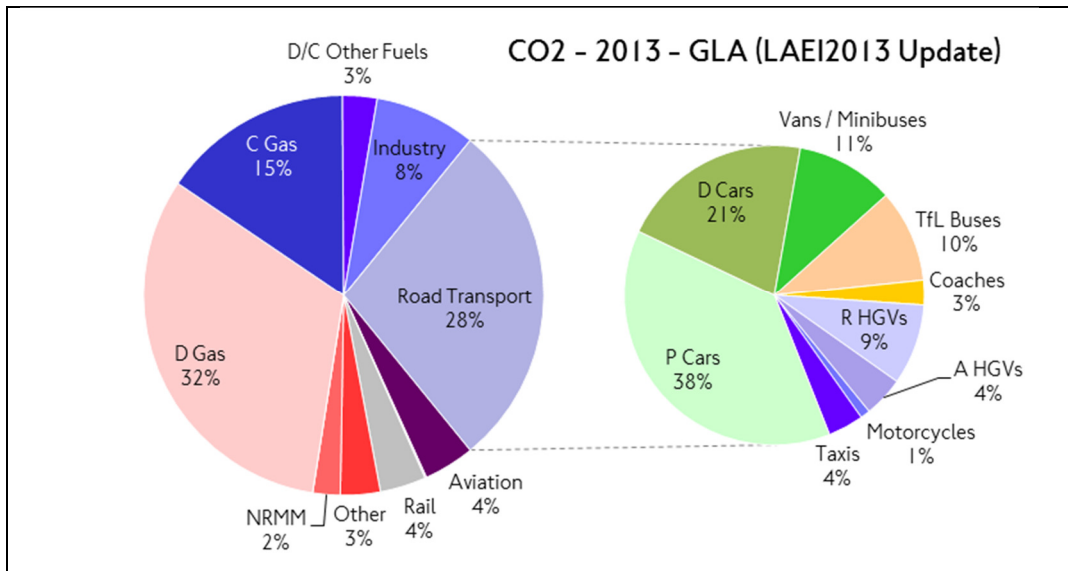
Legend:

A HGVs = Articulated HGVs	C Gas = Commercial Gas
P Cars = Petrol Cars	R HGVs = Rigid HGVs
D Cars = Diesel Cars	D Gas = Domestic Gas
	D/C Other Fuels = Domestic/Commercial Other Fuels
	C/D Dust = Construction / Demolition Dust



Legend:

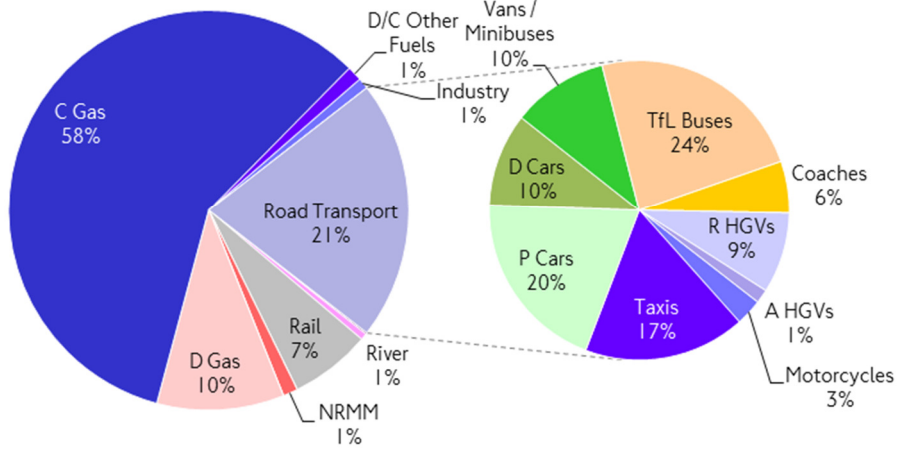
A HGVs = Articulated HGVs	C Gas = Commercial Gas
P Cars = Petrol Cars	R HGVs = Rigid HGVs
D Cars = Diesel Cars	D Gas = Domestic Gas
	D/C Other Fuels = Domestic/Commercial Other Fuels
	C/D Dust = Construction / Demolition Dust



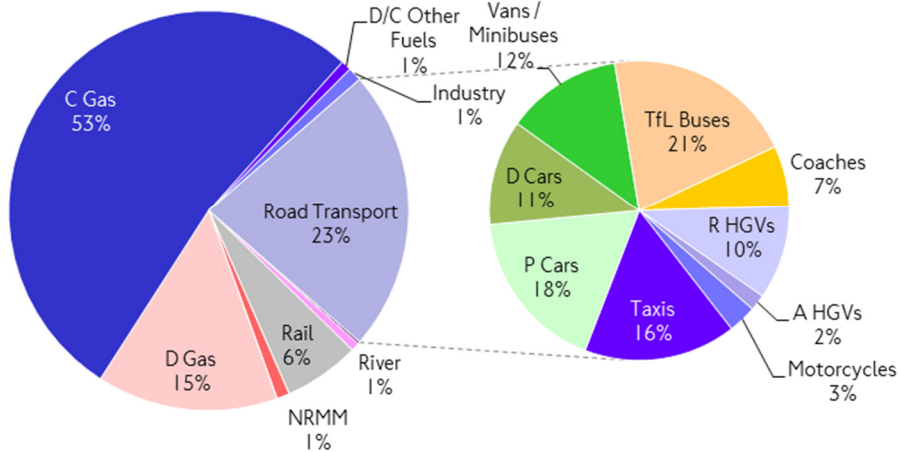
Legend:

A HGVs = Articulated HGVs	C Gas = Commercial Gas
P Cars = Petrol Cars	R HGVs = Rigid HGVs
D Cars = Diesel Cars	D Gas = Domestic Gas
	D/C Other Fuels = Domestic/Commercial Other Fuels
	C/D Dust = Construction / Demolition Dust

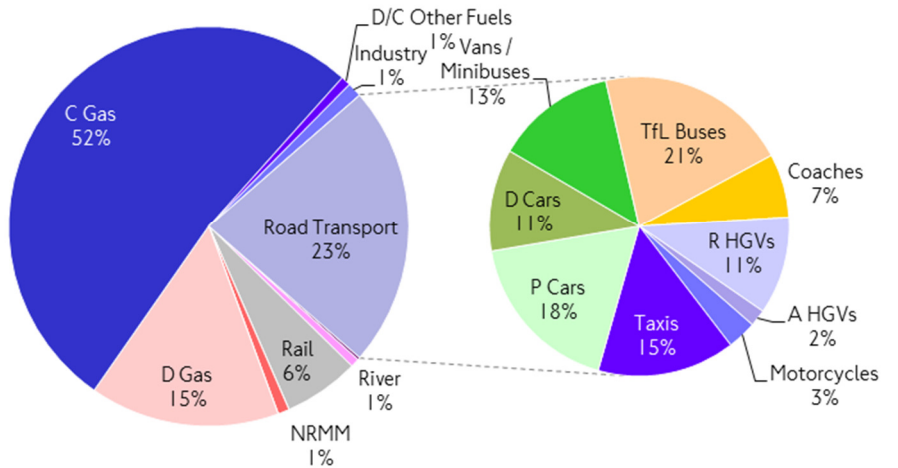
CO2 - 2013 - Central (LAEI2013 Update)



CO2 - 2019 - Central (LAEI2013 Update)



CO2 - 2020 - Central (LAEI2013 Update)



Legend:
 A HGVs = Articulated HGVs C Gas = Commercial Gas
 P Cars = Petrol Cars R HGVs = Rigid HGVs D/C Other Fuels = Domestic/Commercial Other Fuels
 D Cars = Diesel Cars D Gas = Domestic Gas C/D Dust = Construction / Demolition Dust

Appendix C: Explanation of emissions function changes and the effects on the revised baseline

Predicted concentrations for the baseline 2020 scenario, which includes the introduction of the ULEZ in 2020 as originally planned, are higher than those presented within the earlier consultation (2016) on the ULEZ proposals. This appendix provides a summary of the main changes, and sets out the overall impact of these changes on baseline 2020 concentrations.

Baseline 2020 concentration modelling has been updated to take account of three main changes:

- Updated COPERT emissions factors for road vehicles
- Updated traffic growth factors in order to ensure consistency with the MTS reference case
- Revised Heathrow Airport terminal layout

Updated COPERT emissions factors

The LAEI 2013 provided an updated view of baseline 2020 concentrations which includes the introduction of the ULEZ in 2020, and was published in April 2016. The COPERT emissions factors for that modelling were from version 4.10 and included limited changes to the NO_x emissions factors for Euro 5 and 6 diesel cars and vans. It was generally expected that these would provide a better representation of the newer Euro 6 vehicle emissions, however, examination of the results (including through the Defra Air quality plan (AQP)) has recognised that some factors are likely to have been overly optimistic. An updated version of these emissions factors was released to TfL from Defra in December 2016 – referred to as COPERT 5. Whilst the COPERT 5 update included significant changes to the emissions factors for Euro 5 and 6 diesel cars and vans, there were also more minor changes across the emissions factors for lorries, buses and coaches.

Changes to emissions factors for cars

Emissions factors for Euro 6 diesel cars have undergone significant revision, whilst other diesel car factors have remained unchanged. Three stages of Euro 6 emissions factors are provided in order to represent the staged requirements for the more stringent tests which are aimed at reducing the difference between laboratory testing and the actual emissions during real world driving.

This means that for diesel cars, the emissions factors have increased substantially. At 20kph, which is comparable to central London speeds, the emissions for 2017 Euro 6 diesel cars are around 2.5 times higher. As newer and cleaner diesel cars enter the fleet, the emissions are expected to reduce. COPERT 5 estimates that emissions from diesel cars would reduce to around 2 times higher by 2019, and only around 30 per cent higher by 2025. However, this estimate is dependent on two factors: the successful implementation of testing requirements in reducing emissions, and the continued increase of the newest Euro 6 diesel cars into the fleet. Based on the successful results that the test requirements have delivered for Euro VI larger vehicles (buses and lorries) it is expected that emissions from Euro VI diesel cars will

reduce much more successfully than for previous Euro standards. Testing undertaken by TfL has shown that Euro 6 for new diesel cars is performing better⁶⁶.

Changes to emissions factors for diesel vans

Both Euro 5 and Euro 6 emissions factors for vans have been updated in COPERT 5. As for cars, Euro 6 vans also have three stages of emissions represented within the factors. For larger vans (Class N1, II and III), the requirements for real driving emissions (RDE) testing are one year later than for cars, and therefore the emissions stages are later.

Whilst Euro 4 emissions factors are unchanged, Euro 5 emissions factors are now higher than Euro 4 and it is only through the Euro 6 emissions factors that improved emissions from diesel cars are expected.

At 20kph, the emissions for current year Euro 6 diesel vans are around four times higher than they were in the previous emissions functions. As newer and cleaner diesel vans enter the fleet the emissions are expected to reduce. COPERT 5 estimates that these would be around three times higher by 2019, and only around 50 per cent higher by 2025.

It is important to note that Euro 6 diesel vans are much cleaner than Euro 5. The improving emissions for Euro 6 vehicles over time will mean that the benefits of the ULEZ will continue after its introduction as the proportion of the cleaner Euro 6 vehicles increases.

Changes to emissions factors for lorries, buses and coaches.

Although the emissions factors for these vehicles are similar, some changes have occurred; the emissions at lower speeds have increased, whilst emissions at higher speeds are lower. At low speeds emissions are about 40 per cent higher, but this still represents a reduction in emissions of more than 90 per cent compared to Euro 5.

Updated traffic growth

Traffic growth forecasts for 2020 have been revised in order to align with the draft MTS reference case. Car growth is about five per cent lower, lorries about two per cent lower, and vans reduce by less than one per cent. Bus and coach vehicle kilometres are predicted to increase by around five per cent. London-wide, the total vehicle kilometres are about four per cent lower in 2020 than those in the LAEI 2013.

Changes to Heathrow Airport Terminal Layout

The modelled locations of emissions within the Heathrow airport boundary have been reallocated to reflect the new Terminal 5 layout and previous and planned closure of terminals. No change has been made to the emissions totals previously included within the LAEI 2013. No consideration of any proposed expansion of Heathrow has been included in the emissions estimates.

⁶⁶ <http://content.tfl.gov.uk/in-service-emissions-performance-of-euro-6vi-vehicles.pdf>

Description of changes in the baseline 2020 concentrations.

The impact of the above changes means that forecast concentrations for 2020 have increased compared to those presented within the LAEI 2013. Background concentrations have increased by around two to three $\mu\text{g}/\text{m}^3$ in central London, with roadside concentrations being around five to eight $\mu\text{g}/\text{m}^3$ higher than previously estimated. An estimate of the change in the length of roads where NO_2 concentrations exceed the limit value has been made as a result of the updated emissions factors and traffic growth. This indicates that twice the road lengths are now predicted to exceed the limit value in central London, and about 60 per cent more London-wide. Further information about the areas of exceedence and population exposure across London is presented in the main body of this report.

Appendix D: Explanation of the effects of emissions function changes on source apportionment

The emissions factors update has resulted in an increase in total NO_x emissions in London – equating to a 10 per cent increase in central London and a seven per cent increase across London. There are only minor changes to the total emissions and a source apportionment of road transport, other transport and non-transport emissions in 2013. This is because the main changes in the functions affected the Euro 6/VI standards (and Euro 5 diesel vans), and in 2013 these only formed a small proportion of the vehicle kilometres. However for 2020 these Euro 6/VI vehicles dominate the fleet compositions, and, as set out in Appendix B, the forecast road transport NO_x emissions have increased. The changes in emissions proportions and source apportionment for road transport are shown the in figures below.

Figure 31: Central NO_x emissions in 2013 and 2020 comparing LAEI 2013 and LAEI 2013 update

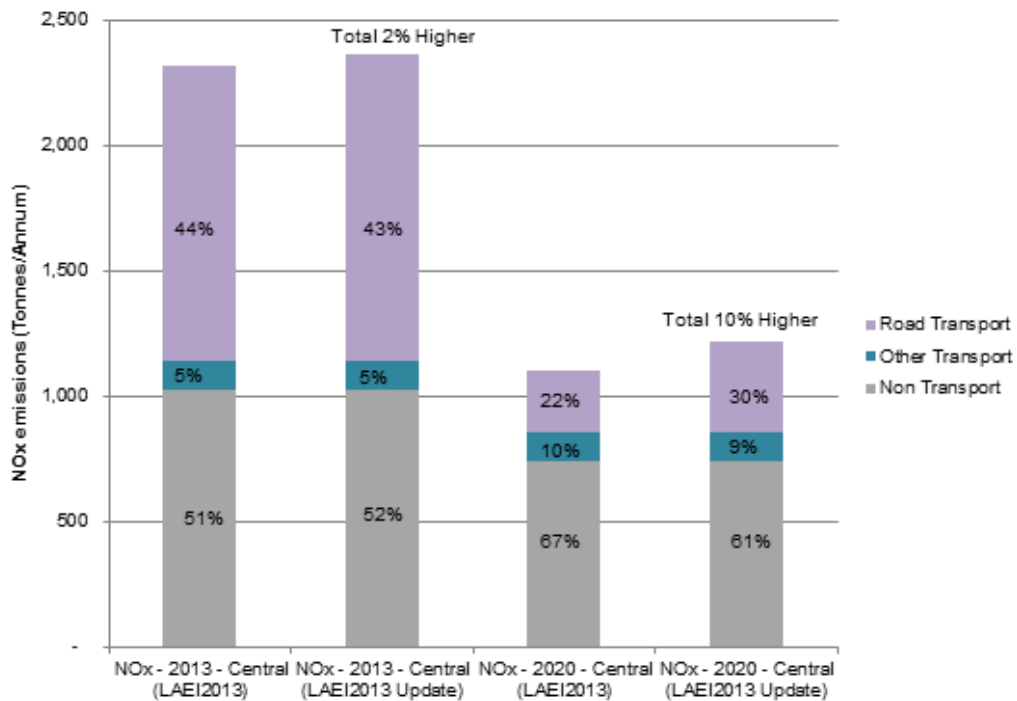
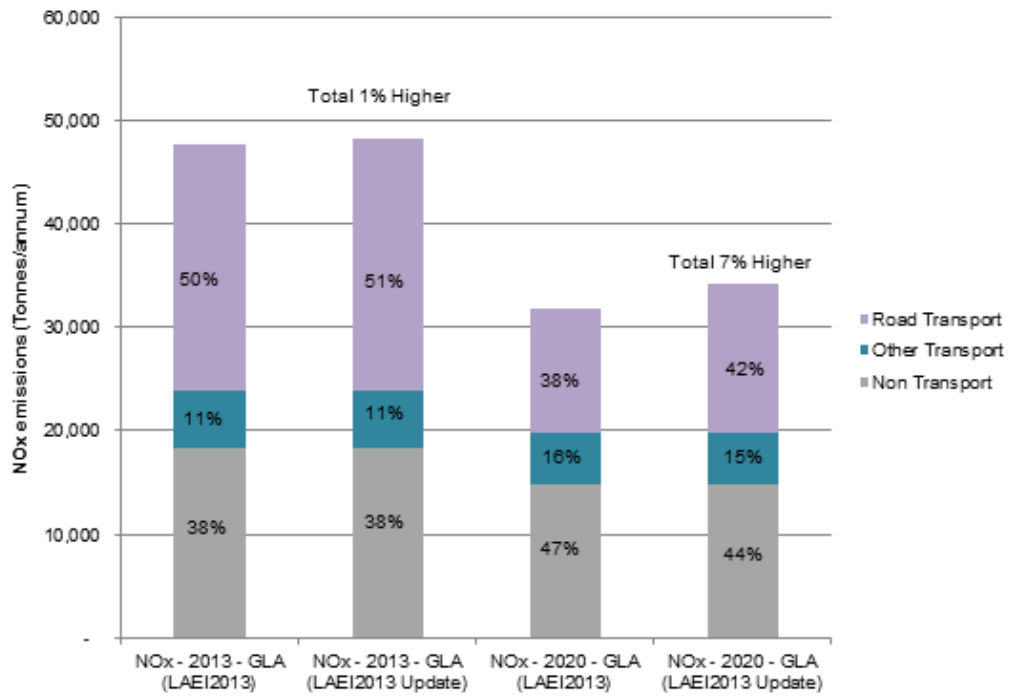
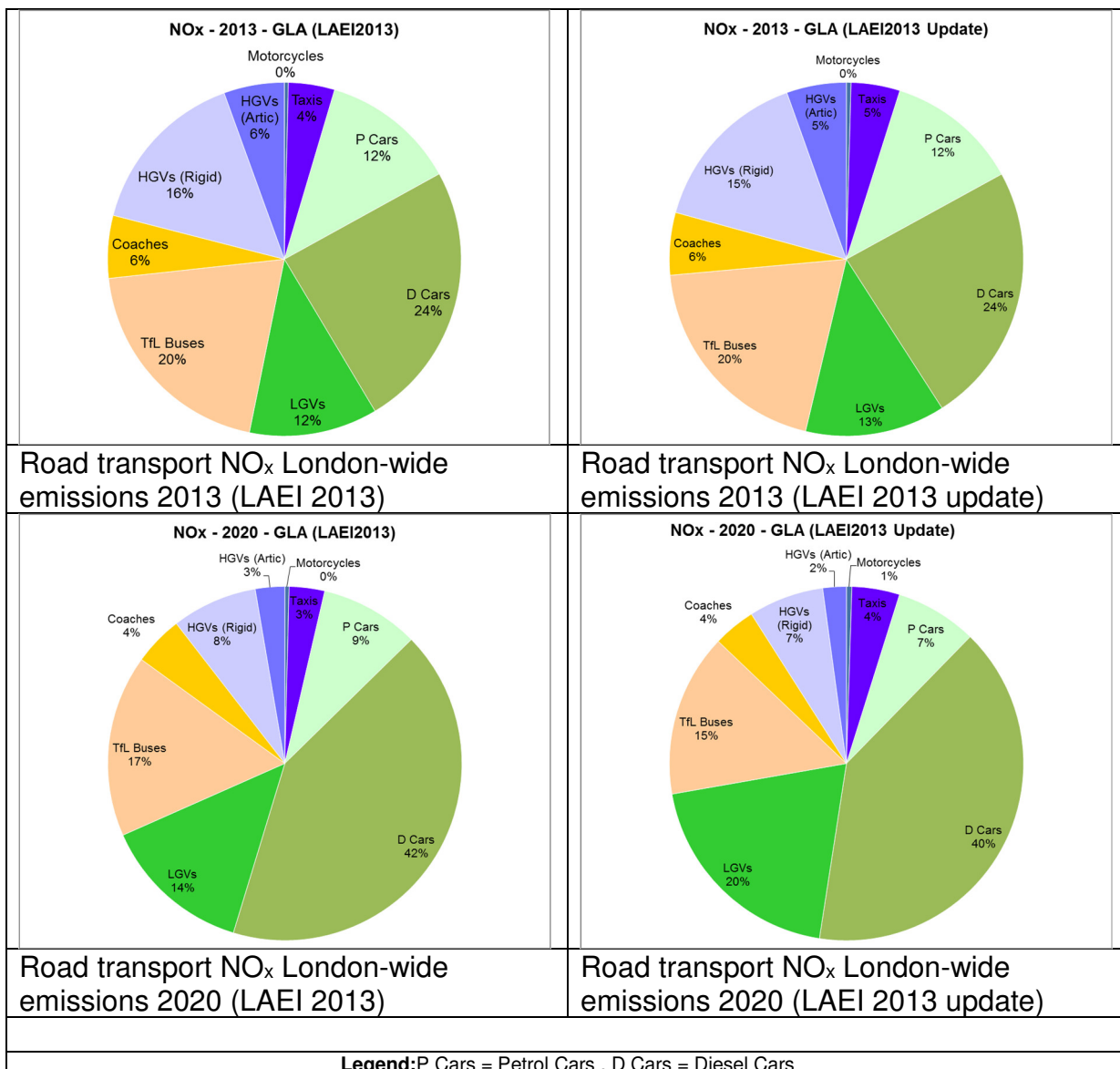
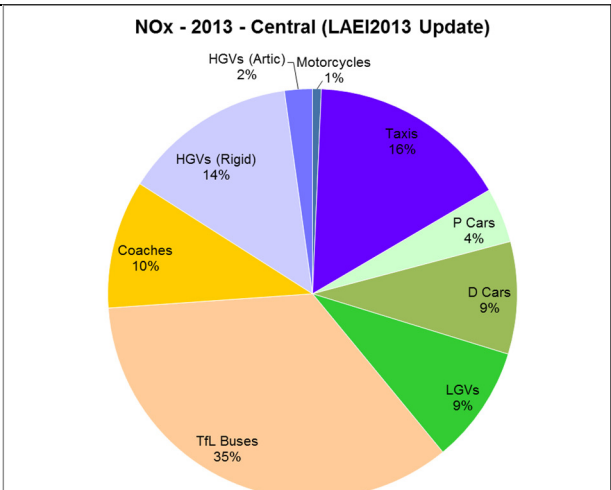
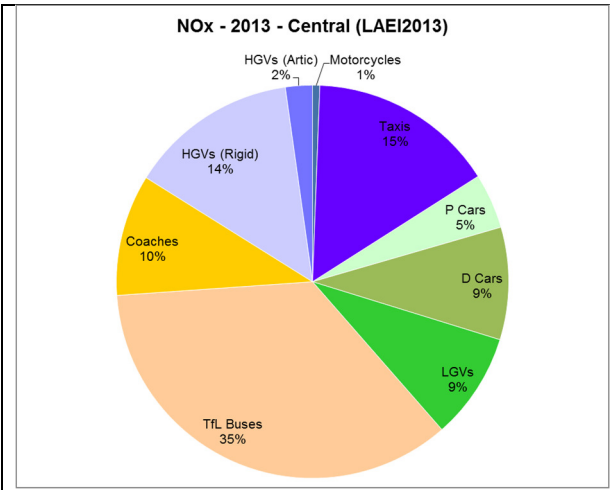


Figure 32: GLA NOx emissions in 2013 and 2020 comparing LAEI 2013 and LAEI 2013 update

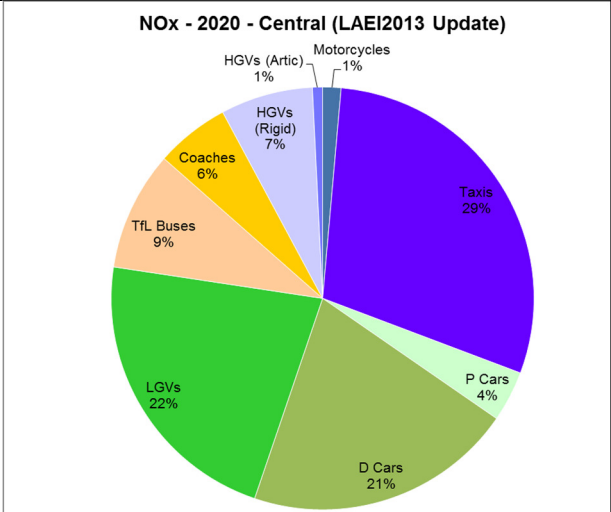
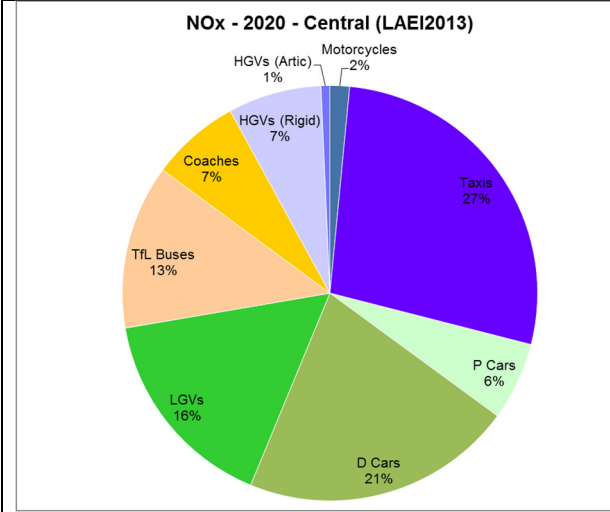






Road transport NO_x central London emission 2013 (LAEI 2013)

Road transport NO_x central London emissions 2013 (LAEI 2013 update)



Road transport NO_x central London 2020 (LAEI 2013)

Road transport NO_x central London 2020 (LAEI 2013 update)

Legend: P Cars = Petrol Cars , D Cars = Diesel Cars

Appendix E: Fleet compositions in 2019 with in the ULEZ 2020 (baseline) and with the ULEZ in 2019

Numbers are percent within category

			2019 with ULEZ in 2020			2019 with ULEZ in 2019		
Cars - Petrol - All Pollutants			Central	Inner	Outer	Central	Inner	Outer
Petrol cars	Euro Standard	Catalyst Status	2019	2019	2019	2019	2019	2019
Petrol ICE (Internal Combustion = Conventional)	Pre-Euro 1	NA	-	-	-	-	-	-
	Euro 1	OK	0.00	0.00	0.00	0.00	0.00	0.00
	Euro 1	FAIL	0.00	0.00	0.00	0.00	0.00	0.00
	Euro 2	OK	0.02	0.03	0.03	0.01	0.02	0.03
	Euro 2	FAIL	0.00	0.01	0.01	0.00	0.00	0.01
	Euro 3	OK	0.07	0.11	0.11	0.03	0.08	0.11
	Euro 3	FAIL	0.00	0.00	0.00	0.00	0.00	0.00
	Euro 4	OK	0.22	0.20	0.20	0.18	0.14	0.16
	Euro 4	FAIL	0.00	0.00	0.00	0.00	0.00	0.00
	Euro 5	OK	0.22	0.21	0.21	0.22	0.18	0.20
	Euro 5	FAIL	0.00	0.00	0.00	0.00	0.00	0.00
	Euro 6	OK	0.40	0.37	0.37	0.50	0.50	0.43
	Euro 6	FAIL	0.00	0.00	0.00	0.01	0.01	0.00
	Petrol HEV (Hybrid Electric Vehicle)	Euro 3	OK	0.00	0.00	0.00	0.00	0.00
Euro 3		FAIL	0.00	0.00	0.00	0.00	0.00	0.00
Euro 4		OK	0.00	0.00	0.00	0.00	0.00	0.00
Euro 4		FAIL	0.00	0.00	0.00	0.00	0.00	0.00
Euro 5		OK	0.01	0.01	0.01	0.01	0.01	0.01
Euro 5		FAIL	0.00	0.00	0.00	0.00	0.00	0.00
Euro 6		OK	0.03	0.03	0.03	0.03	0.03	0.03
Euro 6	FAIL	0.00	0.00	0.00	0.00	0.00	0.00	
Petrol PHEV (Plugin Hybrid Electric Vehicle)	Euro 5	OK	0.00	0.00	0.00	0.00	0.00	0.00
	Euro 5	FAIL	0.00	0.00	0.00	0.00	0.00	0.00
	Euro 6	OK	0.01	0.01	0.01	0.01	0.01	0.01
	Euro 6	FAIL	0.00	0.00	0.00	0.00	0.00	0.00
Cars - Diesel - NOx			Central	Inner	Outer	Central	Inner	Outer
Diesel cars	Euro Standard	Catalyst Status	2019	2019	2019	2019	2019	2019
Diesel ICE (Internal Combustion = Conventional)	Pre-Euro 1	NA	-	-	-	-	-	-
	Euro 1	NA	0.00	0.00	0.00	0.00	0.00	0.00
	Euro 2	NA	0.01	0.01	0.01	0.00	0.00	0.01
	Euro 3	NA	0.06	0.07	0.09	0.02	0.05	0.08
	Euro 4	NA	0.17	0.22	0.26	0.07	0.16	0.24
	Euro 5	OK	0.22	0.28	0.34	0.09	0.20	0.31
	error - add to ok	FAIL	-	-	-	-	-	-
	Euro 6 (up to 2016)	OK	0.20	0.14	0.08	0.30	0.20	0.09
	Euro 6 (up to 2016)	FAIL	0.00	0.00	0.00	0.00	0.00	0.00
	Euro 6c (2017-2019)	OK	0.32	0.26	0.21	0.48	0.36	0.25
	Euro 6c (2017-2019)	FAIL	0.00	0.00	0.00	0.01	0.00	0.00
	Euro 6d (2020+)	OK	-	-	-	-	-	-
	Euro 6d (2020+)	FAIL	-	-	-	-	-	-
	Diesel HEV (Hybrid Electric Vehicle)	Euro 5	OK	0.00	0.00	0.00	0.00	0.00
error - add to ok		FAIL	-	-	-	-	-	-
Euro 6 (up to 2016)		OK	0.01	0.01	0.00	0.01	0.01	0.00
Euro 6 (up to 2016)		FAIL	0.00	0.00	0.00	0.00	0.00	0.00
Euro 6c (2017-2019)		OK	0.01	0.01	0.01	0.01	0.01	0.01
Euro 6c (2017-2019)		FAIL	0.00	0.00	0.00	0.00	0.00	0.00
Euro 6d (2020+)		OK	-	-	-	-	-	-
Euro 6d (2020+)		FAIL	-	-	-	-	-	-

			2019 with ULEZ in 2020			2019 with ULEZ in 2019		
LGVs - Petrol - All Pollutants			Central	Inner	Outer	Central	Inner	Outer
Petrol LGVs	Euro Standard	Catalyst Status	2019	2019	2019	2019	2019	2019
Petrol ICE (Internal Combustion = Conventional)	Pre-Euro 1	NA	-	-	-	-	-	-
	Euro 1	OK	-	-	-	-	-	-
	Euro 1	FAIL	-	-	-	-	-	-
	Euro 2	OK	0.03	0.03	0.03	0.00	0.03	0.03
	Euro 2	FAIL	0.01	0.01	0.01	0.00	0.01	0.01
	Euro 3	OK	0.08	0.09	0.09	0.01	0.09	0.09
	Euro 3	FAIL	0.02	0.02	0.02	0.00	0.02	0.02
	Euro 4	OK	0.21	0.22	0.23	0.19	0.22	0.23
	Euro 4	FAIL	0.04	0.04	0.05	0.04	0.04	0.05
	Euro 5	OK	0.22	0.22	0.23	0.23	0.22	0.23
	Euro 5	FAIL	0.03	0.04	0.04	0.04	0.04	0.04
	Euro 6	OK	0.33	0.32	0.29	0.45	0.32	0.29
	Euro 6	FAIL	0.02	0.02	0.02	0.04	0.02	0.02
LGVs - Diesel - NOx			Central	Inner	Outer	Central	Inner	Outer
Diesel LGVs	Euro Standard	Catalyst Status	2019	2019	2019	2019	2019	2019
Diesel ICE (Internal Combustion = Conventional) - Class N1 (I)	Pre-Euro 1	NA	-	-	-	-	-	-
	Euro 1	NA	-	-	-	-	-	-
	Euro 2	NA	-	-	-	-	-	-
	Euro 3	NA	0.04	0.05	0.05	0.02	0.05	0.05
	Euro 4	NA	0.13	0.17	0.18	0.08	0.15	0.16
	Euro 5	NA	0.26	0.34	0.35	0.16	0.31	0.33
	Euro 6	OK	0.22	0.15	0.11	-	-	-
	Euro 6	FAIL	0.00	0.00	0.00	-	-	-
	Euro 6c	OK	0.35	0.28	0.30	-	-	-
	Euro 6c	FAIL	0.00	0.00	0.00	-	-	-
	Euro 6d	OK	-	-	-	-	-	-
	Euro 6d	FAIL	-	-	-	-	-	-
			Central	Inner	Outer	Central	Inner	Outer
	Euro Standard	Catalyst Status	2019	2019	2019	2019	2019	2019
Diesel ICE (Internal Combustion = Conventional) - Class N1 (II/III)	Pre-Euro 1	NA	-	-	-	-	-	-
	Euro 1	NA	-	-	-	-	-	-
	Euro 2	NA	-	-	-	-	-	-
	Euro 3	NA	0.04	0.05	0.05	0.00	0.05	0.05
	Euro 4	NA	0.13	0.17	0.18	0.05	0.17	0.18
	Euro 5	NA	0.26	0.34	0.35	0.12	0.34	0.35
	Euro 6	OK	0.19	0.14	0.14	0.27	0.14	0.14
	Euro 6	FAIL	0.00	0.00	0.00	0.00	0.00	0.00
	Euro 6c	OK	0.37	0.28	0.27	0.54	0.28	0.27
	Euro 6c	FAIL	0.00	0.00	0.00	0.01	0.00	0.00
	Euro 6d	OK	-	-	-	-	-	-
	Euro 6d	FAIL	-	-	-	-	-	-

		2019 with ULEZ in 2020			2019 with ULEZ in 2019		
		Central	Inner	Outer	Central	Inner	Outer
HGVs - Rigid - NOx							
Rigid HGV	Euro Standard	2019	2019	2019	2019	2019	2019
Diesel ICE (Internal Combustion = Conventional)	Pre-Euro I	-	-	-	-	-	-
	Euro I	0.00	0.00	0.00	0.00	0.00	0.00
	Euro II	0.00	0.01	0.01	0.00	0.00	0.01
	Euro III	0.02	0.03	0.03	0.00	0.02	0.02
	Euro IV	0.04	0.06	0.06	0.01	0.04	0.05
	Euro V	0.13	0.18	0.20	0.02	0.12	0.15
	Euro VI	0.80	0.72	0.70	0.97	0.82	0.78
HGVs - Artic - NOx							
Artic HGV	Euro Standard	2019	2019	2019	2019	2019	2019
Diesel ICE (Internal Combustion = Conventional)	Pre-Euro I	-	-	-	-	-	-
	Euro I	0.00	0.00	0.00	0.00	0.00	0.00
	Euro II	0.00	0.00	0.00	0.00	0.00	0.00
	Euro III	0.01	0.02	0.02	0.00	0.01	0.01
	Euro IV	0.06	0.08	0.08	0.01	0.06	0.07
	Euro V	0.13	0.19	0.20	0.02	0.13	0.16
	Euro VI	0.80	0.71	0.69	0.97	0.80	0.76
Buses/Coaches - NOx							
Bus & Coach	Euro Standard	2019	2019	2019	2019	2019	2019
Diesel ICE (Internal Combustion = Conventional)	Pre-Euro I	-	-	-	-	-	-
	Euro I	-	-	-	-	-	-
	Euro II	0.00	0.00	0.00	0.00	0.002	0.002
	Euro III	0.01	0.01	0.01	0.00	0.010	0.012
	Euro IV	0.02	0.02	0.04	0.01	0.020	0.034
	Euro V	0.29	0.42	0.44	0.14	0.367	0.413
	Euro VI	0.68	0.55	0.51	0.84	0.601	0.538
Taxis (London) - All Pollutants							
London Taxi	Euro Standard			2019			
Diesel ICE (Internal Combustion = Conventional)	Pre-Euro I			-			
Diesel ICE (Internal Combustion = Conventional)	Euro I			-			
Diesel ICE (Internal Combustion = Conventional)	Euro II			-			
Diesel ICE (Internal Combustion = Conventional)	Euro III			0.06			
Diesel ICE (Internal Combustion = Conventional)	Euro IV			0.26			
Diesel ICE (Internal Combustion = Conventional)	Euro V			0.19			
Diesel ICE (Internal Combustion = Conventional)	Euro VI			0.18			
PHEV (Plugin Hybrid Electric Vehicle) - ZEC (Zero Capable Emissions)	-			0.31			
		Central	Inner	Outer	Central	Inner	Outer
Cars - Petrol / Diesel / BEV Split		2019	2019	2019	2019	2019	2019
Electric		0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Petrol		57.0%	54.6%	54.4%	57.7%	53.0%	53.7%
Diesel		42.6%	45.0%	45.3%	41.9%	46.6%	45.9%
LGVs - Petrol / Diesel / BEV Split							
Electric		2019	2019	2019	2019	2019	2019
Petrol		2.1%	2.1%	2.1%	2.6%	2.1%	2.1%
Diesel		2.5%	2.1%	1.9%	2.8%	2.1%	1.9%

Motorcycles - All Pollutants		2019 with ULEZ in 2020			2019 with ULEZ in 2019		
		Central	Inner	Outer	Central	Inner	Outer
Engine Type + Engine Size (CC)	Euro Standard	2019	2019	2019	2019	2019	2019
2-stroke - 0 ≤ cc < 50	Pre-Euro 1	-	-	-	-	-	-
	Euro 1	0.06	0.06	0.06	0.03	0.06	0.06
	Euro 2	0.04	0.04	0.04	0.02	0.04	0.04
	Euro 3	0.53	0.53	0.53	0.51	0.53	0.53
	Euro 4	0.37	0.37	0.37	0.44	0.37	0.37
	Euro 5	-	-	-	-	-	-
2-stroke - 50 ≤ cc < 150	Pre-Euro 1	-	-	-	-	-	-
	Euro 1	0.04	0.04	0.04	0.02	0.04	0.04
	Euro 2	0.04	0.04	0.04	0.00	0.04	0.04
	Euro 3	0.49	0.49	0.49	0.49	0.49	0.49
	Euro 4	0.43	0.43	0.43	0.49	0.43	0.43
	Euro 5	-	-	-	-	-	-
4-stroke - 50 ≤ cc < 150	Pre-Euro 1	-	-	-	-	-	-
	Euro 1	0.04	0.04	0.04	0.02	0.04	0.04
	Euro 2	0.04	0.04	0.04	0.03	0.04	0.04
	Euro 3	0.49	0.49	0.49	0.47	0.49	0.49
	Euro 4	0.43	0.43	0.43	0.48	0.43	0.43
	Euro 5	-	-	-	-	-	-
4-stroke - 150 ≤ cc < 250	Pre-Euro 1	-	-	-	-	-	-
	Euro 1	0.08	0.08	0.08	0.03	0.08	0.08
	Euro 2	0.05	0.05	0.05	0.02	0.05	0.05
	Euro 3	0.51	0.51	0.51	0.52	0.51	0.51
	Euro 4	0.35	0.35	0.35	0.43	0.35	0.35
	Euro 5	-	-	-	-	-	-
4-stroke - 250 ≤ cc < 750	Pre-Euro 1	-	-	-	-	-	-
	Euro 1	0.12	0.15	0.15	0.03	0.15	0.15
	Euro 2	0.05	0.09	0.09	0.02	0.09	0.09
	Euro 3	0.52	0.49	0.49	0.55	0.49	0.49
	Euro 4	0.32	0.27	0.27	0.40	0.27	0.27
	Euro 5	-	-	-	-	-	-
4-stroke - 750 ≤ cc	Pre-Euro 1	-	-	-	-	-	-
	Euro 1	0.07	0.11	0.11	0.03	0.11	0.11
	Euro 2	0.05	0.08	0.08	0.02	0.08	0.08
	Euro 3	0.60	0.55	0.55	0.61	0.55	0.55
	Euro 4	0.28	0.25	0.25	0.34	0.25	0.25
	Euro 5	-	-	-	-	-	-

TfL Buses - NOx		2019 with ULEZ in 2020			2019 with ULEZ in 2019		
		Central	Inner	Outer	Central	Inner	Outer
London Bus	Euro / Technology	2019	2019	2019	2019	2019	2019
Diesel ICE - Single Decker	Pre-Euro I	-	-	-	-	-	-
Diesel ICE - Single Decker	Euro I	-	-	-	-	-	-
Diesel ICE - Single Decker	Euro II	-	-	-	-	-	-
Diesel ICE - Single Decker	Euro III	-	-	-	-	-	-
Diesel ICE - Single Decker	Euro IV	0.00	0.04	0.14	-	0.04	0.14
Diesel ICE - Single Decker	Euro V	-	-	0.00	-	-	0.00
Diesel ICE - Single Decker	Euro V	0.01	0.08	0.16	-	0.08	0.16
Diesel ICE - Single Decker	Euro VI	0.00	0.04	0.08	-	0.04	0.08
Diesel ICE - Single Decker	Euro II + SCR (Retrofit)	-	-	-	-	-	-
Diesel ICE - Single Decker	Euro III + SCR (Retrofit)	0.00	0.00	0.00	-	0.00	0.00
Diesel ICE - Single Decker	Euro IV + SCR (Retrofit)	-	-	-	-	-	-
Diesel ICE - Double Decker	Pre-Euro I	-	-	-	-	-	-
Diesel ICE - Double Decker	Euro I	-	-	-	-	-	-
Diesel ICE - Double Decker	Euro II	-	-	-	-	-	-
Diesel ICE - Double Decker	Euro III	-	-	-	-	-	-
Diesel ICE - Double Decker	Euro IV	0.01	0.05	0.14	-	0.05	0.14
Diesel ICE - Double Decker	Euro V	0.01	0.01	0.02	-	0.01	0.02
Diesel ICE - Double Decker	Euro V	0.05	0.12	0.16	-	0.12	0.16
Diesel ICE - Double Decker	Euro VI	0.00	0.10	0.20	-	0.10	0.20
Diesel ICE - Double Decker	Euro II + SCR (Retrofit)	-	-	-	-	-	-
Diesel ICE - Double Decker	Euro III + SCR (Retrofit)	0.02	0.02	0.01	-	0.02	0.01
Diesel ICE - Double Decker	Euro IV + SCR (Retrofit)	-	-	-	-	-	-
Diesel ICE - Articulated	Pre-Euro I	-	-	-	-	-	-
Diesel ICE - Articulated	Euro I	-	-	-	-	-	-
Diesel ICE - Articulated	Euro II	-	-	-	-	-	-
Diesel ICE - Articulated	Euro III	-	-	-	-	-	-
Diesel ICE - Articulated	Euro IV	-	-	-	-	-	-
Diesel ICE - Articulated	Euro V	-	-	-	-	-	-
Diesel ICE - Articulated	Euro V	-	-	-	-	-	-
Diesel ICE - Articulated	Euro VI	-	-	-	-	-	-
Diesel ICE - Articulated	Euro II + SCR (Retrofit)	-	-	-	-	-	-
Diesel ICE - Articulated	Euro III + SCR (Retrofit)	-	-	-	-	-	-
Diesel ICE - Articulated	Euro IV + SCR (Retrofit)	-	-	-	-	-	-
Diesel HEV - Single Decker	Euro IV	-	-	0.00	-	-	0.00
Diesel HEV - Single Decker	Euro V	0.00	0.00	0.00	-	0.00	0.00
Diesel HEV - Single Decker	Euro VI	-	-	-	-	-	-
Diesel PHEV - Double Decker	Euro IV	0.00	0.00	0.00	-	0.00	0.00
Diesel PHEV - Double Decker	Euro V	0.03	0.02	0.00	-	0.02	0.00
Diesel PHEV - Double Decker	Euro VI	0.79	0.47	0.08	0.92	0.47	0.08
BEV H2 Fuel Cell - Single Decker	H2 Fuel Cell	0.07	0.03	0.00	0.08	0.03	0.00

Appendix F: Borough factsheets (emissions and concentrations)

Borough Emissions	Total Road Transport NOx Emissions (Tonnes)		Total Road Transport PM ₁₀ Emissions (Tonnes)		Total Road Transport PM _{2.5} Emissions (Tonnes)		Total Road Transport CO ₂ Emissions (Tonnes)		Percentage Reduction Total Road Transport Emissions as a result (%)			
	2019 Baseline	2019 with ULEZ brought forward	2019 Baseline	2019 with ULEZ brought forward	2019 Baseline	2019 with ULEZ brought forward	2019 Baseline	2019 with ULEZ brought forward	Nox	PM10	PM2.5	Co2
Barking and Dagenham	347	334	42	42	22	22	127271	126362	4%	1%	1%	1%
Barnet	974	941	118	117	62	61	376489	373485	3%	1%	1%	1%
Bexley	489	474	59	59	31	31	180745	179293	3%	1%	1%	1%
Brent	558	536	68	67	35	34	197840	196320	4%	1%	1%	1%
Bromley	631	612	89	88	46	45	239344	237353	3%	1%	1%	1%
Camden	336	295	41	40	21	20	135720	133064	12%	2%	4%	2%
City Of London	118	93	13	13	7	6	47111	46208	21%	3%	5%	2%
Croydon	595	575	81	80	41	41	223134	221402	3%	1%	1%	1%
Ealing	756	731	89	89	46	46	267167	265259	3%	1%	1%	1%
Enfield	840	817	109	108	56	56	356783	354843	3%	1%	1%	1%
Greenwich	564	545	70	70	36	36	207707	206251	3%	1%	1%	1%
Hackney	292	264	35	35	18	17	112341	110374	10%	2%	3%	2%
Hammersmith and Fulham	296	279	33	33	17	17	103203	101675	6%	1%	3%	1%
Haringey	359	336	42	41	21	21	124021	122016	6%	2%	3%	2%
Harrow	345	335	47	47	24	24	131982	130911	3%	1%	1%	1%
Havering	823	803	84	84	46	45	348610	346786	2%	1%	1%	1%
Hillingdon	1003	974	117	116	62	61	393808	390884	3%	1%	1%	1%
Hounslow	717	695	87	86	45	45	267753	265655	3%	1%	1%	1%
Islington	235	206	28	28	14	14	88692	86990	12%	2%	4%	2%
Kensington and Chelsea	285	265	32	31	17	16	105864	104518	7%	1%	3%	1%
Kingston Upon Thames	384	374	49	48	25	25	149868	148618	3%	1%	1%	1%
Lambeth	372	336	48	47	24	24	149153	146538	10%	2%	3%	2%
Lewisham	371	346	47	47	24	23	141208	138893	7%	2%	3%	2%
Merton	334	323	43	42	22	22	123655	122770	3%	1%	1%	1%
Newham	450	421	53	52	27	27	168972	166236	6%	2%	3%	2%
Redbridge	635	616	77	76	40	40	239613	237693	3%	1%	1%	1%
Richmond Upon Thames	420	408	55	54	28	28	154466	153290	3%	1%	1%	1%
Southwark	354	313	46	45	23	22	141207	138356	12%	2%	3%	2%
Sutton	290	281	40	40	20	20	105094	104253	3%	1%	1%	1%
Tower Hamlets	410	378	50	50	26	25	151892	149566	8%	2%	3%	2%
Waltham Forest	455	440	54	54	29	28	166822	165551	3%	1%	1%	1%
Wandsworth	405	381	52	51	26	26	154891	152523	6%	1%	3%	2%
Westminster	577	503	65	64	34	33	221994	218584	13%	2%	4%	2%

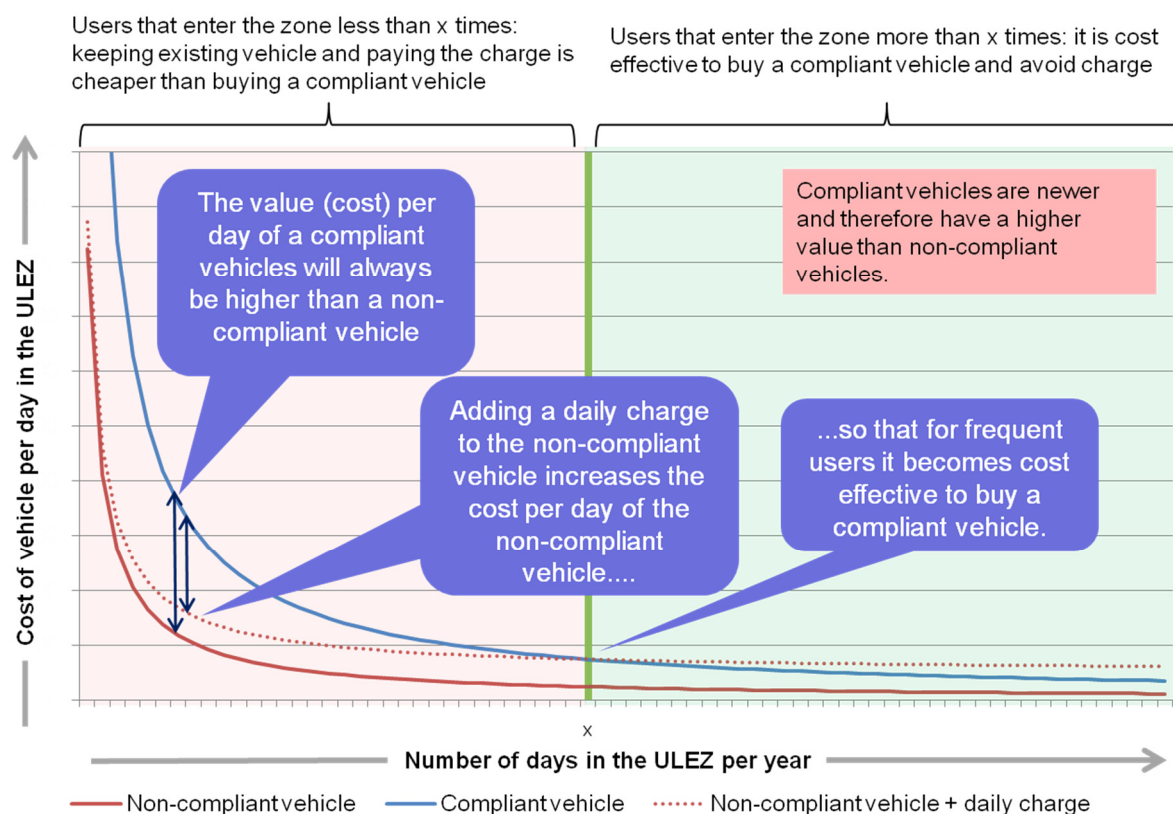
Borough Concentrations and Exposure	Total Population	Total Population in Output Areas (OA) exceeding NO ₂ Limit Values		Percentage of Borough population exceeding NO ₂ Limit Values		% Change in population living in OA exceeding the NO ₂ limit value	Population weighted average concentration (µg/m ³) 2019 Baseline			Population weighted average concentration (µg/m ³) 2019 with ULEZ brought forward			Change in population weighted average concentration in 2019 (µg/m ³)			Percentage Change in population weighted average concentration in 2019)		
		2019	2019 Baseline	2019 with ULEZ brought forward	2019 Baseline		2019 with ULEZ brought forward	2019	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}	NO ₂
Barking and Dagenham	211,848	437	0	0%	0%	-100%	28	23	14	28	23	14	-0.3	0.0	0.0	-1%	-0.1%	-0.1%
Barnet	395,199	12,259	9,380	3%	2%	-23%	29	23	14	29	23	14	-0.4	0.0	0.0	-1%	-0.1%	-0.1%
Bexley	245,573	0	0	0%	0%	-	27	23	14	26	23	14	-0.3	0.0	0.0	-1%	-0.1%	-0.1%
Brent	337,605	15,199	13,226	5%	4%	-13%	32	24	15	31	24	15	-0.4	0.0	0.0	-1%	-0.1%	-0.1%
Bromley	328,584	0	0	0%	0%	-	25	22	14	25	22	14	-0.3	0.0	0.0	-1%	-0.1%	-0.1%
Camden	243,025	33,766	21,246	14%	9%	-37%	36	25	15	35	25	15	-1.0	0.0	0.0	-3%	-0.1%	-0.2%
City Of London	9,336	4,003	3,361	43%	36%	-16%	40	27	16	38	27	16	-2.0	-0.1	-0.1	-5%	-0.2%	-0.3%
Croydon	390,877	516	516	0%	0%	0%	27	23	14	27	23	14	-0.3	0.0	0.0	-1%	-0.1%	-0.1%
Ealing	360,013	11,355	9,236	3%	3%	-19%	31	23	14	31	23	14	-0.4	0.0	0.0	-1%	-0.1%	-0.1%
Enfield	335,343	4,501	3,818	1%	1%	-15%	28	23	14	28	23	14	-0.3	0.0	0.0	-1%	-0.1%	-0.1%
Greenwich	290,178	5,244	3,467	2%	1%	-34%	30	24	15	30	23	15	-0.4	0.0	0.0	-1%	-0.1%	-0.1%
Hackney	275,759	12,579	6,161	5%	2%	-51%	34	25	15	33	25	15	-0.8	0.0	0.0	-3%	-0.1%	-0.2%
Hammersmith and Fulham	189,639	21,247	17,118	11%	9%	-19%	35	25	15	34	25	15	-0.7	0.0	0.0	-2%	-0.1%	-0.2%
Haringey	279,689	6,999	4,006	3%	1%	-43%	31	24	15	31	24	15	-0.6	0.0	0.0	-2%	-0.1%	-0.1%
Harrow	256,111	0	0	0%	0%	-	27	22	14	26	22	14	-0.3	0.0	0.0	-1%	-0.1%	-0.1%
Havering	259,702	0	0	0%	0%	-	24	22	14	24	22	14	-0.2	0.0	0.0	-1%	0.0%	-0.1%
Hillingdon	299,337	0	0	0%	0%	-	27	22	14	26	22	14	-0.2	0.0	0.0	-1%	0.0%	-0.1%
Hounslow	275,902	10,765	9,180	4%	3%	-15%	32	23	14	31	23	14	-0.3	0.0	0.0	-1%	-0.1%	-0.1%
Islington	234,123	13,468	4,784	6%	2%	-64%	34	25	15	34	25	15	-1.0	0.0	0.0	-3%	-0.1%	-0.2%
Kensington and Chelsea	163,566	41,368	34,152	25%	21%	-17%	38	25	15	37	25	15	-0.9	0.0	0.0	-2%	-0.1%	-0.2%
Kingston Upon Thames	176,998	1,820	1,295	1%	1%	-29%	29	23	14	28	23	14	-0.3	0.0	0.0	-1%	-0.1%	-0.1%
Lambeth	329,583	15,041	8,086	5%	2%	-46%	33	24	15	32	24	15	-0.8	0.0	0.0	-2%	-0.1%	-0.2%
Lewisham	305,772	2,346	845	1%	0%	-64%	31	24	15	30	24	15	-0.6	0.0	0.0	-2%	-0.1%	-0.1%
Merton	209,819	325	325	0%	0%	0%	29	23	14	29	23	14	-0.4	0.0	0.0	-1%	-0.1%	-0.1%
Newham	348,838	11,528	8,495	3%	2%	-26%	32	24	15	32	24	15	-0.5	0.0	0.0	-2%	-0.1%	-0.1%
Redbridge	309,032	9,212	8,279	3%	3%	-10%	29	23	14	28	23	14	-0.4	0.0	0.0	-1%	-0.1%	-0.1%
Richmond Upon Thames	198,743	1,285	1,018	1%	1%	-21%	30	23	14	29	23	14	-0.3	0.0	0.0	-1%	-0.1%	-0.1%
Southwark	325,602	17,668	7,423	5%	2%	-58%	34	25	15	33	25	15	-0.9	0.0	0.0	-3%	-0.1%	-0.2%
Sutton	202,474	0	0	0%	0%	-	27	23	14	27	23	14	-0.3	0.0	0.0	-1%	-0.1%	-0.1%
Tower Hamlets	323,667	46,792	40,433	14%	12%	-14%	36	25	15	35	25	15	-0.9	0.0	0.0	-2%	-0.1%	-0.2%
Waltham Forest	279,782	6,975	6,100	2%	2%	-13%	30	24	15	30	23	14	-0.4	0.0	0.0	-1%	-0.1%	-0.1%
Wandsworth	328,869	7,917	5,339	2%	2%	-33%	32	24	15	32	24	15	-0.6	0.0	0.0	-2%	-0.1%	-0.2%
Westminster	245,224	65,455	46,803	27%	19%	-28%	38	26	16	37	26	16	-1.2	0.0	0.0	-3%	-0.2%	-0.2%

Appendix G: Further details on the response modelling of the original scheme

Estimating the response of non-compliant users in the spreadsheet model (those not expected to be compliant under a 'business as usual' scenario in 2020) required information on the relative costs of the different behaviours that could be adopted by vehicle operators and the frequency with which the user would enter the ULEZ.

The cost per trip of buying a compliant vehicle was compared with the cost of making a trip in an existing, non-compliant vehicle (ie staying and paying the daily charge). Calculations of vehicle costs took into account the average age of the compliant and non-compliant vehicles (ie fleet age profiles) and their depreciated value. The more frequently a user enters the ULEZ, the more frequently they become liable for the daily charge if they drive a non-compliant vehicle. Consequently, the more frequently a user enters the ULEZ, the more likely they are to buy a compliant vehicle to avoid this charge. Whilst frequent users of the zone make up a small proportion of the total unique vehicles that enter the ULEZ over a period of a year, they contribute a large proportion of the distance driven on a given day (and thus emissions).

Figure 33: Illustration of how a daily charge induces a vehicle upgrade



The decision on whether to incur the relative costs of paying a daily charge or upgrade a vehicle is dependent on the price elasticity of demand. This was calculated using values derived from TfL^{67,68} and academic studies⁶⁹, and applied to each of the different vehicle types. This allowed an estimate to be made of the proportion of users who were likely to upgrade, pay or stop driving in the ULEZ during the period of enforcement. For cars, the output of the spreadsheet model was enhanced through the use of stated preference surveys and in combination gave a good basis for the estimated response to the original scheme design.

Having calculated the likely behavioural response, fleet compositions were updated to reflect the assumptions made, and the total distance driven in the zone was revised through traffic modelling (to take account of trips no longer being made).

⁶⁷ <http://www.tfl.gov.uk/assets/downloads/demand-elasticities-for-car-trips-to-central-london.pdf>

⁶⁸ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/232294/hgv-charging-tax-information.pdf

⁶⁹Graham, DJ & Glaister, S. (2004). Road traffic demand elasticity estimates: A review. *Transport Reviews*, 24(3), 261-274.

Appendix H: Integrated Impact Assessment

Attached separately and can be found at: tfl.gov.uk/airquality-consultation

Glossary

Air pollutants: Generic term for substances emitted that have adverse effects on humans and the ecosystem

Auto Pay: Auto Pay is an account system that allows drivers to register with TfL and pay the Congestion Charge automatically each month via direct debit or a payment card

ANPR (Automatic Number Plate Recognition): A system which uses cameras to identify vehicles from their licence plates

BAME (British, Black, Asian, and minority ethnic): Used to refer to members of non-white communities in the UK)

CHP (combined heat and power): Local electricity generation that captures the heat that would otherwise be wasted to provide useful thermal energy (such as steam or hot water) that can be used for space heating, cooling, domestic hot water and industrial processes

Congestion Charge (CC), Congestion Charge zone (CCZ): An area in central London where a daily charge (£11.50) applies to vehicles using the zone Monday to Friday, 07:00 to 18:00

CCMES (Mayor's Climate Change Mitigation and Energy Strategy): Statutory document outlining the Mayoral plans to reduce CO₂ emissions and encourage renewable energy

CO₂ (carbon dioxide): Principal greenhouse gas related to climate change

COPERT (calculation of air pollutant emissions from road transport): A software tool used world-wide to calculate air pollutant and greenhouse gas emissions from road transport. The development of COPERT is coordinated by the European Environment Agency (EEA), in the framework of the activities of the European Topic Centre for Air Pollution and Climate Change Mitigation. The European Commission's Joint Research Centre manages the scientific development of the model. COPERT has been developed for official road transport emission inventory preparation in EEA member countries.

DVLA (Driver and Vehicle Licensing Agency): The Government agency that maintains the registration and licensing of drivers in Great Britain and the registration and licensing of vehicles, together with the collection and enforcement of VED in the UK.

Economic and Business Impact Assessment (EBIA): Assessment that identifies and assesses the impacts on London's economy as a result of the proposals, the potential impacts on small to medium sized enterprises (SMEs) and the monetised health benefits of the scheme.

Environmental Impact Assessment (EIA): Assessment that identifies and assesses the impacts of the proposals across a range of environmental issues as a

result of the proposals including: air quality, noise, climate change, biodiversity, cultural heritage, landscape, townscape and the urban realm, material resources and wastes.

Euro standards: Standards set by the European Union for the maximum emissions of air pollutants for new vehicles sold within EU member states. They range from Euro 1–6 for light vehicles, with 6 being the most recent and Euro I–VI for heavy vehicles

EV (electric vehicle): Vehicle which uses an electric motor for propulsion. Includes both pure electric vehicles that run solely from batteries and plug-in hybrid electric vehicles that have an attached petrol or diesel engine to power the battery engine

Equality Impact Assessment (EqIA): Assessment that identifies and assesses the impacts on equality issues, in particular those groups of people with protected characteristics or who are socio-economically disadvantaged.

Greenhouse gas: Gases that absorb heat, contributing to climate change. The most significant of which is CO₂

Health Impact Assessment (HIA): Assessment that identifies and assesses the impact of the proposals on the health and well-being of the population of Greater London and the ability to access health-related facilities and services. The assessment also addresses equality issues and thus has some overlap with the EqIA.

HGV (heavy goods vehicle): Type of truck weighing >3.5T

Integrated Impact Assessment (IIA): The IIA identifies and assesses the impacts and the likely effects on equality, the economy and the environment arising from the proposal

LAEI (London Atmospheric Emissions Inventory): Database of emissions sources and information about rates of emissions for air pollutants emitted within and around London

London Environment Strategy (LES): A statutory strategy containing a general assessment by the Mayor of the environment in Greater London as well as policies and proposals in relation to biodiversity municipal waste management, climate change mitigation and energy, adaptation to climate change, air quality, and ambient noise

LEZ (Low Emission Zone): A charging zone across most of Greater London for vehicles that do not meet emissions standards for PM₁₀

LGV (light goods vehicle): Also known as light commercial vehicle; designed and constructed for the carriage of goods and weighing less than 3.5T

Limit values: Legal maximum levels of atmospheric concentrations of air pollutants

MAQS (Mayor's Air Quality Strategy): Statutory document outlining the Mayor's plans to reduce air pollution

MTS (Mayor's Transport Strategy): A statutory document setting out the Mayor's intentions for London transport

NO_x (nitrogen oxides): A generic term for nitrogen dioxide (NO₂) and nitrogen monoxide (NO), which can form NO₂ in the atmosphere. Euro standards set limits for vehicle emissions of NO_x

NO₂ (nitrogen dioxide): A gas formed by combustion, identified as an air pollutant harmful to human health. The European limit values measure concentrations of NO₂ in the air

OLEV (Office for Low Emission Vehicles): Cross-governmental office set up to support the development of the low emission vehicle sector

PHV (private hire vehicle): Licensed vehicles that are available for hire on a pre-booked basis. Also known as minicabs

Plug-in hybrid: A vehicle which combines conventional internal combustion and electric propulsion with batteries charged from an electric power source

PM (particulate matter): A mixture of various solid and liquid particles of various chemical compositions suspended in the air

PM₁₀ (particulate matter <10 microns in diameter): Particulate matter that is harmful to human health and subject to EU limit values

PM_{2.5} (particulate matter <2.5 microns in diameter): The smallest and most harmful form of particulate matter; also subject to EU limit values

RDE (real driving emission): Test to measure the pollutants, such as NO_x and PM, emitted by vehicles while being driven on the road. RDE complements lab tests to help ensure that vehicles deliver anticipated emissions under real world driving conditions

Sensitive locations: Sensitive locations (often called sensitive receptors) include, but are not limited to, hospitals, schools, daycare facilities, housing for the elderly and convalescent facilities. These are places where the occupants are more susceptible to the adverse effects of exposure to toxic chemicals, pesticides, and other pollutants.

Taxi (black cab): A specialist vehicle licensed by TfL to ply for hire in London. Most taxis are licensed to carry five passengers although some are licensed to carry six

VED (Vehicle Excise Duty): Annual charge levied for vehicles to use the public highway. Banded according to engine size or CO₂ emissions

Zero emission capable vehicle (ZEC vehicles): A vehicle that is constructed to be capable of operating in zero emissions mode for at least part of its operating cycle. The zero emissions mode may be augmented by an internal combustion engine configured to extend the driving range of the vehicle, either by propelling the driven wheels or by powering an on-board generator