Changes to Low Emission Zone and Expansion of the Ultra Low Emission Zone

Supporting information document

November 2017

MAYOR OF LONDON

TRANSPORT FOR LONDON

EVERY JOURNEY MATTERS

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 more modern and affordable for everyone.

Our operational responsibilities include London Underground, London Buses, Docklands Light Railway, 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 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. Under the Mayor's housing strategy, we are using our surplus 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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Part 1: Background and overview

Air pollution is one of the most significant challenges facing London. The equivalent of thousands of deaths per year are attributed to air quality related illnesses and it affects lung function development in children and increases the risk of strokes and dementia in later life.

As part of the Mayor's pledge to help improve air quality and health for all Londoners, he is proposing to make the London-wide Low Emission Zone (LEZ) stronger and expand the Ultra Low Emission Zone (ULEZ) requirements for vehicles. This involves introducing a Euro VI[1] emissions standard London-wide for heavy duty vehicles (buses, coaches, Heavy Goods Vehicles (HGVs) and other specialist heavy vehicles) from 26 October 2020 and expanding the ULEZ for light duty vehicles (such as cars, vans and motorcycles) so that all vehicles are subject to emissions standards within an area roughly bounded by the North and South Circular Roads from 25 October 2021.

We would like your views on these proposals. A summary of the consultation and a short questionnaire can be found at: tfl.gov.uk/airquality-consultation

Structure of this document

This document is in three parts:

- **Part 1** provides the context and background to the Mayor's air quality proposals and the rationale for addressing road transport emissions in London to improve air quality and public health.
- **Part 2** discusses at the proposals. It presents the options of introducing a new Euro VI emissions standard for heavy duty vehicles London wide and extending the ULEZ emission standards for light duty vehicles to inner London so that the ULEZ standards will apply to all vehicles up to, but not including the North and South Circular Roads. It contains detailed information on the development of this proposal and looks at the other options that were assessed.
- **Part 3** describes the impacts of the proposals in reducing emissions and the effects of changing the key features of the scheme.

[1]Euro VI is the latest emission standard for large vehicles. Please refer to Appendix A for a full explanation of the Euro standards

Chapter 1 – The issues of air pollution

1.1 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 pollution is the benefit to public health. It is also a social justice issue for more vulnerable people as well as a health and environmental concern, particularly given the high number of schools, hospitals and care homes affected by poor air quality.

The two pollutants causing the greatest concern in London are:[2]

- **Nitrogen dioxide (NO_2):** At high concentrations, NO_2 causes inflammation of the airways. Long-term exposure is associated with an increase in symptoms of bronchitis in asthmatic children and reduced lung development and function
- **Particulate matter (PM):** Long-term exposure contributes to the risk of developing cardiovascular and respiratory diseases, including lung cancer. Research shows that particles with a diameter of 10 microns and smaller (PM_{10}) 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

The extent of the negative effects of air pollution on health depends on an individual's level of exposure and other conditions they may be vulnerable to, or suffering from. Knowledge in this area is continually increasing as research progresses.

Research has shown air pollution has a big impact on health at all life stages, from development in the womb to the end of life. A baby born in London in 2010, who if exposed to 2010 air quality levels for its entire life, would see its life expectancy reduced by 2.2 years (if male) and two years (if female)..). Mortality is not the only air pollution related health effect. In 2010, London's air pollution was linked to over 3,000 hospital admissions. The economic cost of these health impacts in the Capital is estimated as being up to £3.7bn a year. There is also strong evidence that poor air quality affects children's lung development. A six-year study found that children living in highly polluted areas of London have up to 10 per cent less lung capacity than normal.[3] However there is emerging evidence that improving air quality can reverse those effects. There is also increasing evidence of the link between exposure to pollution and dementia.

[2] www.who.int/mediacentre/factsheets/fs313/en/

[3] sro.sussex.ac.uk/56496/

In 2015, the Greater London Authority (GLA) published its assessment of the combined health impacts of $PM_{2.5}$ and NO_2.[4] Air pollution is one of the most significant challenges facing the Capital.

Air pollution also causes birth defects. A 2013 study in California showed that, for women with the highest NO_2 exposure, the risk of having a pregnancy affected by anencephaly (when babies are born missing part of the brain and skull), was nearly three times greater than for women with the lowest exposure.[5]

Understanding of the effects associated with sudden peaks in air pollutant concentrations is also improving. Air pollution is now believed to play a significant role in some cardiovascular episodes, for instance heart attacks, and in a range of health conditions from asthma to dementia.

Analysis carried out on behalf of the GLA and published in 2016[6] shows the health effects of air pollution are seen disproportionately in the most vulnerable and deprived communities. Among the top 10 per cent of London's most deprived areas, half have NO_2 levels exceeding legal limits. For the 10 per cent of least deprived areas, only one per cent experience illegal NO_2 concentrations.

1.2 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 are based on European Union (EU) directives,[7] which will remain in force regardless of the UK leaving the EU, unless specifically repealed.

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

[5] med.stanford.edu/news/all-news/2013/03/air-pollutants-linked-to-higher-risk-of-birth-defects-researchers-find.html

[6] www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/analysing-air-pollution-exposure-london

[7] Ambient Air Quality Directive 2008/50/EC and Directive 2004/107/EC

Table 1: Legal limits for pollutants of most concern in London[8]

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[9]
$PM_{2.5}$	25µg/m^3 [10]	1 year	Target value came into force on 1 January 2010 Limit value came into force on 1 January 2015	n/a	Compliant
PM_{10}	50µg/m^3	24 hours	Limit value came into force on 1January 2005 (time extension granted to June 2011)	35	Compliant[11]
	40µg/m^3	1 year	Limit value came into force on 1 January 2005	n/a	Compliant
NO_2	200µg/m^3	1 hour	Limit value came into force on 1 January 2010	18	Not compliant
	40µg/m^3	1 year	Limit value came into force on 1 January 2010	n/a	Not compliant

[8] Taken from ec.europa.eu/environment/air/quality/standards.htm

[9] Defra reports on compliance to the European Commission on behalf of the UK, in accordance with the air quality directives. The most recent compliance assessment is for 2015 http://uk-air.defra.gov.uk/library/annualreport/index

[10] An obligation to reduce exposure to concentrations of fine particles also came into force from 2015

[11] Following the subtraction of natural sources in accordance with the directive

The Department for Environment, Food & Rural Affairs (Defra) has reported PM compliance limits for 2015 across England and Wales, with most 'non-reportable' sites[12] in London falling below the legal limits. However, there are no safe limits for $PM_{2.5}$ which is more damaging to health than PM_{10}. 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 levels rise.

Crucially, large areas of the Capital continue to exceed both the annual mean and hourly legal limits for NO_2 and this is likely to continue beyond 2020, so more action needs to be taken. Within the first five days of 2017, Brixton Road breached hourly legal limits in terms of the number of times that pollution episodes are allowed. Further information on pollutant concentrations in London is provided in Section 3.1

Improving air quality in the Capital is a shared responsibility. Under the Greater London Authority 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 the city to tackle pollution emissions, reduce exposure, raise awareness and integrate air quality and public health. However Defra is responsible for the assessment and reporting of compliance with the legal limit values.

For local authorities, a bespoke Local Air Quality Management system is in place (LLAQM), in order to reflect the unique challenges, opportunities, and policies within London, and to enable an enhanced focus on and coordination of local authority air quality work.

The basic statutory framework for local air quality management exists under the national Air Quality Regulations and Part IV of the Environment Act 1995 ('the 1995 Act', as amended, and 'Part IV functions'). 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 relevant local air quality management policy and technical guidance for the Capital should be different from that in the rest of the country in recognition of the particular challenges London faces.

Defra have agreed that this should be issued by the Mayor in the context of the new LLAQM system and in recognition of his London-wide supervisory role. This reflects the Secretary of State's own statutory guidance. As a result, London boroughs need only refer to policy and technical guidance issued by the Mayor rather than to national statutory guidance.[13]

It is the Mayor's ambition, as set out in the draft LES, to go beyond the legal standards and meet World Health Organization (WHO) guidelines for $PM_{2.5}$ to benefit human health.

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

[13] https://www.london.gov.uk/sites/default/files/llaqm_policy_guidance_llaqm.pg_16.pdf

The London Plan

The draft London Plan was published on 29 November 2017. Policy SI 1 states that London's air quality should be significantly improved and exposure to poor air quality, especially for vulnerable people, should be reduced

The current document (published in March 2016) will apply until the new plan is adopted.

The 2016 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.

Mayor's Transport Strategy

The Mayor has developed a draft Mayor's Transport Strategy (MTS) for London. It contains several proposals to reduce emissions. Policy 5 states that the Mayor, through Transport for London (TfL) and working with the boroughs, will take action to reduce emissions (in particular diesel emissions) from vehicles on London's streets, to improve air quality and support London reaching compliance with UK and EU legal limits as soon as possible. Proposal 22 specifically addresses the ULEZ, stating that the Mayor, through TfL, will seek to introduce the central London ULEZ standards and charges in 2019; and that the zone would be expanded London-wide for heavy vehicles by 2020 and to inner London for all other vehicles (except taxis) by 2021.

The draft MTS is yet to be formally approved and published. Until the new strategy is finalised, the 2010 MTS applies. This 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'.

The 2010 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 129 of the MTS.

Proposal 95 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.'

London Environment Strategy (LES)

The Mayor has published a new draft LES, which will, when finalised, supersede the Mayor's Air Quality Strategy (MAQS) and other statutory environment strategies such as the Climate Change Mitigation and Energy Strategy.

The draft LES policies on transport emissions mirror those set out in the MTS. Proposal 4.2.1d states that the Mayor aims to reduce emissions from private and commercial vehicles by phasing out and restricting the use of fossil fuels, prioritising action on diesel. The ULEZ expansion is set out under this proposal.

Until the LES draft is finalised, the current MAQS (published in 2010) applies.

The 2010 MAQS[14] 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 Climate Change Adaptation Strategy and the Municipal Waste Management Strategy.

Transport policies in the MAQS cover five categories: smarter choices and sustainable travel behaviour; technological change and cleaner vehicles; priority locations and local measures; public transport; and emission control schemes such as the LEZ.

It is recognised that action through the Mayor's measures alone is not sufficient to achieve compliance with 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 sets out actions to be taken by others including the EU, 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.

National air quality plan

The government produced a revised draft NO_2 action plan in late 2015 in response to a UK Supreme Court ruling.[15] This brought forward the projected date of compliance with legal air pollution limits to 2025 (from after 2030) in the Capital and to 2020 in the rest of the UK. It also includes a framework for Clean Air Zones to be implemented in several UK cities, including London.

The ULEZ consultation proposals are consistent with the government's UK plan for tackling roadside nitrogen dioxide concentrations (2017). This states that launching a ULEZ in April 2019, subject to consultation, and extending it London-wide for heavy vehicles (HGVs, buses and coaches) and to the North and South Circular Roads for all vehicles is one of a number of measures, including the introduction of the Emissions Surcharge (T-Charge), to be undertaken in London to achieve compliance by 2025 or sooner.

[14] The MAQS forms part of the LES

[15] www.supremecourt.uk/cases/uksc-2012-0179.html

Chapter 2 – Existing initiatives

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

2.1 The Ultra Low Emission Zone (ULEZ)

From April 2019, all cars (except taxis, which are subject to environmental requirements through the taxi licensing system), motorcycles, vans, minibuses, buses, coaches and HGVs will need to meet exhaust emissions standards (ULEZ standards), or pay a daily charge, when travelling in central London.

Table 2 is a summary of the ULEZ standards and daily charges. It also shows the dates from which new vehicles should meet the standards. However, there are some models of vehicles registered before the dates that already meet the emissions standards. We have provided a tool to check whether or not a vehicle meets the ULEZ standards, available at https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/check-your-vehicle

See Appendix A for more details on the Euro standards.

Table 2: ULEZ emissions standards

Vehicle type (includes hybrid vehicles)	ULEZ minimum emissions standards[16]	Date from which newly registered vehicles must meet the new emissions standards (usually a year earlier for early adopters; see Appendix A)	Daily charge if vehicle is not compliant with ULEZ standards[17]
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) Euro 6 (diesel)	From 1 January 2006 From 1 September 2015	£12.50
Large van and minibus – Categories N1 (II and III) and M2	Euro 4 (petrol) Euro 6 (diesel)	From 1 January 2007 From 1 September 2016	£12.50

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

[17] This is payable in addition to any applicable LEZ and/or Congestion Charge

HGV – Categories N2 and N3	Euro VI	From 1 January 2014	£100
Bus/coach – Category M3	Euro VI	From 1 January 2014	£100

The ULEZ daily charge is in addition to any applicable Congestion Charge or Low Emission Zone (LEZ) charges. The ULEZ will operate 24 hours a day, every day of the year, including weekends and public holidays.

The ULEZ will initially cover the same area as the Congestion Charging zone (see Figure 2) and will be clearly signposted. There will be no barriers or toll booths. Cameras will read vehicle number plates as they are driven into and within the zone to check against a database and establish whether or not a vehicle is compliant with the requirements of the scheme[18].

If a vehicle does not meet the ULEZ emissions 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 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).

2.2 The London Low Emission Zone

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

Vehicles need to meet emissions standards or pay a daily charge of £100 or £200. Table 3 lists the vehicles affected by the LEZ daily charges.

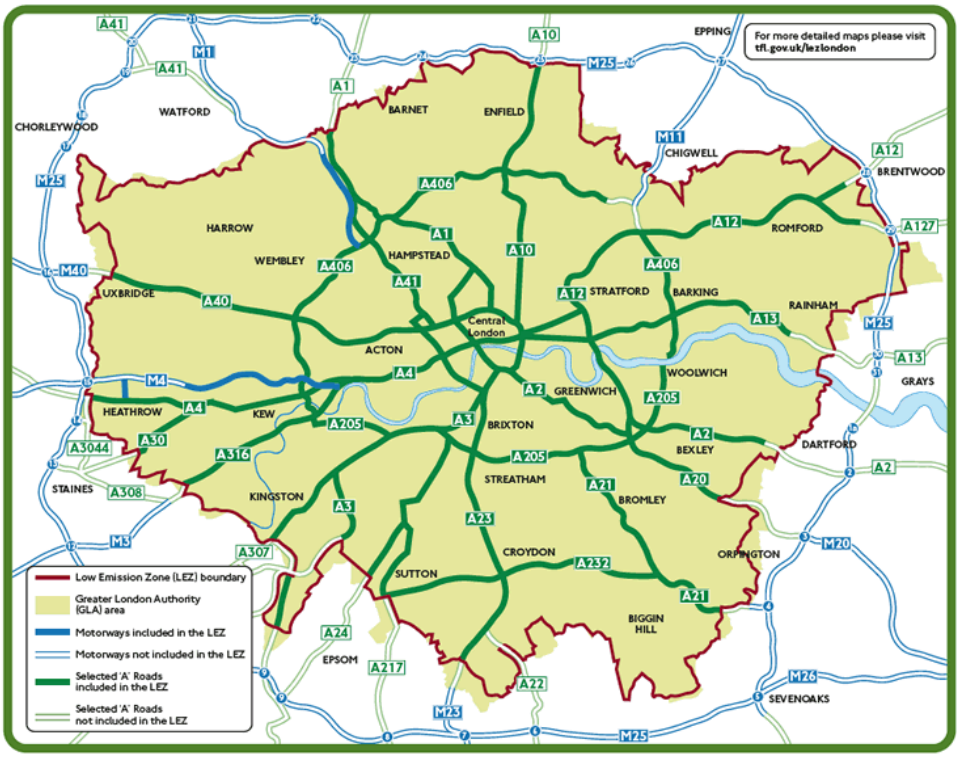
[18] The database will be compiled using information from the Driver & Vehicle Standards Agency, vehicle manufacturers and drivers and operators who have registered with TfL

Table 3: LEZ emissions standards and charges

Vehicle	Weight	Emissions standard	Daily charge	Implementation
Lorries, horseboxes, motor caravans and other specialist vehicles	>3.5T	Euro IV for PM	£200	February 2008 – Euro III for HGV >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 lorries and coaches, and £500 for large vans, motor caravans and minibuses (reduced to £500 and £250 respectively if paid within 14 days).

Figure 1: The area covered by the LEZ



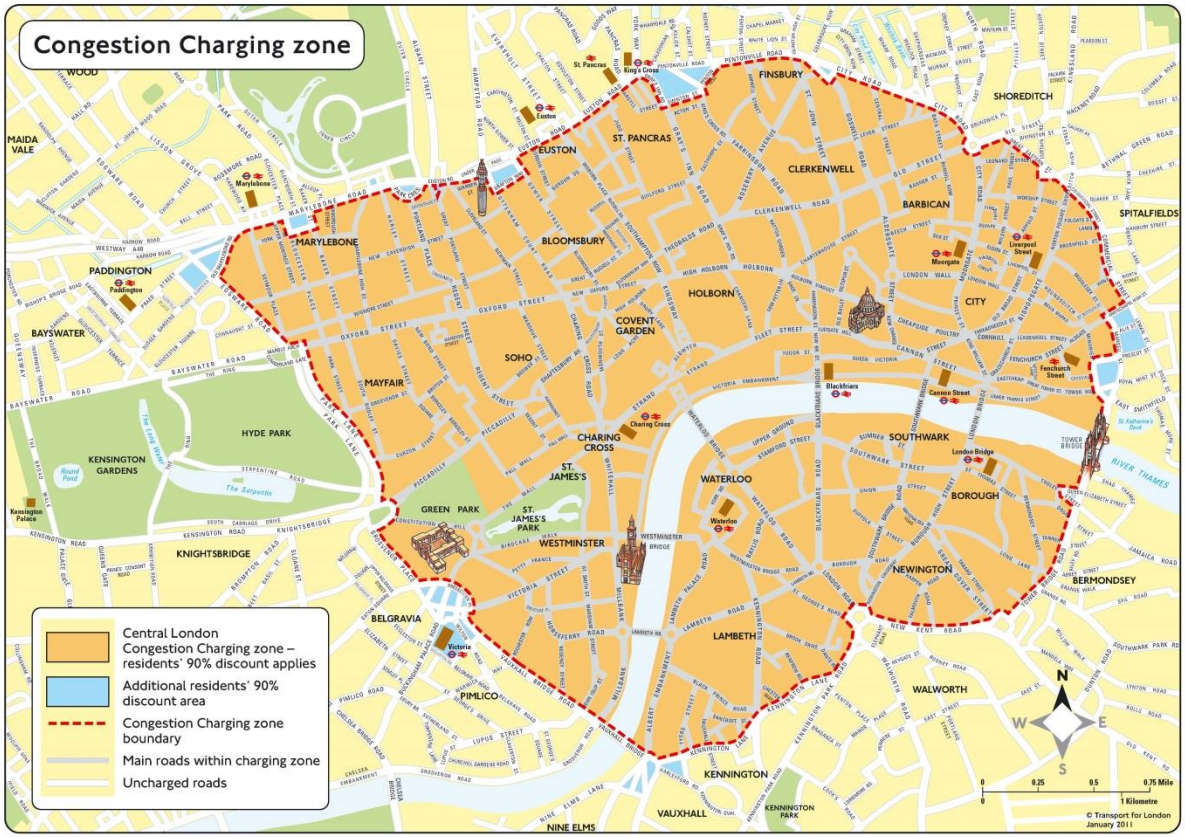
According to the most recent monitoring report, 97 per cent of HGVs and 99 per cent of large vans entering the Capital are compliant with the current LEZ standards, and this is helping to remove the older more polluting vehicles from Greater London.

2.3 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 led 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 2).

Figure 2: Congestion Charging zone



2.4 The T-Charge

The T-Charge (also known as the Emissions Surcharge) was launched on 23 October 2017. It requires vehicles that do not meet the Euro 4/IV emissions standard to pay an additional £10 on top of any applicable Congestion Charge when entering the Congestion Charging zone during Congestion Charging hours. This charge will be replaced by the ULEZ from April 2019, except for residents within the zone, who will continue to be subject to the T-Charge (at the 90 per cent discounted rate for driving a non-compliant vehicle) during the ULEZ residents' sunset period.

2.5 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. Further details can be found on the GLA website at https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality

Low Emission Neighbourhoods

TfL and the Mayor are introducing Five Low Emission Neighbourhoods (LENs) spanning eight boroughs and involving a range of local organisations, with funding for a further five business-led LENs. This is in addition to continuing the Mayor's Air Quality Fund and together these targeted actions will tackle some of the worst pollution hotspots across London.

Air quality alerts

TfL and the GLA provide alerts to Londoners during high and very high pollution episodes by issuing information on 2,500 bus countdown signs, at 140 roadside variable message signs and at 170 tube stations.

Schools audits

The Mayor has provided 50 comprehensive air quality audits at some of our most polluted primary schools. The audits will identify a range of measures to improve air quality in and around the schools, and boroughs will have access to Local Implementation Plan funding in order to deliver the recommendations.

LoCITY

This is our initiative for lowering 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

Cleaner vehicle checker

The GLA have a Cleaner Vehicle Checker, enabling Londoners to check the real world emissions from a vehicle they may be considering buying, available at https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/cleaning-londons-vehicles/newer-vehicle-checker

Ultra low emission vehicles

Together with the GLA and boroughs, we are working to invest in new charging infrastructure to support a major expansion in the use of electric vehicles (EVs). 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, areas which will promote innovative charging infrastructures, and policies and initiatives to support the switch to EVs across different fleets.

Working with the private sector, we will also deliver at least 300 rapid charge points by the end of 2020 to support high-mileage users, such as the freight, taxi and private hire industries, to switch to EVs. The first rapid charge points were installed in October 2017.

Reducing vehicle usage

The draft 2017 MTS sets out an ambition to achieve a zero emission London by 2050 and for 80 per cent of journeys to be undertaken by walking, cycling or public transport by 2041. This will be achieved through transforming London's road network using the Healthy Streets principles.

The draft MTS also sets out proposals for the renewal and expansion of the public transport network to enable additional homes and jobs to be delivered in the Capital in a sustainable manner.

Other emissions sources

Improving London's air quality cannot be done through a reduction in road transport emissions alone – other sources accounted for 49 per cent of the total in 2013. •The GLA is also taking forward a number of initiatives to reduce pollutants from other sources, such as construction machinery and gas boilers. The Mayor is also utilising his planning powers to tackle building and construction emissions, including through implementing 'Air Quality Neutral' planning requirements and a Non Road Mobile Machinery Low Emission Zone. The GLA has also secured funding from the Government's Growth Deal 3 to replace boilers used by small and medium sized enterprises

While the ULEZ will focus on transport emissions, measures to reduce emissions from non-transport sources are set out in the draft LES and include measures such as further retrofitting homes and buildings, providing guidance on the application of 'air quality positive' in the planning system, ensuring that new developments do not worsen air quality and taking action to reduce emissions from non-road mobile machinery (NRMM).

Chapter 3 - The case for further intervention

3.1 Update on London's air quality

Current position

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. Recent London Atmospheric Emissions Inventory analysis (LAEI 2013) of London's $PM_{2.5}$ showed that every single Londoner lives in an area exceeding the World Health Organization (WHO) guidelines for $PM_{2.5}$ concentrations, and that 95 per cent of Londoners live in areas exceeding this limit by 50 per cent.[19]

Annual average PM_{10} concentrations are considered within the legal limits, however modelling still predicts some hotspot locations where the daily average value for PM_{10} is exceeded (for example kerbside at some junctions in central London, or within the road space itself). Annual mean concentrations of $PM_{2.5}$ are also well within the legal limit value of 25µg/m^3. Although compliance has officially been achieved, by reducing PM concentrations even more, the health benefits will be even greater.

In contrast, annual average NO_2 concentrations still exceed the legal limit across much of inner London, as well as in the vicinity of Heathrow Airport and near major roads in outer London. Meeting the NO_2 legal limit poses a huge challenge for many cities in the UK and across Europe. One of the key reasons why ambient levels of NO_2 remain higher than had been previously expected is 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 oxides of nitrogen (NO_x)[20] emissions from light-duty diesel vehicles (eg cars and vans), despite tightening emissions standards for NO_x. However, Euro VI (for heavy vehicles) is performing well and the standard for light vehicles is still bringing about a significant reduction, albeit not as much as it should.

Future year estimates of London's air quality

The Capital's air quality is expected to improve, although further and more urgent action is required. Emissions from all sources are projected to decrease thanks to technological advances in vehicle design, as well as because of policies and legislation already in place to reduce emissions across London, the UK and Europe. This includes the roll-out of a new emissions standard for Euro 6 diesel cars and

[19] https://data.london.gov.uk/dataset/pm2-5-map-and-exposure-data

[20] Vehicle emissions are measured in terms of total NO_x. NO_x is made up of nitrogen oxide (NO) and NO_2, although the NO is subsequently converted into additional NO_2 by interaction with ozone in the atmosphere – this reaction being dependent on the availability of ozone

vans which is anticipated to be more successful at reducing pollutants in urban driving conditions than previous standards, and a forthcoming requirement for all vehicles to meet real world driving emissions tests.[21] However, although it is expected that PM emissions will remain within legal limits, levels of NO_2 will continue to exceed the legal limits in some areas, even with the ULEZ in place in central London.

Further PM_{10} and $PM_{2.5}$ reductions by 2021 will mean that annual average concentrations should remain below the legal limits. However, there is a strong case to continue cutting PM concentrations to ensure health benefits, and a compelling need to accelerate the pace of change to achieve this even sooner in order to move towards meeting the WHO recommended guidelines.

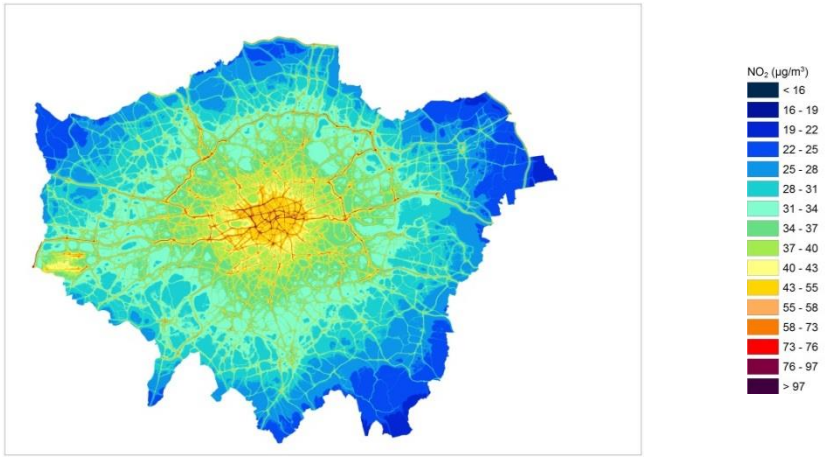
The proportion of the Capital where annual average NO_2 concentrations exceed the legal limit is also expected to decrease by 2021, in part due to the introduction of the ULEZ in central London. However, modelling indicates that, if nothing further is done, concentrations will continue to exceed the limit in central and inner London, in the vicinity of Heathrow Airport and near construction sites and major roads in outer London.

Figure 3 to Figure 6 show the concentrations of pollutants from 2013 – 2025 in the baseline. Please note that the colour scale on $PM_{2.5}$ maps in this document has been adjusted to reflect the Mayor's ambition to work towards the WHO limit value, which is lower that the EU equivalent.

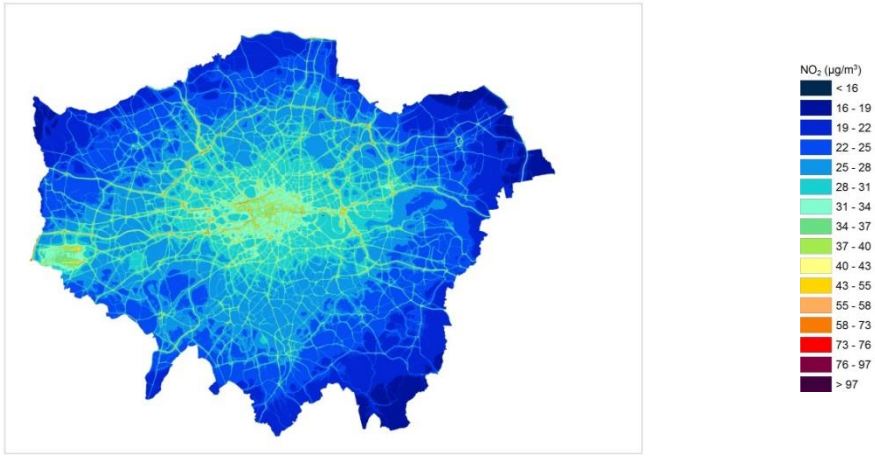
[21] Please see appendix A for more details

Figure 3: NO_2 concentrations 2013-2025 with no further action

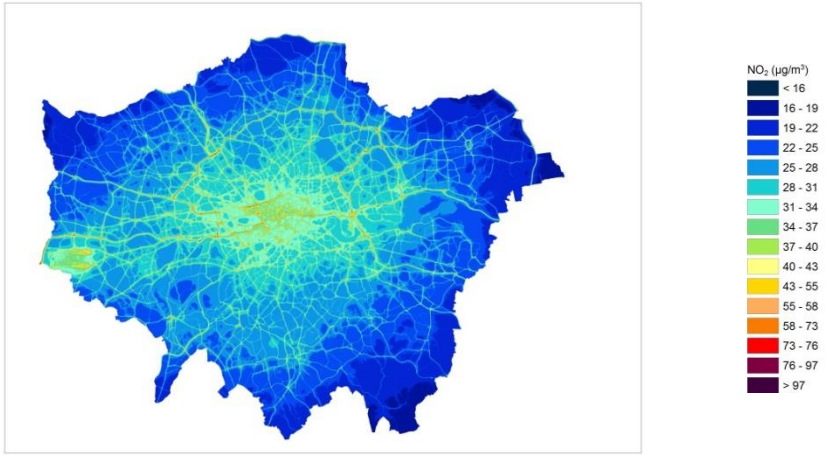
NO_2 annual mean – 2013



NO_2 annual mean – 2021



NO_2 annual mean – 2020



NO_2 annual mean – 2025

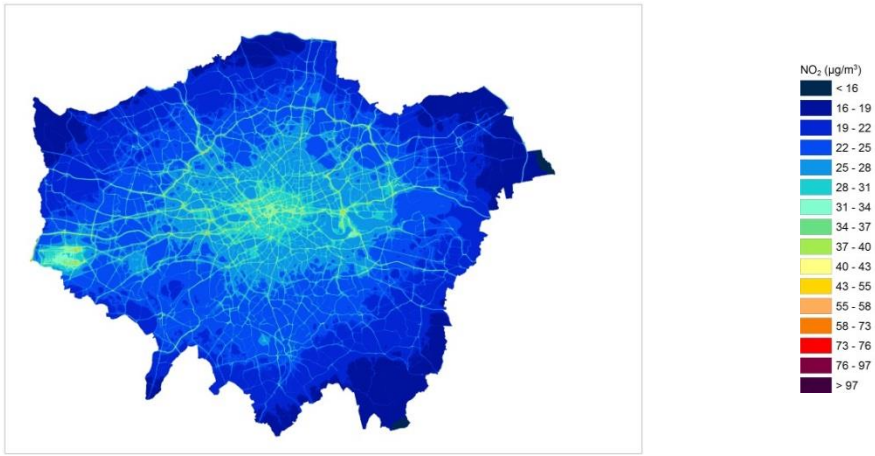
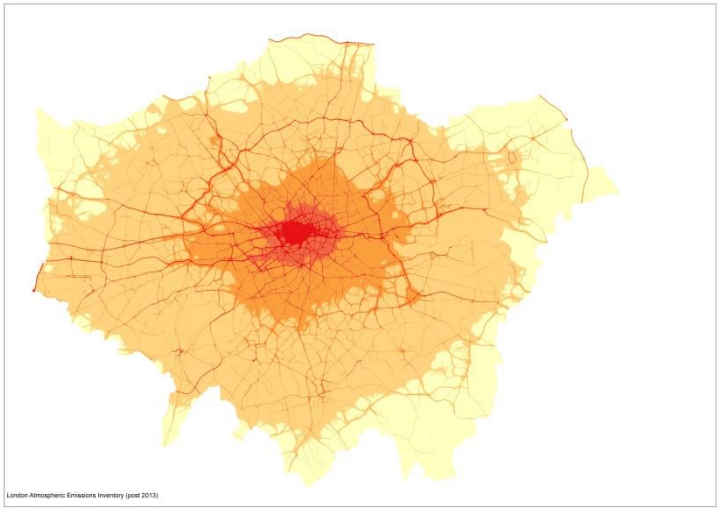
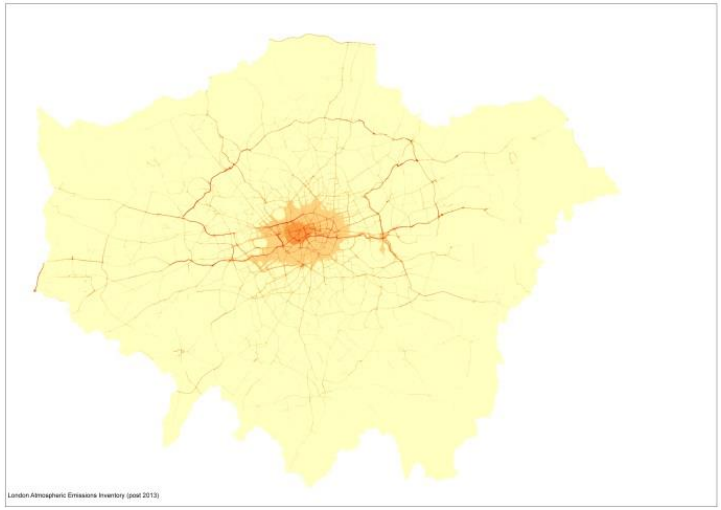


Figure 4: $PM_{2.5}$ concentrations 2013–2025 with no further action

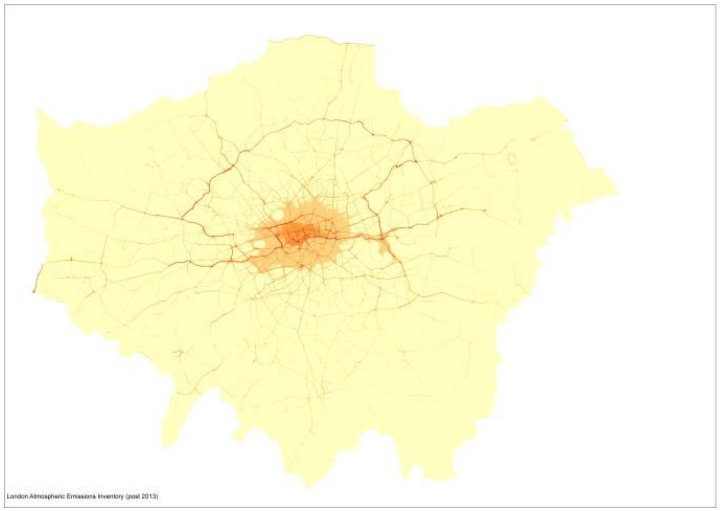
$PM_{2.5}$ annual mean – 2013



$PM_{2.5}$ annual mean – 2021



$PM_{2.5}$ annual mean – 2020



$PM_{2.5}$ annual mean – 2025

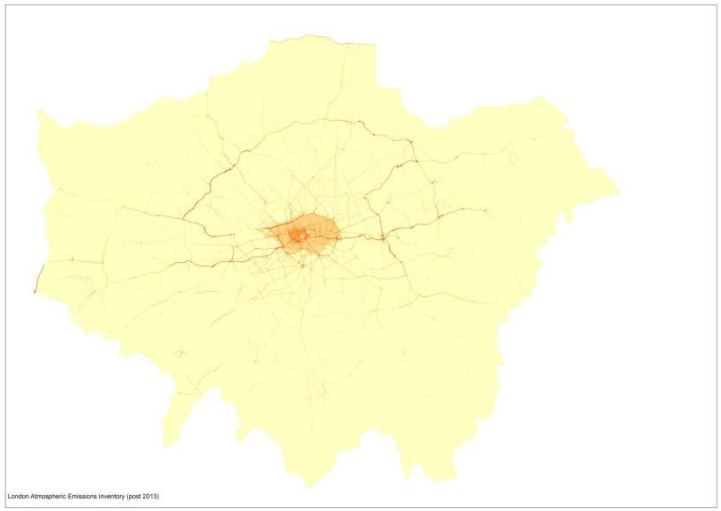
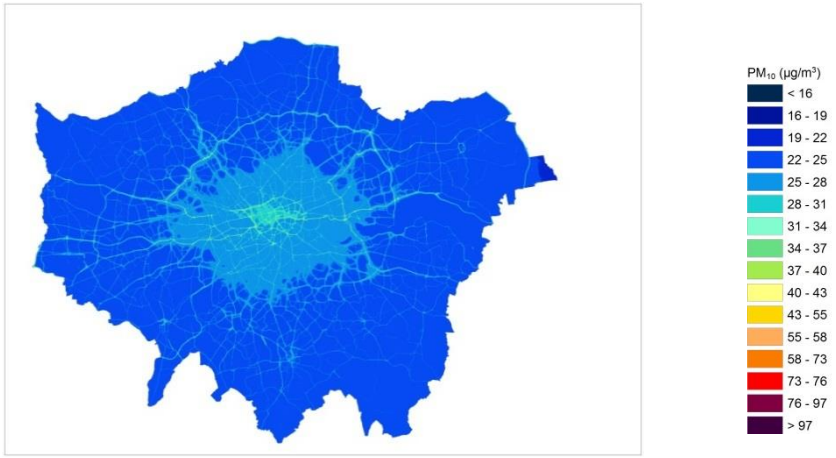
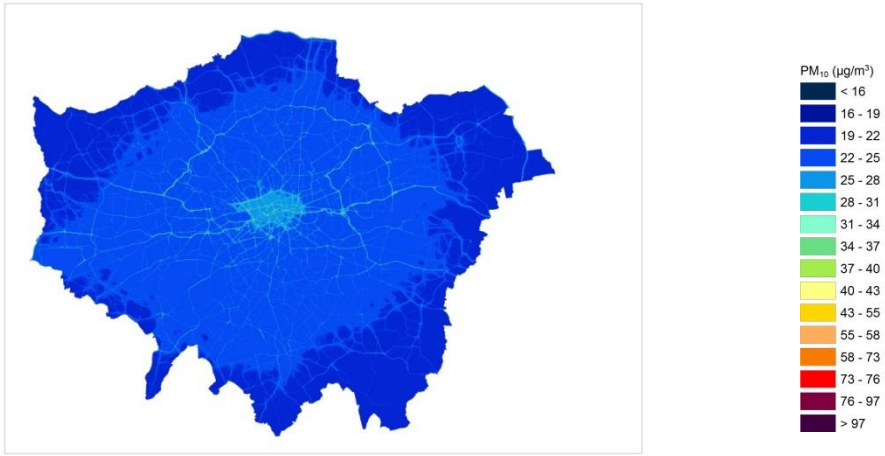


Figure 5: PM_{10} annual mean concentrations 2013-2025 with no further action

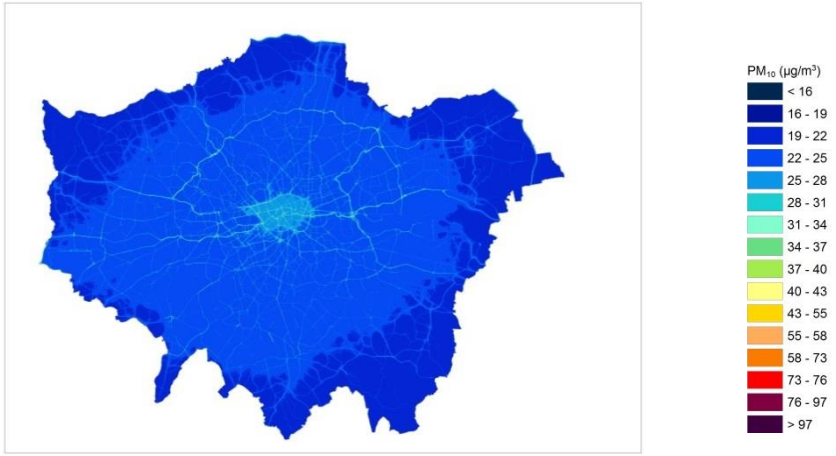
PM_{10} annual mean – 2013



PM_{10} annual mean – 2021



PM_{10} annual mean – 2020



PM_{10} annual mean – 2025

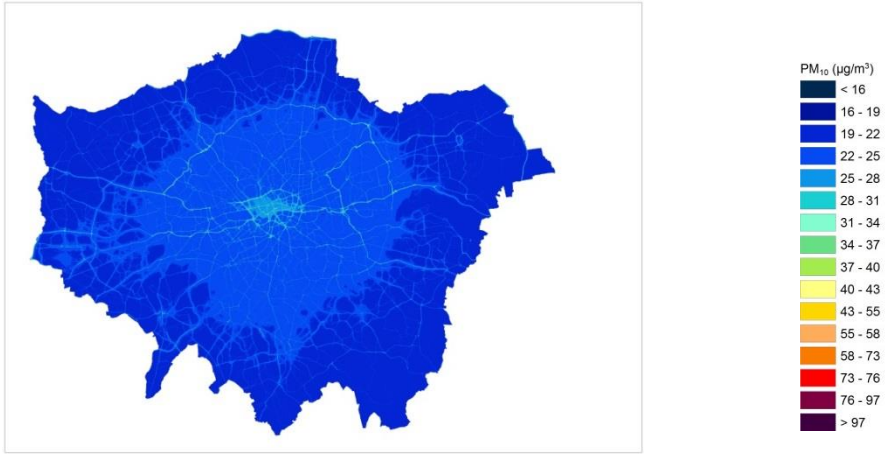
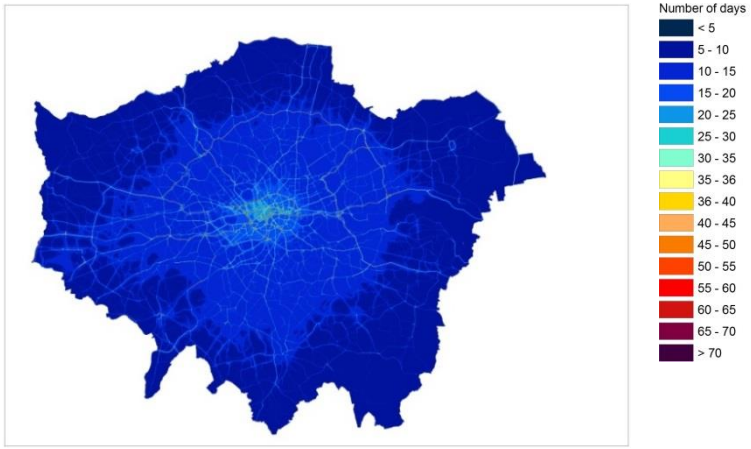
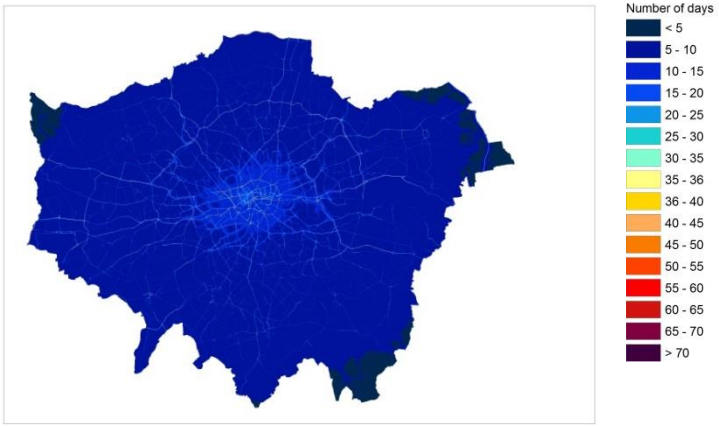


Figure 6: Number of days when PM_{10} limits are exceeded 2013-2025 with no further action

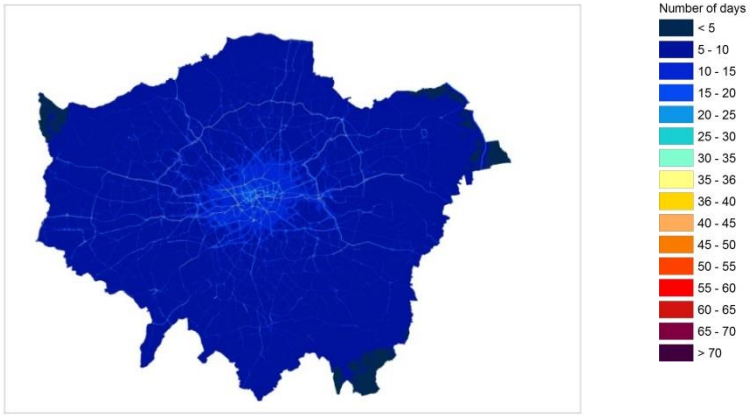
PM_{10} number of exceedence days – 2013



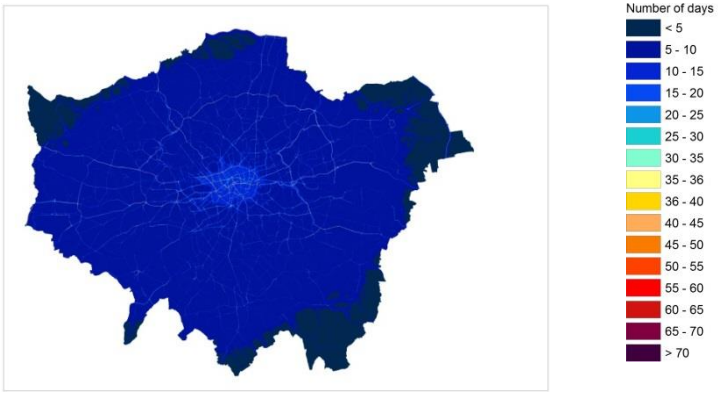
PM_{10} number of exceedence days – 2021



PM_{10} number of exceedence days – 2020



PM_{10} number of exceedence days – 2025

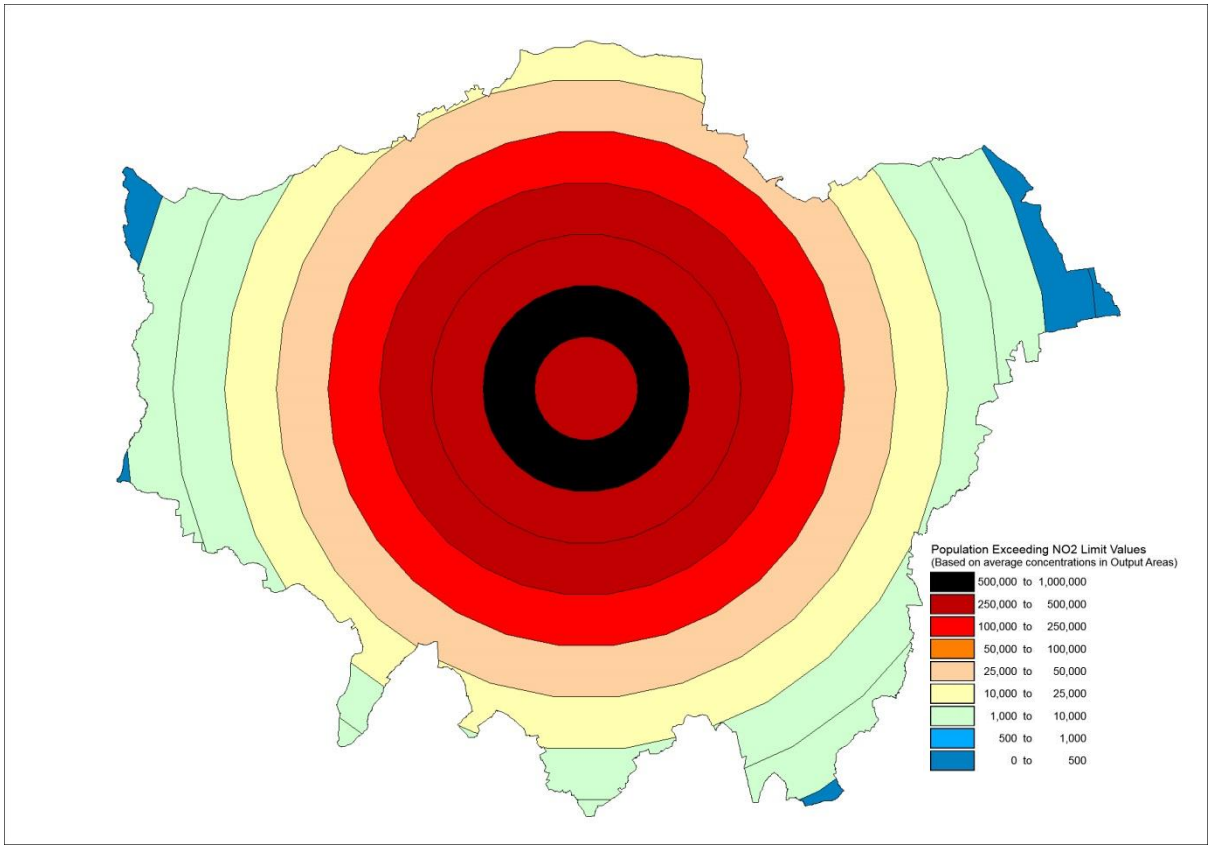


3.2 Areas of exceedence

Whilst air quality remains a problem London-wide, there are areas of the Capital where the problem is more pronounced than others. This is clearly illustrated in Figures 3 to 6 which are based on air quality modelling and population statistics.

Figure 7 shows the number of people living in areas exceeding legal limits in 2013. Whilst every area contains people who where they are exposed to levels exceeding legal limits for NO_2, this is again clearly more pronounced closer to central London. The central area contains fewer people living in an area exceeding legal limits than those living in the ring immediately surrounding it due to a lower absolute number of people living in the central area.

Figure 7: Population in areas of exceedence 2013



By 2020 the situation will have improved, in part due to the introduction of the central London ULEZ in April 2019. However, significant numbers will still be affected London-wide as seen in Figure 8. Of those people living in areas of exceedence, nearly 80 per cent will be within Inner London but outside the existing ULEZ area.

Figure 8: Population in areas of exceedence 2020 with no further action

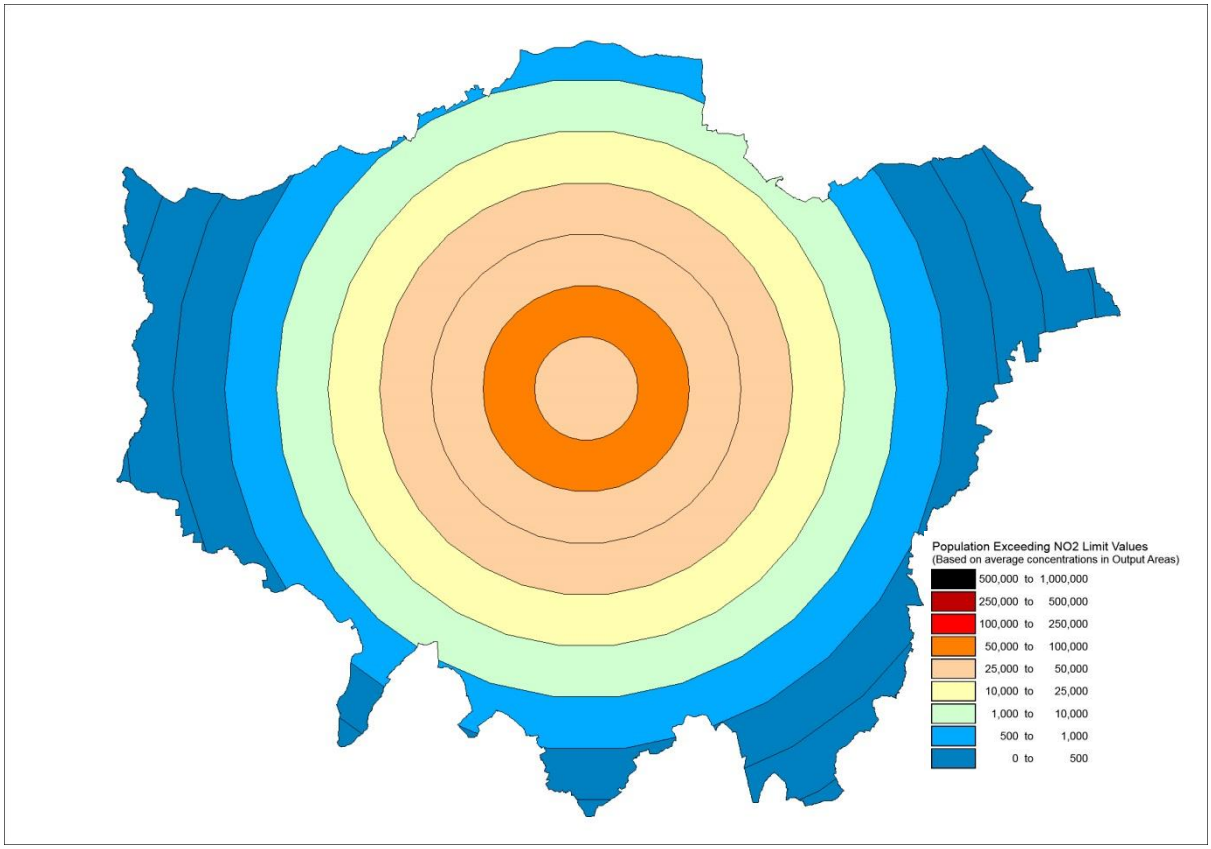


Table 4 shows the estimated percentage of the length of major roads exceeding legal limits in central, inner and outer London. Over 50 per cent of roads in central London are forecast to exceed the limit value for NO_2, even with the current plans for a central London ULEZ in place. About 40 per cent of major road lengths in inner London, and 20 per cent in outer London, are forecast to exceed limit values in 2020.

Table 4: Estimated percentage of road length exceeding legal limits with no further action

Area	% of road length exceeding limit values 2013	% of road length exceeding limit values 2020
Central	100	54
Inner	90	40
Outer	49	18

Figure 9: percentage of road length exceeding legal limits 2013

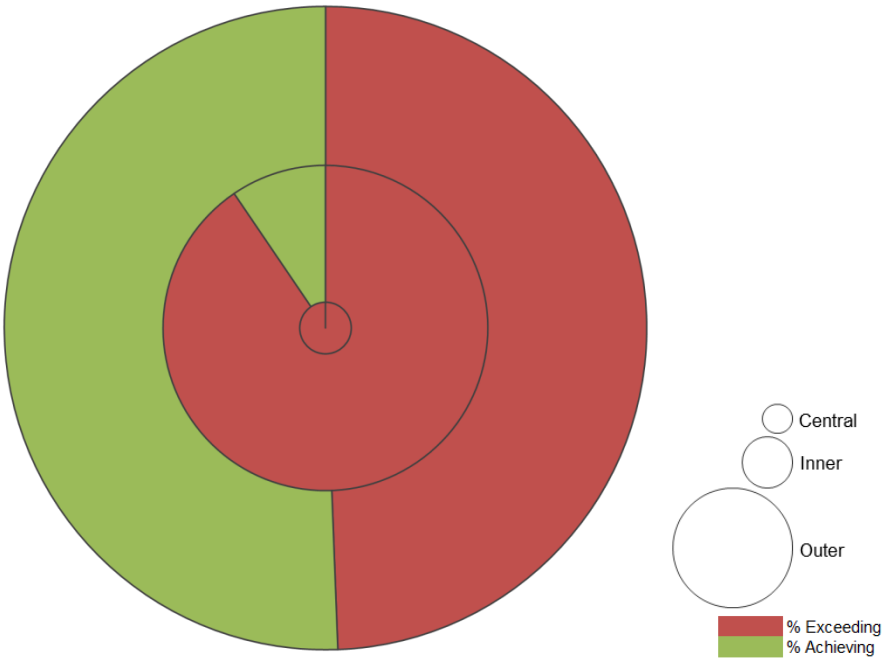


Figure 10: Percentage of road length exceeding legal limits 2020

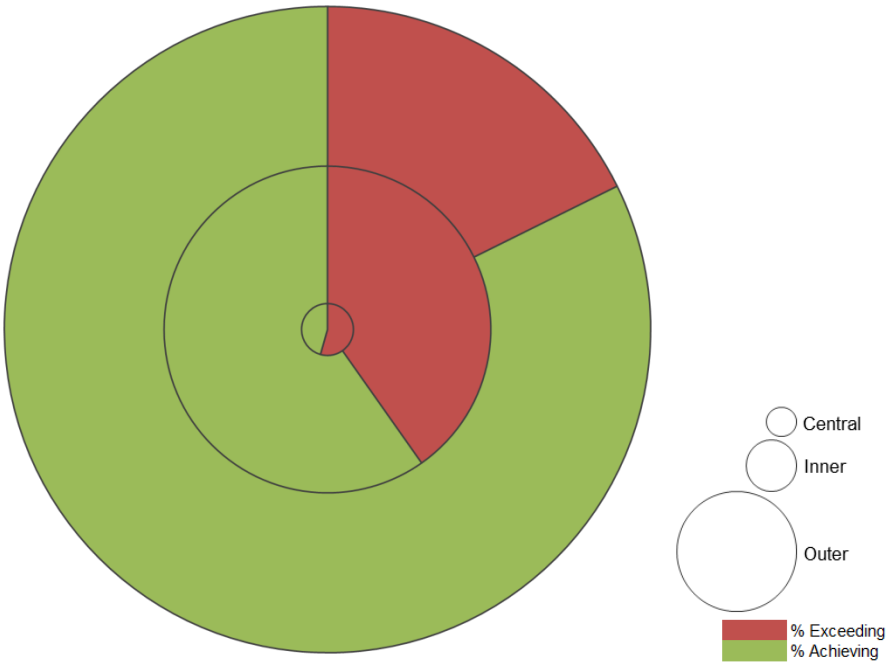


Table 5 shows the number of schools, care homes, hospitals and people living in areas exceeding legal NO_2 limits in 2020 on a zonal basis. Borough by borough figures are available in Appendix C.

Table 5: Population and sensitive receptors in areas of legal NO_2 exceedence 2020

Area	Estimated population	Population in areas of exceedence	% of population in areas of exceedence	No. of schools sites in areas of exceedence	No. of hospitals in areas of exceedence	No. of care homes in areas of exceedence
Central	209,700	23,600	11%	14	6	0
Inner	3,781,300	142,100	4%	47	3	17
Outer	5,080,200	18,500	<1%	4	0	2
London-wide	9,071,200	184,200	2%	65	9	19

What can clearly be seen from the above is that despite significant measures to improve air quality, such as the T-Charge, the cleaning of the bus fleet and the earlier implementation of the ULEZ, air quality will remain a significant London-wide challenge and further action is needed.

What is also clear is that even stronger action is required in inner London where the air quality problem will remain more severe, with nearly 150,000 people projected to be living in areas exceeding legal limits.

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 3b and follows on from the completed consultations listed 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 available 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 (T-Charge), and a non-statutory consultation on ideas for how the ULEZ could be improved. The results are available here: https://consultations.tfl.gov.uk/environment/air-quality-consultation-phase-2	COMPLETE
Stage 3a (4 April–25 June 2017): A statutory consultation on the proposals to introduce the ULEZ early in central London on 8 April 2019 and to strengthen the emissions standards to include particulate matter. The results are available here: https://consultations.tfl.gov.uk/environment/air-quality-consultation-phase-3a	COMPLETE
Stage 3b: (30 November 2017 – 28 February 2018) A statutory consultation on the proposal to expand the ULEZ boundary beyond central London.	THIS CONSULTATION

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 6. A more detailed report is available at http://data.london.gov.uk/dataset/clean-air-consultation-july-2016

Table 6: 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 (T-Charge) 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. However, it also included a policy consultation on changes to the ULEZ that has helped to inform this consultation. A detailed report on the results of the consultation is available at consultations.tfl.gov.uk/environment/air-quality-consultation-phase-2

A total of 15,480 responses were received from the public and businesses with 131 stakeholder responses. The consultation asked two specific questions on potential expansions of the ULEZ

Table 7: Summary of responses to the question Do you agree with the principle of extending the ULEZ to the North and South Circular Roads?

Response	**Count**	**%**
Yes	9,150	59%
No	5,297	34%
Don't know	422	3%
Not answered	611	4%
Total	15,480	100%

Table 8: Summary of the support for the principle of extending the ULEZ London Wide for heavy vehicles

Response	Count	%
Strongly support	9,198	60%
Support	1,960	13%
Neither support or oppose	693	4%
Oppose	700	4%
Strongly oppose	2,221	14%
Don't know	114	1%
Not answered	594	4%
Total	**15,480**	**100%**

The Emissions Surcharge was confirmed as a result of this consultation, and the ULEZ proposals were taken forward for further development in Stage 3a (for central London) and in this consultation. http://www.tfl.gov.uk/airquality-consultation

4.4 Stage 3a results

The Stage 3a consultation focused on the proposals for the ULEZ within the Congestion Charging zone. As a result of this consultation the Mayor confirmed that the ULEZ will begin in central London on 8 April 2019. A detailed report on the results of the consultation is available at consultations.tfl.gov.uk/environment/air-quality-consultation-phase-3a

Of particular relevance to this consultation was the question around the sunset period for residents in central London.

Table 9: Summary of the Stage 3a results for the question on the sunset period

Response	Count	%
Yes I support the revised proposals for the sunset period	4,980	28%
No – sunset period should be longer	3,397	19%
No – sunset period should be shorter	3,850	21%
There should be no sunset period	4,266	24%
Don't know	1,355	7%
Not answered	278	2%
Total	**18,126**	**100%**

4.5 Consultation on a Direct Vision Standard (DVS) for HGVs

Three years ago, we began engagement with the freight industry and its stakeholders 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.

Industry views have helped shape the proposals which now include plans for an HGV Safety Permit Scheme based on the DVS ratings, and industry-recognised safety systems to reduce road danger.

If approved, the proposals will require all HGVs over 12 tonnes to hold a safety permit to enter or operate in the Capital from 2020. Those rated ‘one star’ and above would automatically be granted a permit, while those rated ‘zero star’ (lowest) would have to install specific recognised safety systems, such as sensors and visual warnings and provide comprehensive driver training, before a permit is granted. The HGV Safety Permit Scheme would evolve over time, taking into account advances in technology.

The details of this ‘safe system’ have been included in the latest phase of the DVS consultation and the expertise of both industry experts and vulnerable road user representatives will continue to be an important part of developing the plans. Confirmed star ratings will subsequently be published.

It is proposed that from 2024 only those rated ‘three star’ and above, or which have an advanced safety system, would be allowed on London’s streets.

The DVS 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. Full details are available at tfl.gov.uk/direct-vision-standard

Part 2: The Proposals

The Mayor believes that far-reaching action is needed to address London's poor air quality, and while the currently approved ULEZ scheme in central London will make a valuable contribution, he thinks it can be significantly improved.

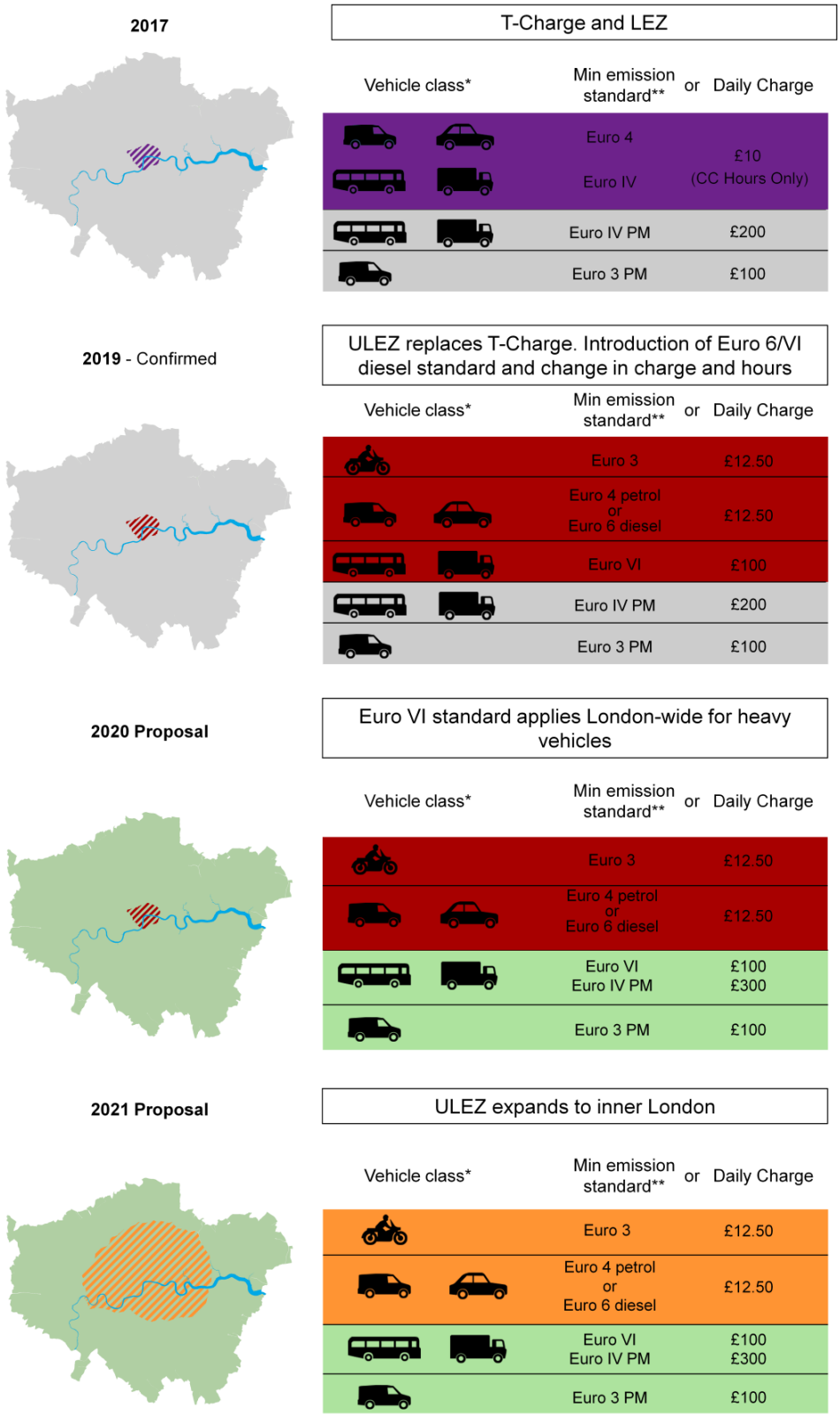
This section of the document puts forward the Mayor's current thinking on the future of the ULEZ and reflects on engagement with Londoners during the first three stages of the consultation.

Formal proposals for the future of the LEZ and ULEZ are being put forward at this stage:

- Introducing a Euro VI requirement (matching the current ULEZ standard) London-wide for heavy vehicles (HGVs, buses, coaches and other specialist vehicles) from 26 October 2020 through changes to the current London-wide LEZ
- Extending the ULEZ emission requirements from central London up to the North and South Circular Roads for light vehicles (cars, vans, minibuses, motorcycles and other light vehicles) from 25 October 2021 so that all vehicles entering inner London are subject to emissions controls from this date.

A summary of the proposals is provided in Figure 11. Full details of the proposals for each type of vehicle are provided later in this chapter.

Figure 11: Summary of proposals for the future of the LEZ and ULEZ



Note: In the hatched areas, standards indicated by both colours apply.

*Vehicle class is indicative only, additional vehicles are affected

**Minimum emissions standard is for NO_x and PM unless otherwise stated

Chapter 5: Expanding the ULEZ and Strengthening the LEZ

5.1 Background to the proposals

As set out in Section 3.1, further action is needed London-wide to improve air quality. Tackling emissions from road transport is a key component of this.

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 outlines the London-wide emissions sources of NO_2 (NO_x emissions).

Vehicle emissions are measured in terms of total NO_x, which is made up of NO and NO_2. NO_2 is the pollutant that has the impact on human health. However, the NO is subsequently converted into additional NO_2 by interaction with ozone in the atmosphere – this reaction being dependent on the availability of ozone.

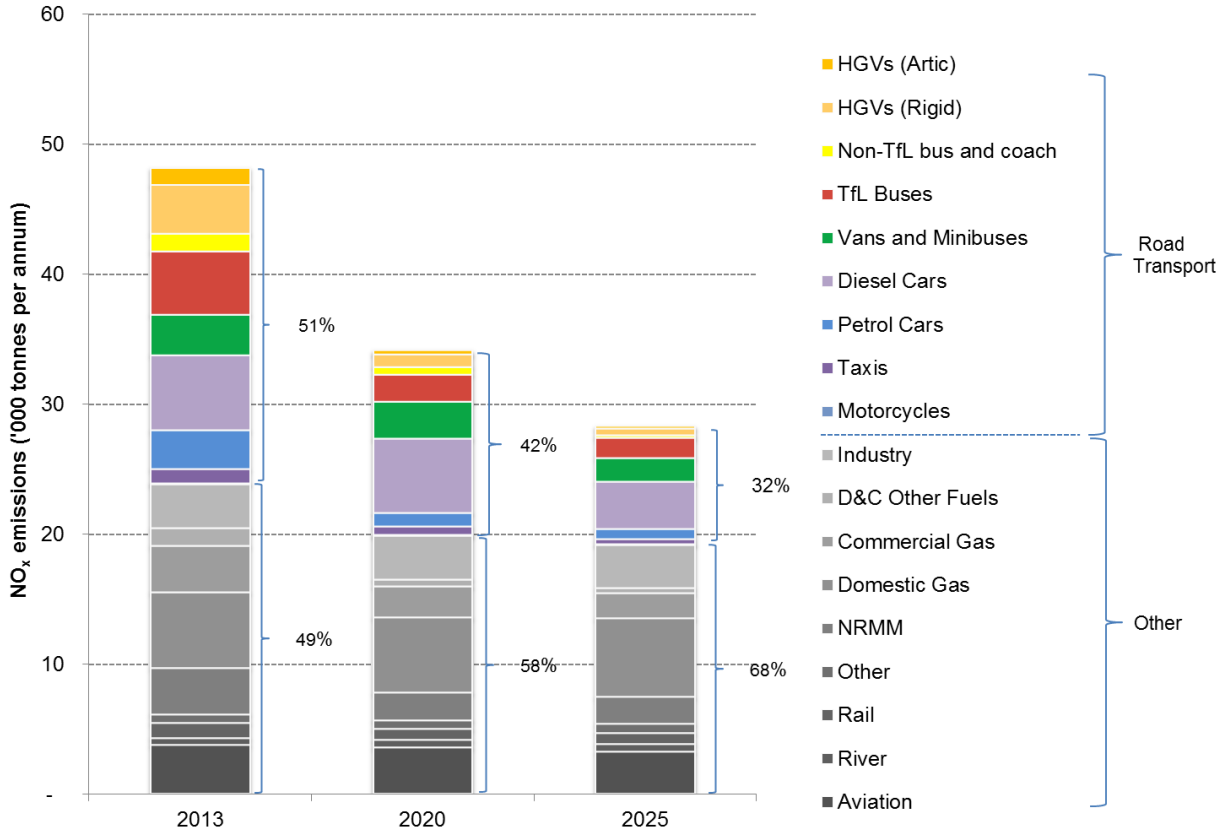
Vehicle emissions standards refer to total NO_x emissions but air quality limit values refer to ambient concentrations and are set for NO_2 and not NO_x (as NO_2 is the harmful component of NO_x. It is also important to note that diesel engines, by the nature of their design, produce higher engine NO_x emissions than petrol engines. In 2013, road transport was estimated to be responsible for 51 per cent of NO_x emissions in Greater London.

This is projected to fall to 42 per cent in 2020, and 32 per cent in 2025, although a greater proportion will still be observed by the roadside in local hotspots. Looking at the sources, it is clear that diesel vehicles generally emit a greater level of NO_x as size and engine capacity increases. The number of kilometres being driven is also a factor. Diesel cars and vans were estimated to contribute about 35 per cent of road transport NO_x emissions in 2013, and this is forecast to increase to about 60 per cent in 2020.

Our forecasts indicate that by 2020 diesel cars and vans will produce more than twice the NO_x emissions than TfL buses, HGVs and coaches combined mainly because their emissions have not been reducing as much as expected. As a result it is important we continue to tackle emissions across all vehicle categories.

NO_x emissions

Figure 12: NO_x sources in Greater London in 2013-2025 (LAEI 2013 update)[22]



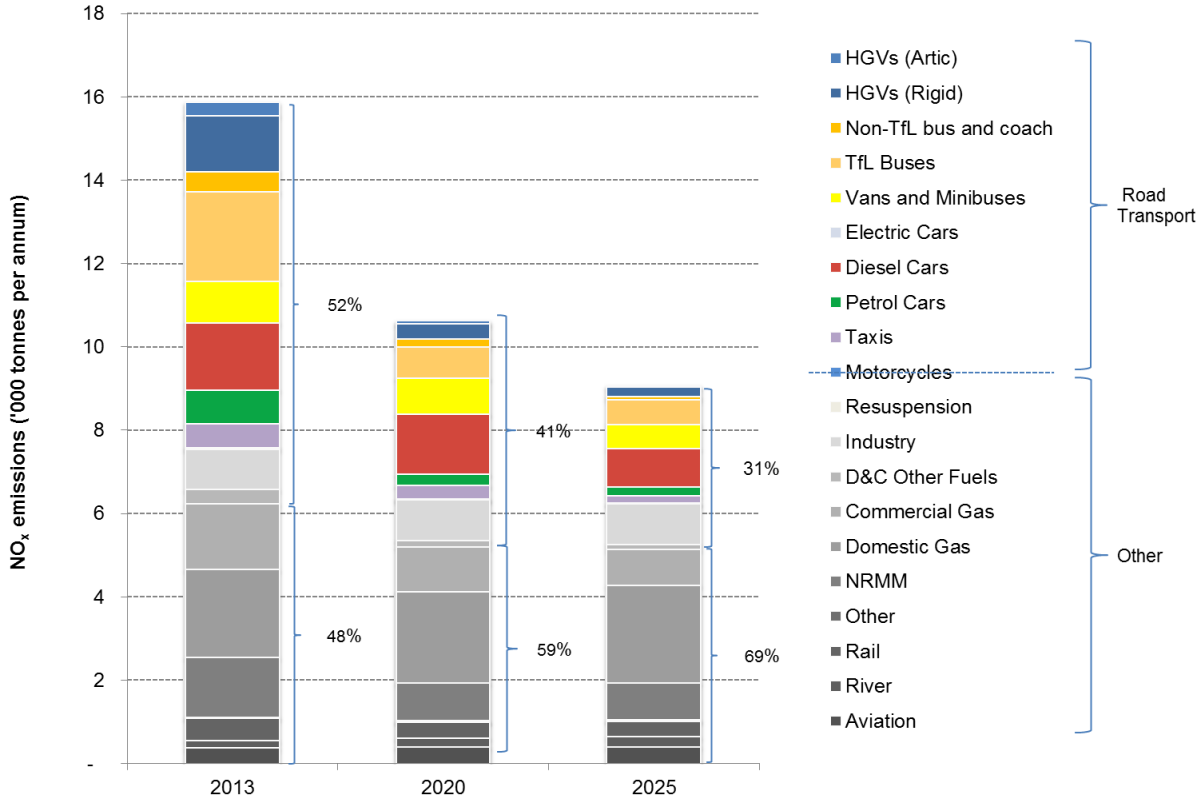
In inner London, road transport was responsible for 52 per cent of NO_x emissions in 2013. Largely owing to the impact of the ULEZ in central London, this is projected to fall to 41 per cent by 2020.

[22] NRMM stands for non-road mobile machinery (eg cranes and diggers).

D&C stands for Domestic and Commercial

The charts may not total 100 per cent due to rounding.

Figure 13: NO_x sources in inner London in 2013-2025 (LAEI 2013 update) [22]



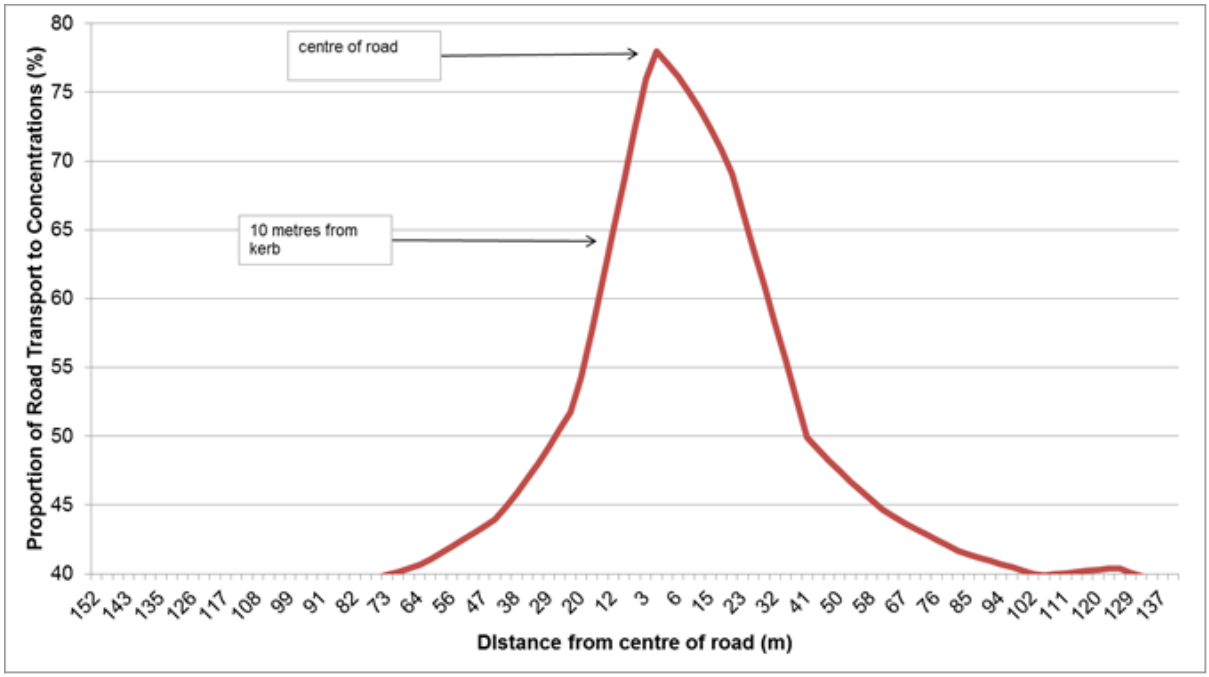
Pollution levels across London vary significantly generally being lowest at background locations and highest at roadside locations due to the effects of dispersion and meteorological conditions. Whilst road transport emissions are forecast to contribute about 41 per cent of NO_x emissions in Inner London in 2020, their contribution to concentrations at the roadside is much greater because the emissions disperse at greater distances from roads due to wind and atmospheric conditions, layout and buildings, and mixing with other sources. As you move closer to the roadside, the contribution from road transport sources increases – this is shown in the figure below which is based on analysis of predicted concentrations and emissions distribution on the north-circular at Swiss Cottage.

It can be seen that effects of dispersion and distance from sources mean that as an average across the area, road transport contributes to about 50 per cent of the concentrations, non-London sources being about 13 per cent, and other local sources making up the remaining 35 per cent. However, as you move closer to the edge of road, where concentrations tend to be highest, the contribution of road transport to pollution concentration increases to about 70 to 75 per cent. This means that the most effective way to have the biggest impact on our highest roadside concentrations is to reduce the emissions from road transport NO_x.

Analysis of the emission on road links in this area also show that all vehicle types contribute to the road transport emissions, with heavy vehicles contributing about 35 per cent, with diesel cars and vans contributing about 55 per cent of the emissions.

Whilst the patterns of concentrations and contribution from different vehicles types will vary across different roads in London, it is essential that we reduce emissions from all road transport in order to reduce pollution levels.

Figure 14: Contribution of road transport to NO_2 concentrations by distance from road



PM_{10} emissions

In 2013, road transport was estimated to be responsible for half of all PM_{10} emissions in London, and is projected to stay at 50 per cent in 2020 and fall to 48 per cent in 2025. This is down to some reductions in non-transport sources, especially in non-road mobile machinery (NRMM).[23] There is no decrease in emissions from vehicle tyre and brake wear (owing to the lack of a technical standard for these emissions). It also assumes some corresponding growth in traffic. Overall, PM_{10} emissions in London are projected to reduce by 13 per cent in 2020 and by 16 per cent in 2025, when compared to 2013.

Further action will be needed to tackle tyre and brake wear in the long term. In addition, for older diesel vehicles, exhaust PM is a significant issue that needs addressing to help reduce overall PM emissions.

[23]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

Figure 15: PM_{10} sources in Greater London 2013–2025 (LAEI 2013 update) [22]

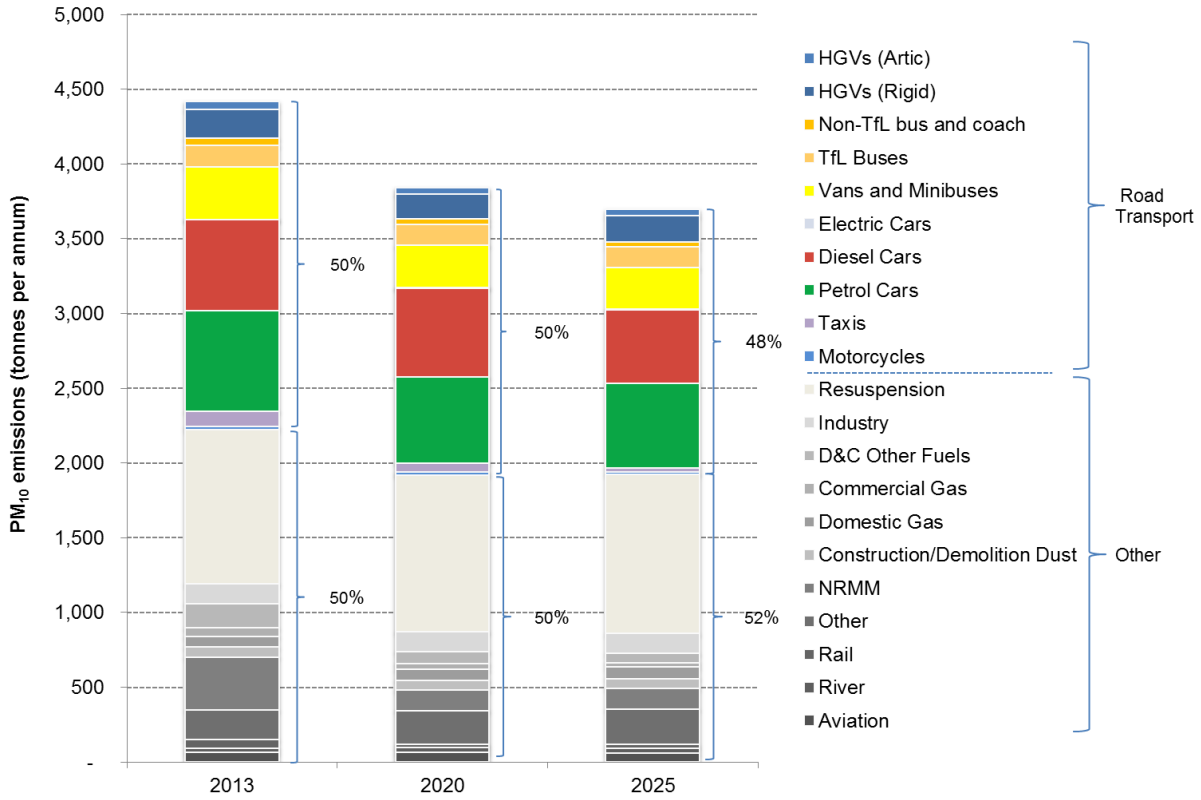
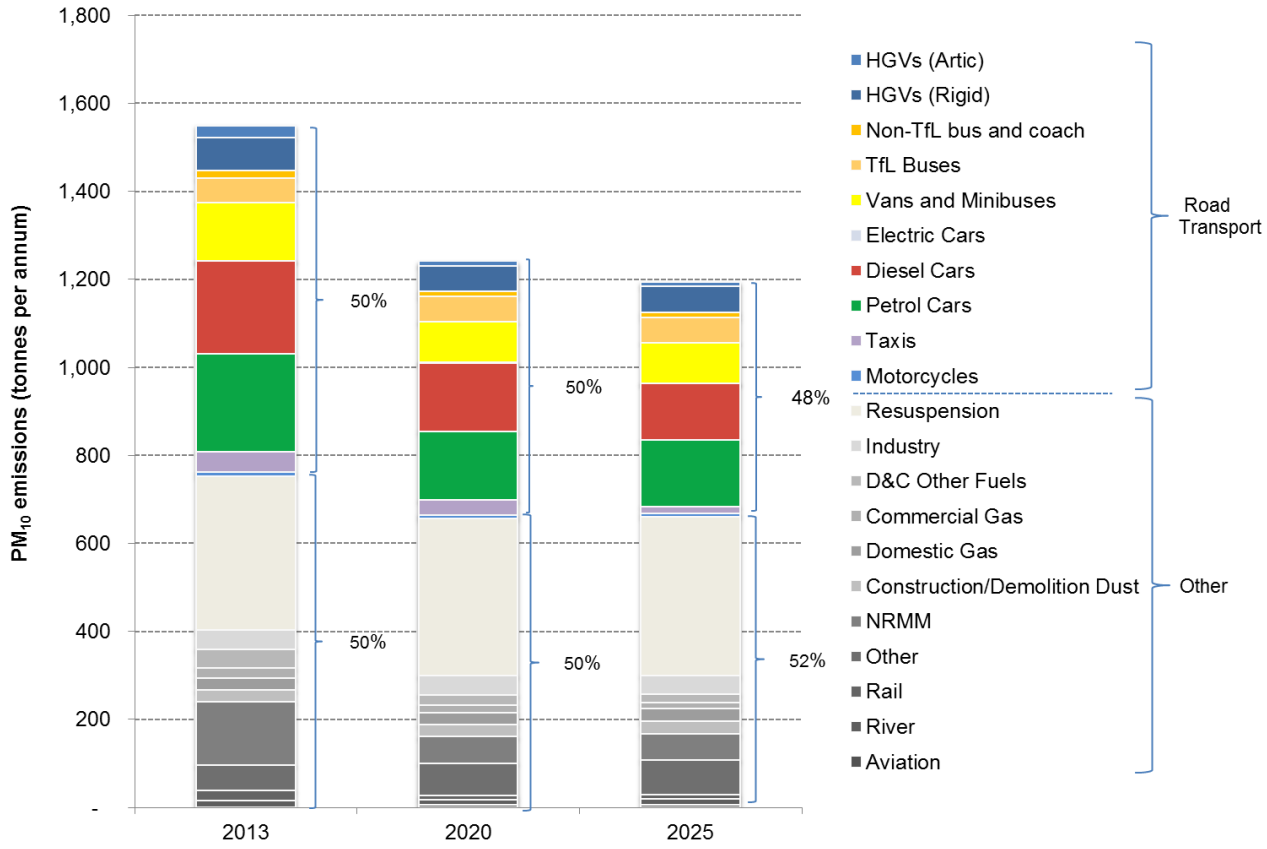


Figure 16: PM_{10} sources in inner London 2013–2025 (LAEI 2013 update)



$PM_{2.5}$ emissions

In 2013, more than 54 per cent of the Capital's $PM_{2.5}$ emissions were from road transport, with emissions from cars and vans contributing around 75 per cent 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 the implementation of planning policies to reduce these emissions across London.

In Greater London in 2020 and 2025, cars are predicted to make up over 60 per cent of road transport related $PM_{2.5}$ emissions, with cars and vans still estimated to be contributing about 75 per cent of road transport 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 around 60 per cent of road transport $PM_{2.5}$ emissions by 2020 and 2025.

In inner London, over 55 per cent of $PM_{2.5}$ emissions were from road transport in 2013. This is predicted to fall to around 50 per cent by 2020 and 2025. Cars and vans are predicted to contribute around 70 per cent of Inner London's road transport $PM_{2.5}$ emissions.

5.2 Proposals for HGVs, coaches and buses

Summary

These vehicles are currently subject to the LEZ as described in Section 2.2 and in addition these vehicle types will be subject to the ULEZ in central London from April 2019.

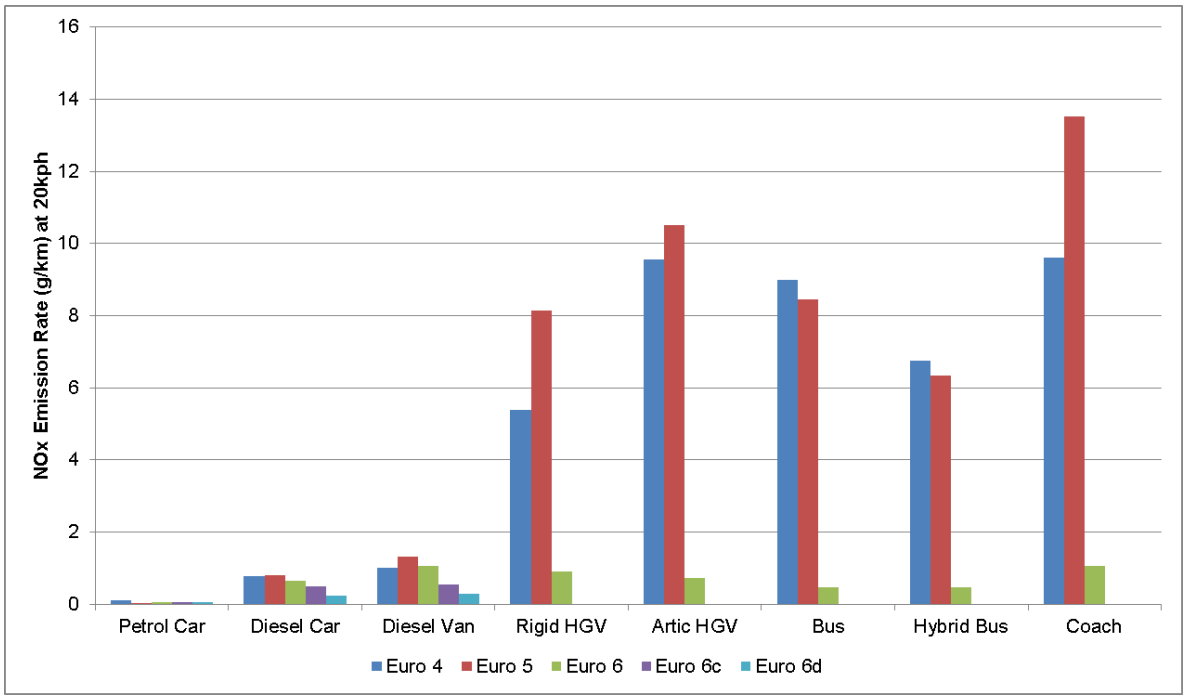
The Mayor is considering options for tightening the requirements for these vehicles (ie heavy vehicles) by introducing a new tier of emissions standards to the London-wide LEZ scheme. This would require them to meet Euro VI emission standards or pay a daily charge.

A strengthening of the LEZ standards for heavy vehicles is being considered because they are, on average, the most polluting vehicles. As shown in Figure 17 they also provide the greatest potential emissions savings, with Euro VI vehicles showing reductions of up to 90 per cent of NO_x when compared to the equivalent Euro V vehicles.

In addition, unlike in central London, the locations of high pollution in outer London mostly occur along the main roads. This is where most heavy vehicle kilometres are driven, and where there are a higher proportion of these vehicles.

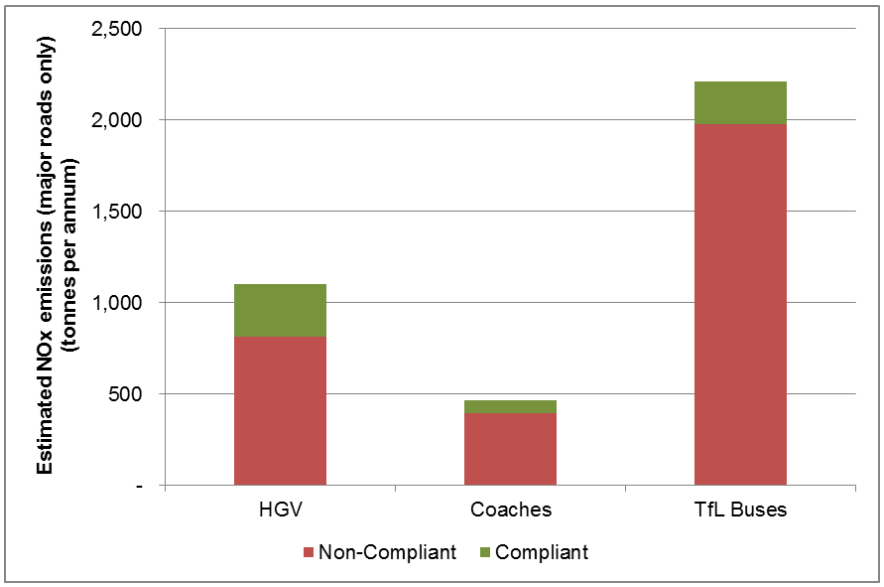
Tackling pollution from heavy vehicles before cars and vans is also in line with the government's Clean Air Zone framework.

Figure 17: NO_x emissions rate at 20kph Euro 4 – 6 (TfL analysis based on Copert 5)



Amongst heavy vehicles, there is also a significant and disproportionate emissions impact of non-compliant vehicles vs compliant vehicles. Pre-Euro VI heavy vehicles are expected to make up 28 per cent of the fleet in 2020 but contribute about 85 per cent of the emissions London-wide and therefore setting tougher standards will help to reduce emissions from heavy vehicles significantly.

Figure 18: Emissions split by compliant and non-compliant heavy vehicles 2020



Number of affected vehicles

We estimate that on average, 3,800 heavy vehicles entering London per day would not be compliant with the standards. This is based on an assumption that the ULEZ is only operational in central London in 2020.

Table 10: Numbers of affected heavy vehicles in 2020

	Number of vehicles on an average day	Estimated non-compliance rate in 2020 (baseline)	Non-compliant number (average day)
HGVs	17,000	20%	3,000
Non-TfL buses and coaches	3,500	36%	800

Cost of compliance

There is huge variation within the vehicle type categories, but to give an indication, we estimate that the average cost of a compliant vehicle would be:

- £30,000 for HGVs
- £100,000 for coaches

The cost of retrofitting vehicles to meet the Euro VI standard and achieve compliance is estimated to be approximately £20,000.

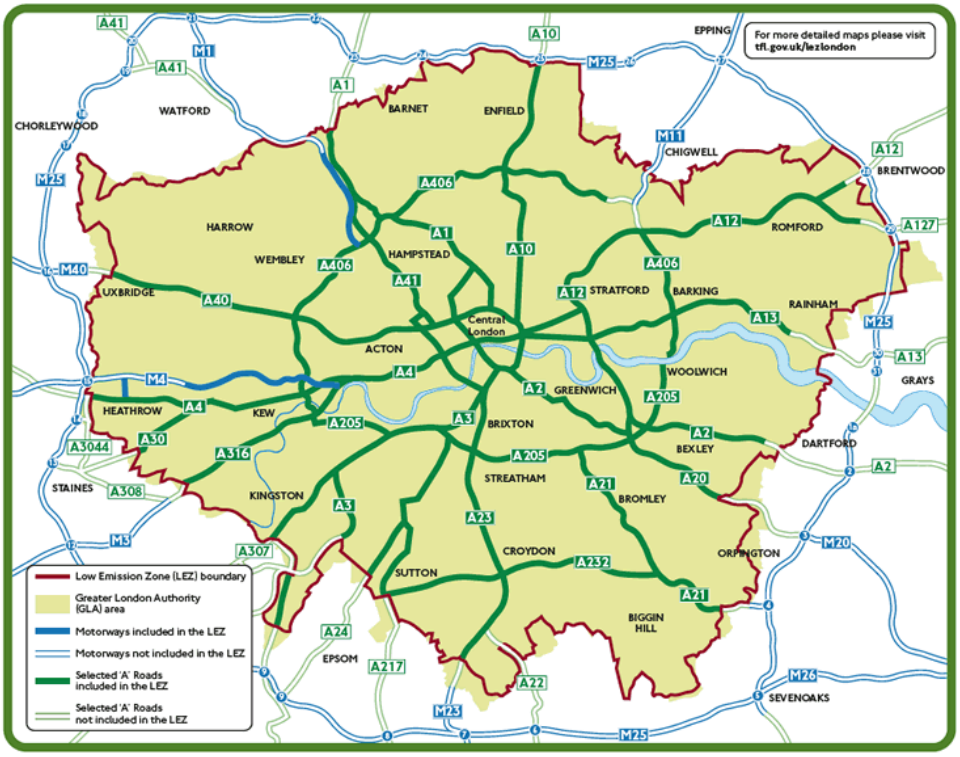
Date of implementation

It is proposed that the LEZ standards for heavy vehicles will change on 26 October 2020. This date has been chosen to give vehicle operators sufficient notice to retrofit or replace vehicles and to give TfL sufficient time to upgrade the operational systems required to effectively manage the scheme. By this time compliant vehicles will have been available for 6 years, ensuring a viable second-hand market.

Boundary

The current LEZ boundary is well-established and has infrastructure and systems in place to operate the scheme.

Figure 19: LEZ boundary



The LEZ boundary was carefully designed to ensure that as much of the Greater London Authority administrative area as possible was covered whilst still enabling diversions to take place to avoid entering the zone. There are no proposals to alter this boundary at present.

Alternative heavy vehicle option considered

An option to expand the ULEZ Euro VI emission standard for heavy vehicles only up to the North and South Circular Roads (as opposed to London-wide) was suggested by some stakeholders in the Stage 2 and 3a consultations. However, such an option would have lower emissions benefits in outer London and cause potential confusion for operators of heavy vehicles as to which standards apply where, given the existing London-wide LEZ standards.

As outlined in Section 3, without further action London-wide there will be areas of outer London that still exceed legal limits for concentrations of NO_2 in 2020.

Emissions standards

The existing LEZ sets a standard that all HGVs, buses, and coaches and other specialist heavy vehicles need to meet a Euro IV standard for PM and that all TfL buses need to meet a Euro IV standard for PM and NO_x.

We are proposing that a Euro VI standard for NO_x and PM is introduced for buses (including TfL buses), coaches, HGVs and other specialist vehicles. This is the same standard that will be introduced in the central London ULEZ.

Table 11 shows the vehicle classes that are defined as heavy vehicles and would be required to meet the new Euro VI standard for NO_x and PM.

Table 11: Vehicles defined as 'heavy'

Vehicle type	Weight
• Lorries • Motor caravans • Motorised horseboxes • Breakdown and recovery vehicles • Snow ploughs • Gritters • Refuse collection vehicles • Road sweepers • Concrete mixers • Fire engines • Tippers • Removal lorries • Other specialist vehicles	More than 3.5 tonnes gross vehicle weight
• Buses • Coaches (with 8+ passenger seats)	More than 5 tonnes gross vehicle weight

Charge level

Any vehicle that does not meet the Euro IV PM standard when driving in the central London ULEZ from 2019 will incur both a LEZ and ULEZ charge, totalling £300. This was agreed during the 2015 consultation on the introduction of the ULEZ.

From 2020 we are proposing that for heavy vehicles, this will be replaced with an appropriate London-wide LEZ charge.

The revised charge levels for the LEZ would be as shown in Table 12

Table 12: Proposed London-wide LEZ charges from 26 October 2020

Vehicle type	Charge
Heavy Vehicle whose PM emissions are higher than Euro IV PM standards	£300
Heavy Vehicle that does not meet Euro VI NO_x and/or PM standards but meets Euro IV PM standards.	£100

These charge levels have been chosen at a deterrent level. The Euro IV PM charge was set at £200 in 2007 following consultation.

The new £300 rate includes the additional £100 charge for not meeting the Euro VI standard London-wide.

If paid, the charge will enable a vehicle to travel in the London wide LEZ on a specified date. There will be no additional charge for heavy vehicles to enter the ULEZ in inner London as the new tighter LEZ standards are identical to the existing central London ULEZ standards.

Penalty charges for heavy vehicles

If a vehicle does not meet the LEZ emissions standards and the daily 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 other penalties received.

For heavy vehicles we are proposing the penalty charges are as follows.

Table 13: Proposed PCN amounts for the LEZ from 26 October 2020

Vehicle type	Penalty Charge	Penalty Charge if paid within 14 days
Heavy vehicle that exceeds Euro IV standard PM emissions	£2,000	£1,000
Heavy vehicle that exceeds Euro VI standard NO_x and PM emissions but meets Euro IV PM standard	£1,000	£500

Discounts and exemptions for these vehicle types

We are proposing limited discounts and exemptions for the scheme, in line with previously agreed discounts and exemptions for the ULEZ. The following heavy vehicles would automatically be exempt from the scheme:

- **Specialist vehicles designed and built for mainly off-road use** including agricultural and forestry tractors, mowing machines, agricultural and farm machinery and equipment, mobile cranes and road and building construction machinery. These vehicles have engines that do not use the Euro standards and it is therefore not possible for them to meet a Euro VI standard. To reduce emissions from these vehicle types the GLA has introduced a Non-Road Mobile Machinery (NRMM) Low Emission Zone, that mandates the use of machines that meet appropriate emissions standards as a planning condition
- **Vehicles with a historic tax class and Vehicles registered before 1 January 1973**: We recognise that these vehicles are highly specialist, limited in numbers and are unable to retrofit without significant alterations to the character of the vehicles
- **Military vehicles operated by the Ministry of Defence (MoD) and visiting forces:** Military vehicles are legally prevented from being subject to road user charges. Vehicles being used on a road for naval, military or air force purposes under the instruction of the armed forces or MoD will be exempt. Civilian vehicles (known as 'white fleet' vehicles) operated by the MoD and used for other purposes (eg staff cars) will not be exempt and will need to

comply with the emissions standards or pay a daily charge in order to enter the ULEZ

- **Showman's vehicles:** Some specially modified or constructed showman's vehicles are eligible for a 100 per cent discount. This was agreed in 2007 during the consultation to introduce the LEZ. There are a series of strict criteria that need to be met in order to prove that these vehicles are eligible for a discount
- **Heavy duty emergency services vehicles:** London's emergency services are showing leadership in cleaning up their fleets and are determined to take bold steps towards becoming cleaner and greener, rather than asking for a blanket exemption. In line with Government guidance, the Mayor supports some flexibility and recognises, unlike for most fleets, it is not always possible to predict when emergency vehicles will be required. Therefore, the Mayor intends to work closely with each service on a specific memorandum of understanding that will outline how they intend to comply with the ULEZ, taking into account their unique circumstances. It is expected that the arrangements will be time limited akin to the sunset period offered to residents and disabled vehicles and will apply to specialist and emergency response vehicles. However, all general purpose vehicles and most vehicles stationed in the zone will be expected to comply by the start of the scheme.

5.3 Proposals for TfL buses

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 inner London, they were responsible for 18 per cent of total NO_x and 35 per cent of road transport NO_x. All TfL buses in Greater London currently meet a minimum Euro IV standard for NO_x and PM and in many instances, they exceed this.

We are proposing that TfL buses will be required to meet the same emissions standards as other heavy vehicles. There will be no exemptions for TfL buses. Unlike other vehicles, TfL buses will not have the option to pay the charge and will be contractually required to meet the emissions standards by the appropriate date.

In addition, all double-decker buses operating in the Congestion Charging zone will be hybrid electric vehicles and all single-decker buses in the zone will emit nothing from their engine exhaust (eg they will be full electric or hydrogen models).

The Mayor has asked us to introduce further improvements to reduce emissions from buses. This includes:

- Ensuring all of our buses operating in the Congestion Charging zone are compliant with the ULEZ Euro VI emissions standard by 2019 and a further commitment that our double-decker buses operating in the area will be hybrid
- All single-decker buses in the Congestion Charging zone will emit nothing from their engine exhaust (eg they will be full electric or hydrogen models) by 2020.
- Implementing up to 12 Low Emission Bus Zones across London to tackle the worst pollution hotspots by concentrating cleaner buses on the dirtiest routes.

The first zones will be delivered in Putney High Street and Brixton/Streatham from 2017

- Purchasing only hybrid or zero emission double-decker buses from 2018
- Working towards London's entire bus fleet being zero emission by 2037 at the very latest

5.4 Proposals for cars and car derived vans

Summary

Whilst there are significant benefits to be gained from the proposals for heavy vehicles, alone they are not sufficient to tackle London's air quality problems. Further action is needed. On an individual basis light vehicles are less polluting; however they make up a far greater percentage of traffic within inner London and so contribute overall to a greater proportion of emissions as indicated in Section 5.1. We are proposing that from 25 October 2021, all cars will need to meet emissions standards of Euro 4 for petrol or Euro 6 for diesel or pay a daily charge of £12.50 when driving in the area approximately bounded by the North and South Circular Roads ('inner London').

Numbers of affected vehicles

We estimate that in 2021, on an average day, there would be approximately 100,000 cars that do not meet the emissions standards required to enter the expanded ULEZ zone. Drivers of these vehicles will need to upgrade to a compliant vehicle, use alternative modes of transport (for example public transport), forego the journey or pay the daily ULEZ charge. With the ULEZ proposals in place we would expect this number to reduce. Please see section 6.1 for a discussion of this.

Table 14: Number of affected cars in 2021

	Number of vehicles on an average day	Estimated non-compliance rate in 2021 (if there is no ULEZ in inner London)	Number of non-compliant vehicles (on an average day)
Car	540,000	19%	100,000

Cost of Compliance

Based on the age of the oldest compliant vehicles in 2021, we estimate the average cost of upgrading to a compliant vehicle will be:

- £1,000 for a compliant petrol car
- £5,700 for a compliant diesel car

Emissions standards

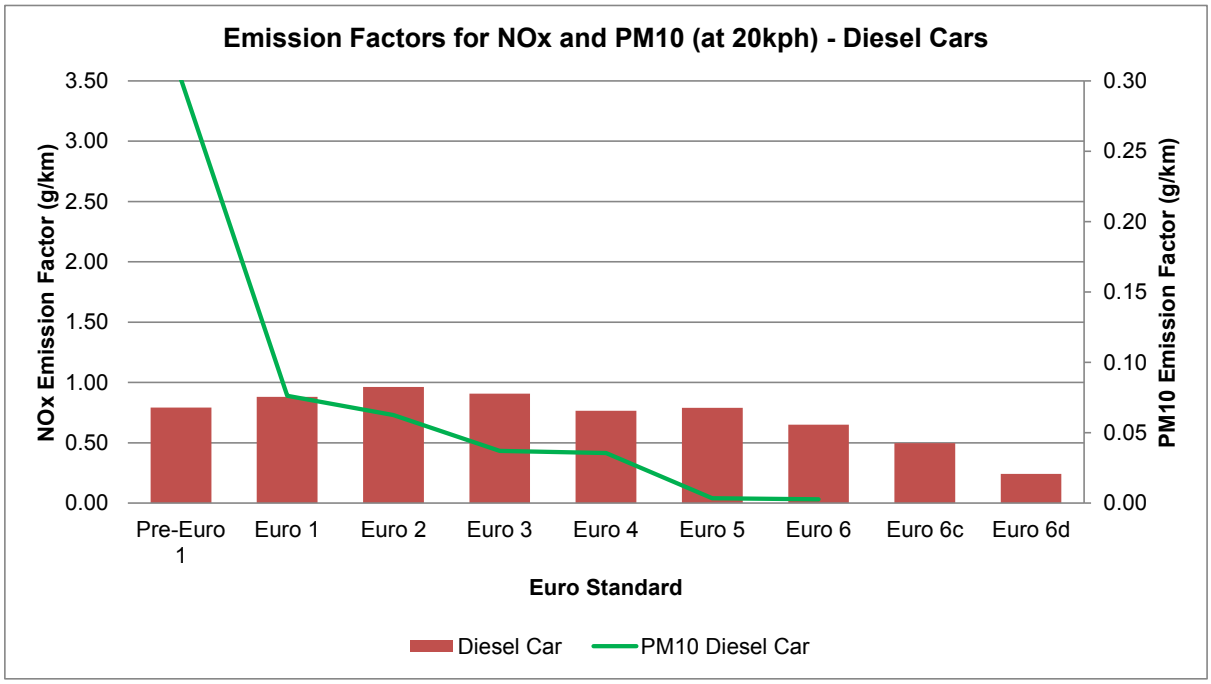
From April 2019, cars, vans and motorcycles will be subject to the ULEZ in central London as set out in Section 2.1. The Mayor is proposing an expansion of the ULEZ across a wider area, broadly speaking up to the North and South Circular Roads. Emissions standards for the central London ULEZ (see Table 2 on page 12) would therefore be extended to this wider area:

- Euro 4 (NO_x) for petrol vehicles
- Euro 6 (NO_x and PM) for diesel vehicles

The difference in standards is due to the fact that the legal emissions limit for Euro 6 diesel NO_x is equivalent to that of Euro 4 petrol NO_x. There is no PM standard for Euro 4 petrol vehicles, which is why only a NO_x standard applies.

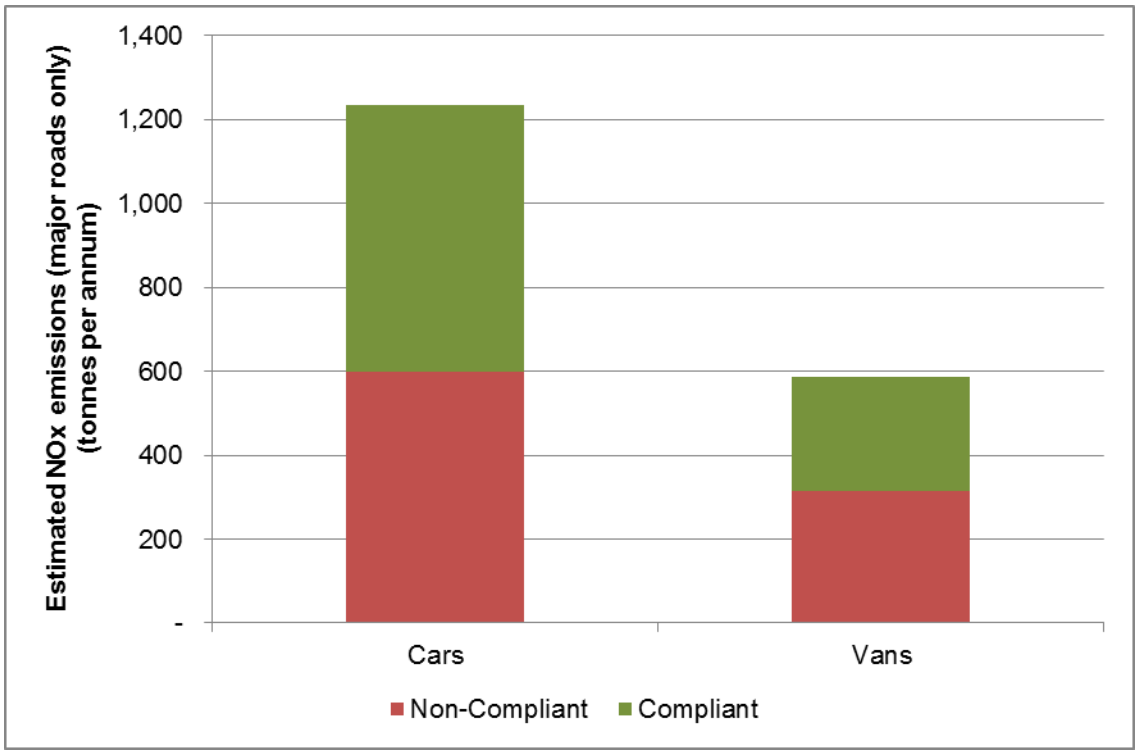
The real world performance (ie the emissions emitted during 'real world' driving as opposed to the emissions produced during laboratory testing) of diesel vehicles has come under significant scrutiny in recent years. However, whilst early Euro 6 diesel vehicles do currently have higher emissions under real world driving conditions, the introduction of real world testing as part of later phases of the Euro 6 standard (see Appendix A for further information) is expected to further reduce diesel emissions. This is set out in Figure 20. However, significant reductions in PM_{10} exhaust emissions have already been successfully brought about through the introduction of the Euro standards.

Figure 20: Emissions factors for NO_x and PM_{10} diesel cars (Tfl analysis based on Copert5)



Emissions from non-compliant cars and vans are estimated to make up 22 per cent of the fleet but around 50 per cent of NO_x emissions from these vehicle types in inner London, and 29 per cent of the fleet but about 56 per cent of emissions London-wide in 2021..

Figure 21: Emissions of compliant and non-compliant cars and vans in inner London 2021



Date of implementation

We are proposing a date of 25 October 2021 to implement the ULEZ expansion up to the North and South Circular Roads.

The start date in 2021 acknowledges the technical challenges in delivering an expanded ULEZ and provides TfL with adequate time to develop the infrastructure and systems required to operate the scheme.

By 2021, a 16-year old petrol car and a six-year old diesel car will be compliant with the ULEZ standards.

Charge level

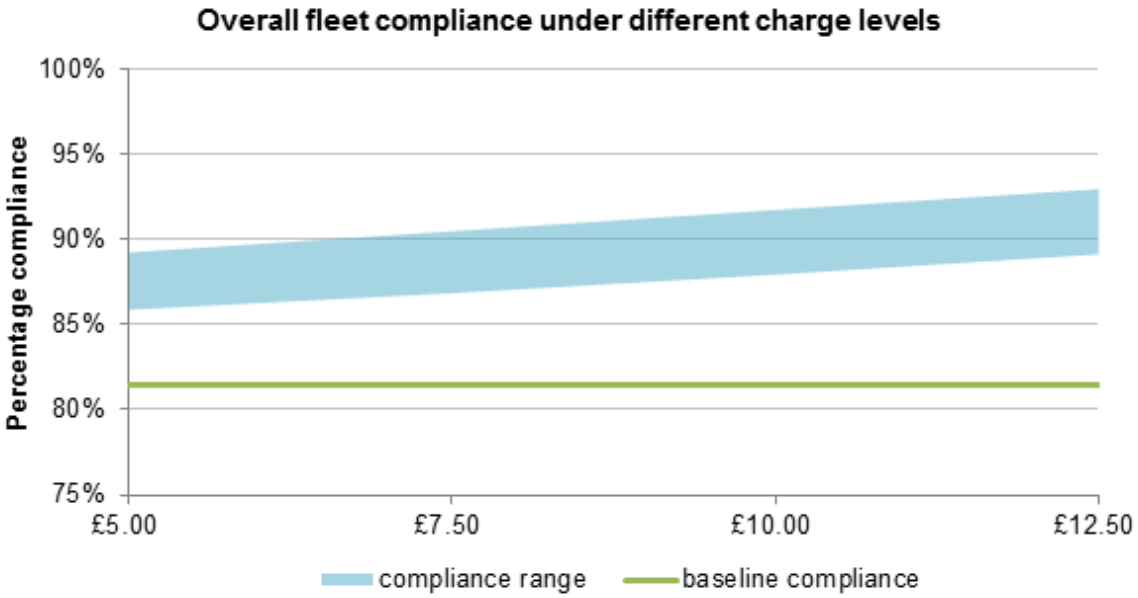
A range of charges was considered and a question about the charge level was asked during the Stage 2 consultation.

Table 15: Stage 2 consultation responses to the question on the charge level

Response	Count	%
The daily charge should be the same for light vehicles at £12.50	6,174	40%
The daily charge should be lower than £12.50 for light vehicles	3,559	23%
I do not support the expansion of the ULEZ	5,131	33%
Not answered	616	4%
Total	15,480	100%

The behavioural response to a range of charges for car drivers was modelled using stated preference survey data. At the lower range of charges there was a significantly lower range of expected compliance with the standards as a larger proportion of drivers would opt to stay and pay the charge.

Figure 22: Estimated rate of compliance with the standards at various charge levels



It was felt that for clarity and simplicity, and to maximise the emissions impact, that the charge should be £12.50, in line with that of the central ULEZ.

Penalty charges

If a vehicle does not meet the ULEZ emissions standards and the daily 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.

The ULEZ PCN for light vehicles is currently set at £130 in line with the PCN for non-payment of the Congestion Charge (CC) and other moving traffic violations on the Transport for London Road Network (TLRN). We recently consulted on proposals to increase the CC and TLRN PCN level from £130 to £160. Whilst no decision has been taken yet, we are consulting on increasing the ULEZ PCN level for light vehicles, in order to maintain a deterrent effect and to ensure consistency if the decision is made to increase the CC and TLRN PCN.

Discounts and exemptions for these vehicle types

Expanded zone residents

In light of the pressing need to take urgent action to reduce air pollution, we are not proposing any discount, exemption or sunset period for residents. Residents will need to comply with the emissions standards or pay a daily charge in order to drive their vehicles in the zone. The proposed 2021 start date of the expanded ULEZ means that should the decision to expand the ULEZ be made, residents would have three years notice to change their vehicles. By 2021, a 16 year old petrol vehicle and

a 6 year old diesel vehicle will be compliant with the minimum emissions standards, providing an affordable second hand option.

TfL's transport models suggest that around 50 to 60 per cent of the car trips in Inner London are made by residents and we saw from the stated preference survey results that residents were more likely to upgrade to a compliant vehicle than non-residents. Applying a discount, exemption or sunset period for residents would greatly reduce the emissions benefits of the scheme.

Congestion Charging zone (CCZ) residents

Residents of the CCZ are currently entitled to a three-year sunset period for the ULEZ, expiring on 10 April 2022. In order to ensure that all residents living in the extended ULEZ area are treated the same, we are proposing to bring forward the end date of the CCZ residents' sunset period to 24 October 2021, to align with the start date of the expanded ULEZ.

This would mean that from 25 October 2021, all residents living and driving in the area up to the North and South Circular Roads would be required to meet emissions standards or pay a daily charge

Other sunset periods

Disabled and disabled tax class vehicles currently have a sunset period until September 2023, after which time they will need to comply with the emissions standards or pay a daily charge to drive in the ULEZ. We are proposing to maintain this sunset period for these vehicle types.

Emergency services vehicles

London's emergency services are showing leadership in cleaning up their fleets and are determined to take bold steps towards becoming cleaner and greener, rather than asking for a blanket exemption. In line with Government guidance, the Mayor supports some flexibility and recognises, unlike for most fleets, it is not always possible to predict when emergency vehicles will be required. Therefore, the Mayor intends to work closely with each service on a specific memorandum of understanding that will outline how they intend to comply with the ULEZ, taking into account their unique circumstances. It is expected that the arrangements will be time limited akin to the sunset period offered to residents and disabled vehicles and will apply to specialist and emergency response vehicles. However, all general purpose vehicles and most vehicles stationed in the zone will be expected to comply by the start of the scheme.

5.5 Proposals for larger vans, minibuses and similar vehicles

Summary

We are proposing that from 25 October 2021, vans, minibuses and similar vehicles will need to meet Euro 6 emissions standards or pay a daily charge of £12.50 to drive in the area up to the North and South Circular Roads. This would be in addition to any applicable Congestion Charge and LEZ charges.

Numbers of affected vehicles

We estimate that on an average day, approximately 35,000 vans entering the area up to the North and South Circular Roads would not be compliant with the Euro 6 standard. Drivers of these vehicles would need to pay the ULEZ charge, upgrade to a compliant vehicle, use an alternative transport mode or forego the trip. With the ULEZ proposals in place we would expect this number to reduce. Please see Section 6.1 for a discussion of this.

Table 16: Number of affected vans in 2021

	Number of vehicles on an average day	Estimated non-compliance rate in 2021 (without a ULEZ scheme in inner London)	Number of non-compliant vehicles (on an average day)
Larger Van	100,000	35%	35,000

Cost of Compliance

Based on the age of the oldest compliant vehicles in 2021 we estimate the average cost of buying a compliant larger van will be £13,500.

Emissions standards and the boundary

We are proposing that these vehicles would need to meet a Euro 6 emissions standard within the expanded ULEZ. The Euro 6 standard would apply in the area up to the North and South Circular Roads (the same boundary as for cars set out in Section 5.9).

The existing London-wide LEZ sets a Euro 3 PM emission standard for large diesel vans. We are proposing that this standard is maintained. This affects the following vehicle types, as shown in Table 17.

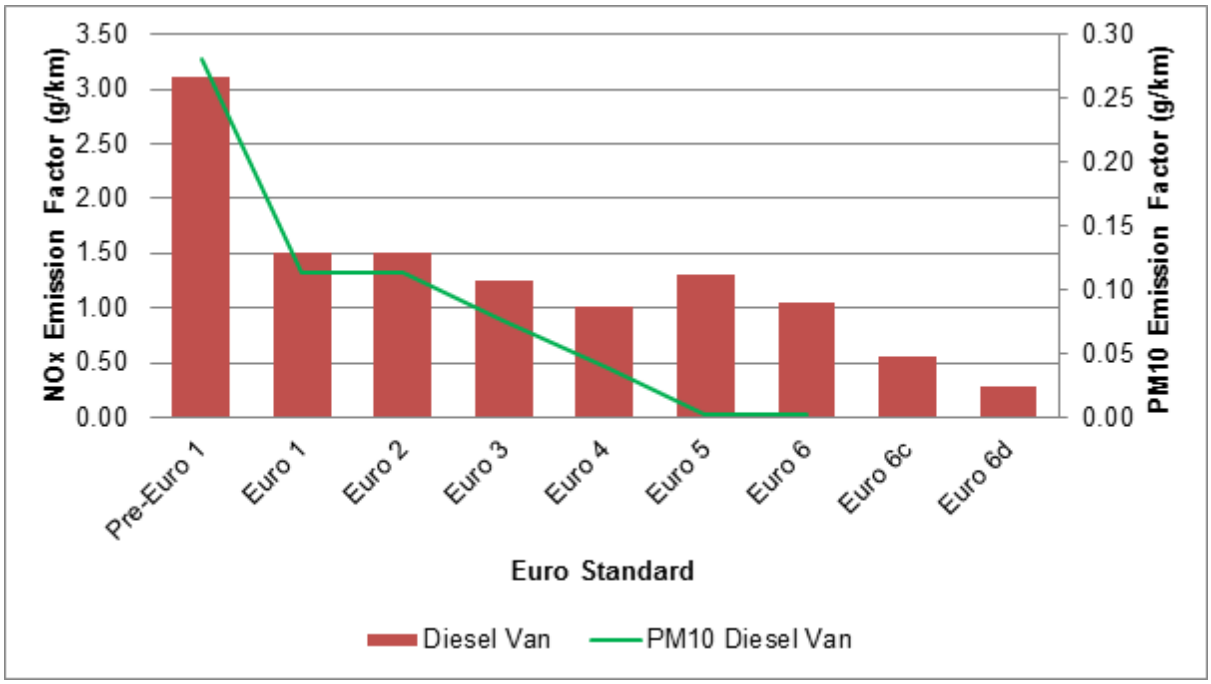
Table 17: Vehicle types affected by the LEZ Euro 3 PM emission standard

Vehicle type	Weight
• Larger vans • Motorised horseboxes • 4x4 light utility vehicles • Pick-ups • Other specialist vehicles	Between 1.205 tonnes unladen and 3.5 tonnes gross vehicle weight
• Motor caravans • Ambulances	2.5-3.5 tonnes gross vehicle weight
• Minibuses (with 8+ passenger seats)	5 tonnes or less gross vehicle weight

The real world performance (ie the emissions emitted during 'real world' driving as opposed to the emissions produced during laboratory testing) of diesel vehicles has come under significant scrutiny in recent years. However, whilst Euro 6 diesel vehicles do not presently meet NO_x emissions limits during real world driving, they do emit less NO_x when compared to previous Euro standards. The implementation of

Euro standards has seen a real world decrease in PM emissions. The introduction of real world testing as part of later phases of the Euro 6 standard[24] is expected to further reduce diesel emissions as set out in Figure 23.

Figure 23: NO_x and PM emissions of Diesel Vans



Date of implementation

We are proposing an implementation date of 25 October 2021, the same as for cars and car-derived vans. By this date a five-year old vehicle would be considered compliant with the scheme.

Charge level

Non-compliant vans will need to pay a charge of £12.50 to drive in the ULEZ. This will be in addition to the £100 LEZ charge for non-compliant pre-Euro 3 vans.

There are no proposals to alter the LEZ charge level for vans that do not meet Euro 3 PM standards. This was set at £100 in 2007 following consultation.

The lower charge level for Euro 3, 4 and 5 vans reflects the difficulties in reaching the Euro 6 standard compared to the significantly older Euro 3 PM standard. It has been set to enable occasional trips to be made by van operators, whilst encouraging those who travel in more frequently to upgrade their vehicles.

There are no proposals to alter the PCN level for vans that do not meet Euro 3 PM standards. This was set at £500 in 2007 following consultation.

The PCN for non-Euro 6 vans would be as for cars, as set out in Section 5.4. A non-Euro 3 PM compliant vehicle driving into the expanded ULEZ that did not pay either the LEZ or ULEZ charge would be liable for both a £500 London-wide LEZ PCN and

[24] See appendix A

a ULEZ PCN of £130 or £160, subject to consultation, totalling up to £660 (reduced by 50 per cent if paid within 14 days).

Discounts and exemptions for these vehicle types

Disabled passenger tax class vehicles will benefit from a sunset period until 7 September 2023.

As with other emergency service vehicle types, the Mayor intends to work closely with each service on a specific memorandum of understanding that will outline how they intend to comply with the ULEZ, taking into account their unique circumstances. It is expected that the arrangements will be time limited akin to the sunset period offered to residents and disabled vehicles and will apply to specialist and emergency response vehicles. However, all general purpose vehicles and most vehicles stationed in the zone will be expected to comply by the start of the scheme.

5.6 Proposals for powered two-wheelers and other L-Category vehicles

Summary

From April 2019 motorcycles and other L-Category vehicles will be subject to the ULEZ scheme as set out in Section 2.1.

We are proposing that from 25 October 2021, motorcycles would need to meet the Euro 3 emissions standard or pay a daily charge of £12.50 to drive in the area up to the North and South Circular Roads.

Affected vehicles

Defra estimates that by 2021, 91 per cent of motorcycles will meet the Euro 3 emissions standard. Modelling for the initial ULEZ in central London indicated that this would rise to 95 per cent in response to the ULEZ being introduced.

Cost

Based on the age of the oldest compliant 125cc commuter bike, the most popular type of powered two-wheeler in the UK, we estimate the average cost of buying a compliant motorcycle would be around £100.

Emissions standards

Emissions standards for motorcycles are less developed than for other vehicle types. In recognition of this, the emissions standard for these vehicles has been set at Euro 3. Broadly speaking this is vehicles registered in 2007 or later.

Date of implementation, charge level and discounts and exemptions

The date of implementation, charge level and discounts will be the same as those for cars as discussed in Section 5.4.

Whilst the overall contribution to NO_x from motorcycles is small, this is because the overall mileage travelled by them within the zone is small. On an individual basis, motorcycles can be polluting vehicles, particularly those with older two-stroke engines.

In response to previous consultations, stakeholders have suggested a lower daily charge for motorcycles. However, the charge is designed to persuade the most frequent entrants into the zone to upgrade their vehicles in order to avoid the charge, and a lower rate would not have this deterrent effect. By 2021, a 14-year old motorcycle would be compliant, providing an affordable second-hand option.

5.7 Proposals for taxis

As agreed in the 2015 consultation, taxis will be exempt from the ULEZ charge. This is because there are separate licensing requirements and an age limit for licensed taxis.

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.

Unfortunately, current taxis are heavy diesel vehicles and we now know that 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 15 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 Plan,[25] launched by the Mayor 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)[26]
- A £3,000 grant towards the first 9,000 ZEC taxis licensed in London, to help reduce the cost for drivers, and lobbying the Government to guarantee the plug-in car grant for these vehicles, enabling up to £7,500 in grants in total
- 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
- A scrappage 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.

[25] tfl.gov.uk/corporate/publications-and-reports/taxi-and-private-hire

[26] A maximum 15-year age limit remains in place for all taxis. The ZEC requirement for taxis is ≤50 g/km CO_2 and a minimum zero emission range of 10 miles

- 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

5.8 Proposals for private hire vehicles

All PHVs will need to comply with the ULEZ standards and charges for cars and vans detailed in Section 5.4.

This distinction has been made as unlike taxis, PHV operators have the option to refuse bookings, or choose to send compliant vehicles for pick-up or drop-off. Additionally, PHVs are subject to a maximum 10-year age limit for licensing.

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
    - 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 ZEC[27]
- From 2023:
    - All PHVs presented for licensing for the first time must be ZEC

As a result of the policies for taxis and PHVs, all these vehicles will be zero emission capable by 2033 at the latest.

Numbers of affected vehicles

Using automatic number plate recognition cameras matched to TfL's licensing database, it is estimated that seven per cent of cars captured in inner London are Private Hire Vehicles.

Looking at the existing fleet of licensed vehicles, currently 37,000 are non compliant with ULEZ standards. Accounting for vehicle removal as a result of the age limit it is estimated that 29,000 vehicles in the PHV fleet in 2021 may be affected by this scheme, though these will not necessarily be driving in the expanded ULEZ.

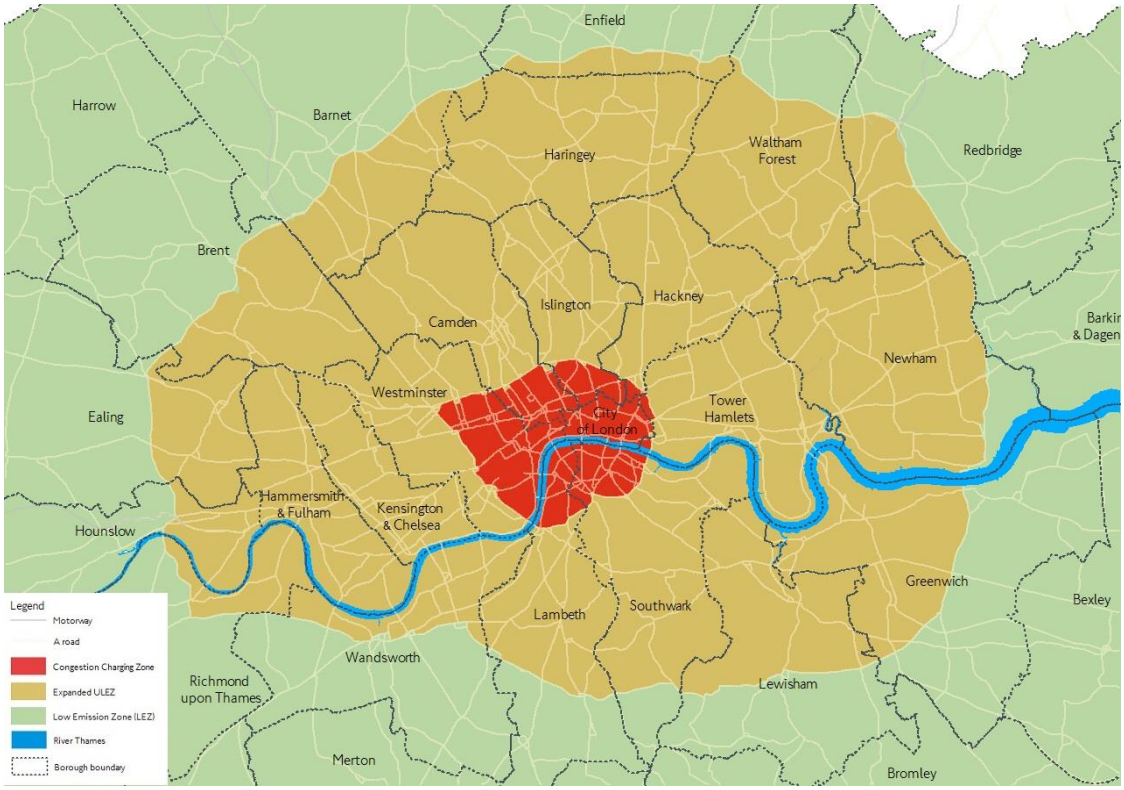
[27] For PHVs the ZEC requirement is ≤50 g/km CO_2 with a minimum zero emission range of 10 miles or ≤75 g/km CO_2 and 20 miles minimum zero emission range. This aligns with the Office for Low Emission Vehicle (OLEV) criteria

5.9 The expanded ULEZ boundary

Boundary

The proposed expansion of the ULEZ to inner London would see it cover the area up to, but not including, the North and South Circular Roads (A205 and A406). All cars, vans, minibuses, PHVs, powered two wheelers and similar vehicles would need to meet the relevant emissions standards or pay a daily charge when driving in the zone.

Figure 24: Proposed boundary of inner London ULEZ up to the North and South Circular Roads



Inner London contains areas with significant NO_2 levels where there is high population exposure to concentrations above health limits. It is estimated that the introduction of ULEZ as currently planned, would result in about 50 per cent fewer people living in areas exceeding legal air pollution limits. Expanding the ULEZ to Inner London would mean that significantly more people would benefit from improvements in air quality.

Some stakeholders have requested an ‘opt-in’ scheme for the boroughs. However the current consensus is that this would not provide a workable solution because of the need for a clear enforcement strategy and an understandable alternative route around the expanded zone.

As with all road user charging schemes, consideration must be given to the most appropriate ‘boundary route’ for drivers opting to avoid the zone. It needs to be a good quality and easily navigable alternative to driving in the zone that is simple to follow and understand. It is considered that the North and South Circular Roads would provide the most appropriate boundary route for an inner London ULEZ. This

means that there would be no charge for using them when driving a light vehicle (eg car, van or motorcycle) that does not meet the ULEZ standard.

Some stakeholders have called for the expanded ULEZ to include the North and South Circular roads. However, this would mean they could not be used as diversion routes. Initial traffic modelling has indicated this would lead to diversions along less suitable residential roads.

Full modelling of the impacts on the boundary has been carried out and is discussed in Section 6.5

Boundary design principles

The boundary was designed using the following principles, based on those used to design the London-wide LEZ.

- Provide driver opportunity to divert at or close to the point of entry. All possible boundary diversions should be suitable for the largest classes of vehicle who may need to divert away from the zone, either by continuing along the boundary route, by a U-turn at a roundabout or by utilising side roads
- Avoid charge-free 'islands', ie ensure all roads outside the zone can be reached without passing through the zone
- Allow minor adjustments to the boundary to ensure practical signage and camera placement. It is a key principle that the regulatory boundary entry signs are placed at or very close to the boundary and at a point where drivers can choose to avoid entering the zone. Where this is not possible, an alternative boundary may be the only solution
- Include all public roads inside the North and South Circular Roads in the zone, including cul-de-sacs and self-contained roads
- Avoid any areas outside North and South Circular roads
- Consider small stretches outside the North and South Circular Roads only where it is very difficult to meet the above objectives within the North and South Circular Roads (eg where a road crosses under/over the North Circular)
- Follow the inside (anti-clockwise) route of the North and South Circular Roads for gyratories.

As a result of these principles small 'turn-backs' are provided at certain locations close to the periphery of the zone. Detailed maps of the proposed boundary are set out as part of the consultation and there is opportunity to provide comments on the boundary plans in response to the consultation.

Alternative option considered

The option to extend the ULEZ London-wide for all vehicle types has been carefully considered. Such an expansion would affect significantly more residents and vehicles and require further infrastructure to operate the scheme.

Detailed analysis of residents' car ownership and travel patterns in inner and outer London has been undertaken and is presented in Appendix D. The key findings are summarised below. There are parts of outer London that are significantly less well

connected by public transport than in the inner zone, and areas with a lower percentage of compliant vehicles. In view of this, and the higher levels of car ownership in outer London, it is unlikely that we would see the same levels of compliance with the standards, or shifts to more sustainable modes as in the inner zone. We would instead be more likely to see an increase in the proportion that opts to 'stay and pay'.

Table 18: Data on residents in inner and outer London

	Inner London (excluding the Congestion Charging zone)	**Outer London**
Number of Households	1.4 million	1.7 million
% availability of cars	45%	70%
Cars per household	0.6	1.0
% of area with low Public Transport Accessibility	18%	87%

An effective and enforceable London-wide zone including cars vans and motorcycles would also require an even more significant expansion in infrastructure required to operate the zone.

In the long term, the MTS sets out goals for all of London's transport system to reach zero emissions by 2050. As a shorter-term measure, we do not believe that a London-wide scheme for all vehicles is appropriate.

As outlined in Section 3.1, whilst there remain significant air quality issues in outer London, they tend to be less widespread than in inner London and focussed on the busiest routes used by heavy vehicles and these vehicles will be affected by the strengthening of the London-wide LEZ standards. A sensitivity test of the potential emissions impacts of a London-wide scheme for all vehicles is undertaken in section 6.7.

The impacts of the tighter LEZ and ULEZ policies and the combined impact on outer London are set out in Part 3 of this document. Where areas of exceedence remain, targeted local interventions are likely to be more appropriate than additional London-wide interventions. The LES and MTS set out proposals for targeted borough action to be taken at local hotspots in addition to wider measures across the different sources of pollution in London and further afield, which will lead to longer term reductions in exposure reduction to pollution.

5.10 Summary of proposals by vehicle type

HGVs, Coaches, coaches, buses and other specialist heavy vehicles

From 26 October 2020, all these vehicles will need to meet Euro VI emission standards or pay a £100 daily charge in order to drive within London. Vehicles that do not meet a Euro IV PM standard will need to pay a total daily charge of £300.

Cars and small vans

From 25 October 2021 all these vehicles will need to meet a Euro 4 standard if petrol or a Euro 6 standard if diesel or pay a £12.50 daily charge to drive within the central and inner London area up to the North and South Circular Roads.

Larger vans, minibuses and similar vehicles

From 25 October 2021 all these vehicles will need to meet a Euro 6 diesel standard or pay a £12.50 daily charge to drive within the central and inner London area up to the North and South Circular Roads. This charge will apply in addition to any applicable £100 LEZ charge for vehicles that do not meet the Euro 3 PM standard.

Motorcycles, mopeds, scooters and similar vehicles

From 25 October 2021, all these vehicles will need to meet a Euro 3 standard or pay a £12.50 daily charge to drive within the central and inner London area up to the North and South Circular Roads.

PHVs

From 25 October 2021 all these vehicles will need to meet a Euro 4 standard if petrol or a Euro 6 standard if diesel or pay a £12.50 daily charge to drive within the central and inner London area up to the North and South Circular Roads. They are also subject to licensing requirements and a 10 year age limit in order to operate as PHVs.

Taxis

These vehicles are exempt from the ULEZ. However they are subject to a ZEC licensing requirement from 2018 and a 15-year age limit.

Part 3: Impacts

This section shows the impacts of the proposals to strengthen the LEZ standards and expand the ULEZ in terms of emissions, concentrations, health benefits and traffic.

Chapter 6 – Impact of the proposals

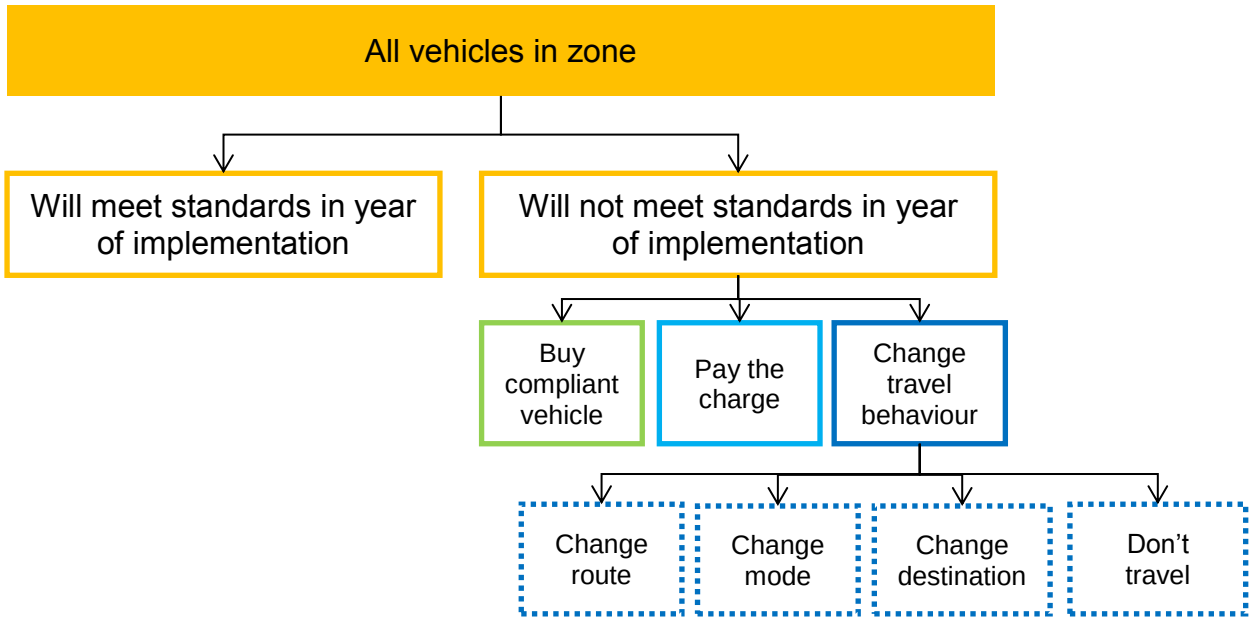
6.1 Responses of vehicle users

A key part of the assessment is estimating 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. Using the LAEI we can estimate the proportion of vehicles that would already meet the required emissions standard in the year of implementation.

Those who have vehicles that do not meet the ULEZ emissions standard have a choice in how they respond to the introduction of the scheme:

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

Figure 25: Schematic diagram of possible responses to the ULEZ proposals



The aim of setting the charge is to encourage frequent users of the zone who drive a non-compliant vehicle to change to a compliant one, or consider alternative, less polluting modes of travel.

For drivers who make only infrequent trips in the zone (of which there are many), it may not be cost effective to upgrade their vehicle specifically to comply with the ULEZ standards. These users are more likely to 'stay and pay' the ULEZ charge for the small number of trips they make in the zone. 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 driving in the ULEZ.

To estimate the response for commercial vehicles, we used data on the frequency of entry into the zone, combined with the cost of compliance to determine for whom upgrading would be the most cost effective course of action. This assessment was done assuming no ULEZ was in place within the central area to simplify analysis. Assuming no ULEZ in place in central London for this analysis does not alter the results by much.

Table 19 shows the breakdown of the estimated responses of the pre-implementation population of vehicles.

No reduction in vehicle kilometres by commercial vehicles has been assumed. This is because it is expected, as a secondary impact, that any businesses that leave the market as a result of the new emissions standards will be replaced by other businesses who have compliant vehicles or who are willing to pay the charge.

Table 19: Breakdown of the responses of the daily population (or vehicle km) of commercial vehicles

	HGV	Coach	LGV
compliant in baseline (assumes no central ULEZ in place)	77%	59%	60%
have become compliant in response to the scheme	16%	26%	10%
stay and pay	2%	5%	27%
change travel behaviour	5%	10%	3%

We undertook surveys of a small representative group of car drivers in London to understand how they would respond to the scheme. This enabled us to estimate the proportion of car drivers that would upgrade. Table 20 shows an aggregated summary of these results.

Table 20: Breakdown of the responses of the daily population (or vehicle km) of cars

	Car
Compliant already (assumes no central ULEZ in place)	70%
have become compliant by year of implementation	21%
stay and pay	6%
change travel behaviour	3%

Table 21 shows the proportion of vehicles that would meet the proposed emissions standards anyway, assuming the proposals to expand the ULEZ and tighten the LEZ put forward in this consultation are not implemented (but that the central ULEZ is in place from 2019 as agreed). This is compared to the estimated levels of compliance if the proposals in this consultation are implemented. These levels of compliance are shown in terms of numbers of vehicles on a typical day.

Table 21 Comparison of the compliant vehicles in the relevant year and charging zone by vehicle type

	Proportion of daily vehicles compliant	
	With Central ULEZ only	**With ULEZ and Tighter LEZ**
HGV London-wide - 2020	80%	95%
Coach London-wide - 2020	64%	94%
LGV Inner London - 2021	65%	72%
Car Inner London - 2021	81%	93%

6.2 Traffic and transport effects

The reduction of traffic or congestion is not the primary aim of the ULEZ. However, introducing an emissions requirement for vehicles is likely to deter a small proportion of trips or lead to a change in how people travel.

Someone who drives a non-compliant car in the zone might choose to respond to the ULEZ charge by changing their destination or how they travel. To understand the scale of this impact we used TfL's strategic models to understand the redistribution of trips and determine any shifts to other modes such as public transport, walking and cycling.

Table 22 shows the change in car trips by non-compliant users. This is shown as the change in trips between the home zone and the destination zone (trip production and attraction zone). For example, for those non-compliant users of the expanded ULEZ, who live in outer London, there is a 25% reduction in trips to central London and a 55% reduction in trips to inner London and a small increase in trips to Outer London locations. It is important to note that whilst these percentage figures appear large, they relate to the change in behaviour of the drivers of less than 10 per cent of the

daily cars in inner London. Table 23 shows the change in public transport, walking and cycling trips caused by people changing their mode and destination. These changes represent an average weekday outside of school holidays.

Table 22 Change in daily amount of car trips of remaining non-compliant vehicles

		Trip destination zone (Trip attraction[28])		
		Central	**Inner**	**Outer**
Trip starting zone (Trip production[29])	**Central**	-15%	-50%	-10%
	Inner	-10%	-60%	-45%
	Outer	-25%	-55%	5%

Table 23 Change in daily public transport and walk/cycle trips by remaining non-compliant vehicles

		Trip Attraction		
		Central	**Inner**	**Outer**
Trip production	**Central**	<5%	5%	<5%
	Inner	5%	10%	5%
	Outer	0%	5%	0%

Non-compliant van and car users, who had previously driven through the inner zone, may consider re-routing to avoid the charge. TfL's highway assignment models were used to assess the impact of this. These responses ultimately lead to a change in vehicle kilometres and speed. The change by charging zone is shown Table 24 below, with the aggregate impact on the boundary set out separately. There is little change at the zone level and on the boundary as a whole. Section 6.5 discusses some of the results for the boundary road in more detail.

For the London-wide proposals for heavy vehicles we are not anticipating any reduction in vehicle kilometres. As with the discussion on commercial vehicles, these traffic impacts have been assessed assuming there is no ULEZ within the central area to simplify the analysis.

[28] Locations which generate the need to travel – see glossary for further information

[29] Locations from which a trip is generated – see glossary for further information

Table 24 Change in total vehicle km and speed by zone

	Change in vehicle km	Change in speed
Inner	-1%	0%
Outer	0%	0%
On the boundary	0%	0%

6.3 Impact on emissions

This section outlines the combined emissions impact of the changes to the LEZ and the ULEZ in 2020, 2021 and 2025. Savings are split between inner London (inside the zone, excluding the Congestion Charging zone) and outer London (outside the zone). The impacts on the North and South Circular Roads are presented in Section 6.5 alongside a wider discussion on traffic displacement

We would not expect significant additional benefits in the Congestion Charging zone as a result of the proposals, as all vehicles will be subject to the ULEZ in this area in 2019. However there may be some additional benefits as drivers of vehicles who travel more frequently in the rest of London, but only occasionally in central London, may change their behaviour when previously they would have opted to pay the charge.

There may also be additional reductions from light duty vehicles in 2020 as vehicle owners and operators start to change their vehicles in response to the proposed scheme. These have not been captured for modelling purposes.

NO_x impacts

Figure 26 Indicates the potential year on year NO_x savings from the proposals to expand the ULEZ and strengthen the LEZ, with modelled savings up to 2025 and indicative savings to 2030.

Figure 26: Road transport NO_x savings from the total scheme London-wide

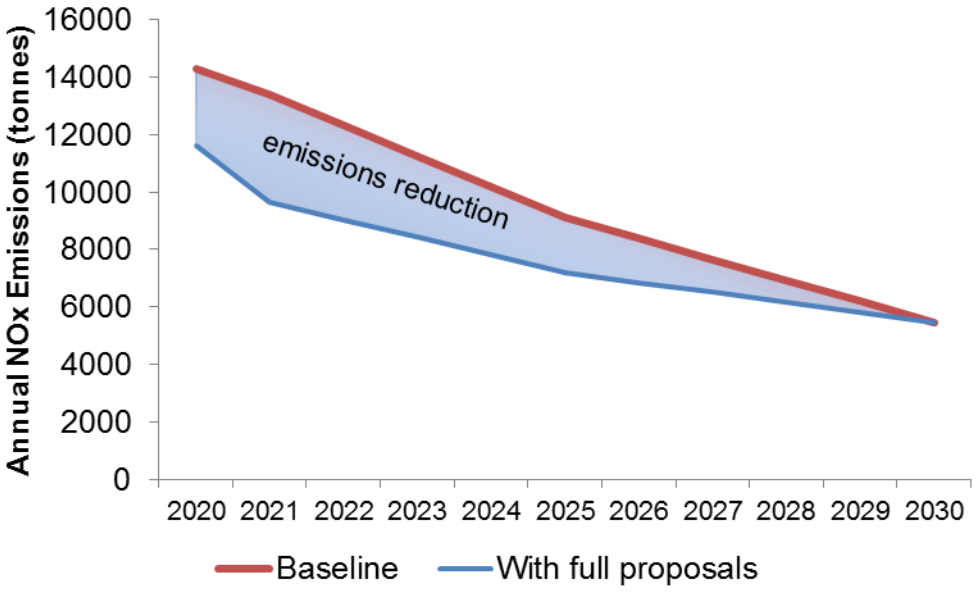


Table 25 to Table 27 show the road transport NO_x emissions savings that would be realised in inner London and outer London broken down by vehicle class. The proposals would mean that Londoners across inner and outer London experience the benefits in emissions reductions which are important steps in improving local air quality. As a result of tightening the emissions standards for heavy vehicles London-wide in 2020, there would be a 21 per cent reduction in road transport NO_x emissions in inner London and 19 per cent in outer London. London-wide, a total reduction of 19 per cent is estimated.

In 2021, the combined impact of the proposals, (with the additional requirements for light duty vehicles in inner London) would be a 31 per cent reduction in road transport emissions in inner London, 28 per cent in outer London, and 28 per cent London-wide.

In 2025, the combined impact of the proposals is forecast to be a 24 per cent reduction in road transport NO_x emissions in inner London, 21 per cent in outer London and 21 per cent London-wide.

Table 25: Road transport NO_x emissions impacts 2020

2020		Total road transport	Coaches and HGVs	Buses
Inner (excluding CCZ)	Reduction (t)	900	310	590
	Reduction (%)	21%	49%	78%
Outer	Reduction (t)	1790	620	1170
	Reduction (%)	19%	54%	87%

Table 26: Road transport NO_x emissions impacts 2021

2021		Total road transport	Cars, vans, minibuses and L-Category vehicles	Coaches and HGVs	Buses
Inner (excluding CCZ)	Reduction (t)	1260	420	250	590
	Reduction (%)	31%	17%	44%	78%
Outer	Reduction (t)	2480	800	510	1170
	Reduction (%)	28%	12%	50%	87%

Table 27: Road transport NO_x emissions impacts 2025

2025		Total road transport	Cars, vans, minibuses and L-Category vehicles	Coaches and HGVs	Buses
Inner (excluding CCZ)	Reduction (t)	670	160	80	430
	Reduction (%)	24%	9%	24%	73%
Outer	Reduction (t)	1250	370	150	730
	Reduction (%)	21%	8%	28%	81%

Figure 27: Impact of proposals on road transport NO_x emissions in inner London 2020–2025

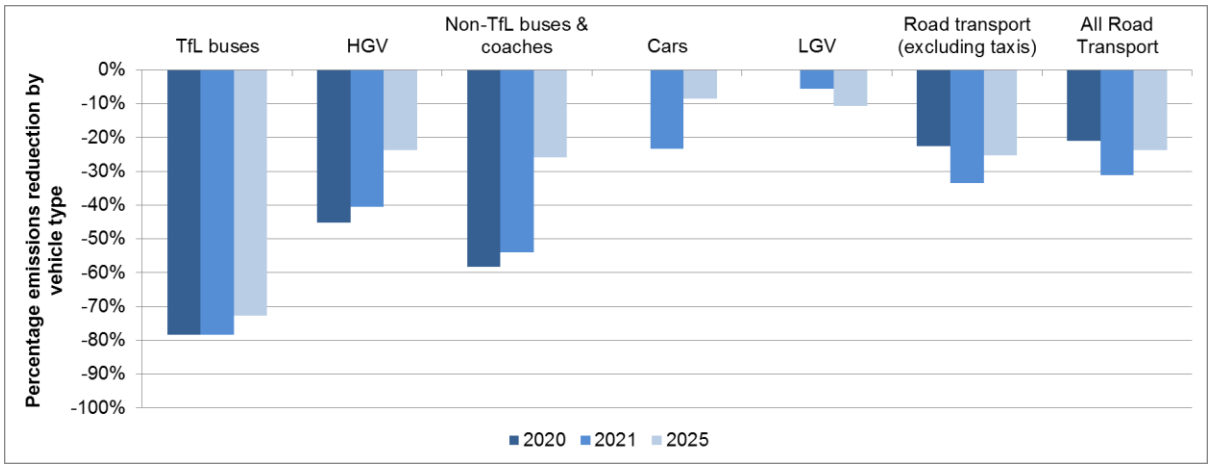
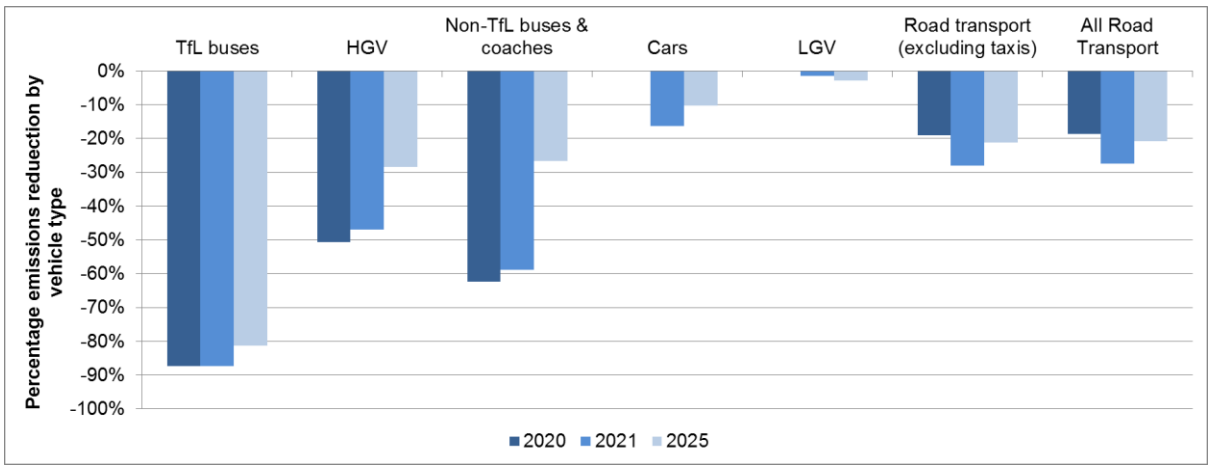


Figure 28: Impact of proposals on road transport NO_x emissions in outer London 2020–2025



PM Impacts

Table 28 to Table 33 show the PM emissions savings that would be realised in inner London and outer London broken down by vehicle type.

In 2020, there would be a reduction of one per cent in road transport PM_{10} emissions in inner London, one per cent in outer London, and a total reduction London-wide of one per cent.

In 2021, the combined impact of the policy (with the additional requirements for light duty vehicles in inner London) would be a five per cent reduction in road transport PM_{10} in inner London, three per cent in outer London, and a total reduction London-wide of three per cent.

In 2025, the combined impact of the policy on road transport PM_{10} emissions, (with the additional requirements for light duty vehicles in inner London) would be two per cent in inner London, two per cent in outer London, and a total reduction London-wide of two per cent.

In 2020, there would be a reduction of two per cent in road transport $PM_{2.5}$ emissions in inner London, two per cent in outer London, and a total reduction London-wide of two per cent.

In 2021, the combined impact of the policy, with the addition of the requirements for light duty vehicles in inner London, would be eight per cent reduction in road transport $PM_{2.5}$ emissions in inner London, five per cent in outer London and a reduction London-wide of six per cent.

In 2025, the combined impact of the policy on road transport $PM_{2.5}$ emissions, with the addition of the requirements for light duty vehicles in inner London, would be three per cent in inner London, three per cent in outer London and a total reduction London-wide of three per cent.

The impacts on total PM emissions are comparatively smaller than for NO_x, due to the majority of these emissions coming from tyre and brake particles. However, any reductions in PM_{10} and $PM_{2.5}$ emissions are important for bringing forward health benefits for Londoners by improving air quality. As a proportion of exhaust emissions however, there are substantial savings due to the additional requirement for PM set out in the proposals for the Euro 6/VI standards. In 2020, London-wide exhaust PM_{10} and $PM_{2.5}$ road transport emissions are forecast to reduce by about 10 per cent, with the reduction from buses, coaches and HGVs being around 60 per cent.

Reductions in exhaust particulates continue in 2021 and 2025 with reductions in road transport exhaust emissions of around 35 per cent in 2021, and 22 per cent in 2025 partly due to the inclusion of cars and vans within the ULEZ requirements.

Table 28: Road transport PM_{10} emissions impacts 2020

2020		Total road transport	Coaches and HGVs	Buses
Inner (excluding CCZ)	Reduction (tonnes)	6	2	4
	Reduction (total %)	1%	3%	7%
	Reduction (% of exhaust PM_{10})	11%	47%	69%
Outer	Reduction (tonnes)	14	5	9
	Reduction (total %)	1%	3%	11%
	Reduction (% of exhaust PM_{10})	9%	48%	82%

Table 29: Road transport PM_{10} emissions impacts 2021

2021		Total road transport	Cars, vans, minibuses and L-Category vehicles	Coaches and HGVs	Buses
Inner (excluding CCZ)	Reduction (tonnes)	27	22	2	4
	Reduction (total %)	5%	5%	2%	7%
	Reduction (% of exhaust PM_{10})	35%	33%	42%	69%
Outer	Reduction (tonnes)	35	25	4	9
	Reduction (total %)	3%	2%	2%	11%
	Reduction (% of exhaust PM_{10})	26%	0%	44%	82%

Table 30: Road transport PM_{10} emissions impacts 2025

2025		Total road transport	Cars, vans, minibuses and L-Category vehicles	Coaches and HGVs	Buses
Inner (excluding CCZ)	Reduction (tonnes)	10	6	1	3
	Reduction (total %)	2%	2%	1%	5%
	Reduction (% of exhaust PM_{10})	22%	16%	23%	62%
Outer	Reduction (tonnes)	22	15	1	5
	Reduction (total %)	2%	2%	1%	7%
	Reduction (% of exhaust PM_{10})	18%	11%	24%	73%

Table 31: Road transport $PM_{2.5}$ emissions impacts 2020

2020		Total road transport	Coaches and HGVs	Buses
Inner (excluding CCZ)	Reduction (tonnes)	6	2	4
	Reduction (total %)	2%	6%	14%
	Reduction (% of exhaust PM2.5)	11%	47%	69%
Outer	Reduction (tonnes)	13	5	8
	Reduction (total %)	2%	6%	22%
	Reduction (% of exhaust PM2.5)	9%	48%	82%

Table 32: Road transport $PM_{2.5}$ emissions impacts 2021

2021		Total road transport	Cars, vans, minibuses and L-Category vehicles	Coaches and HGVs	Buses
Inner (excluding CCZ)	Reduction (tonnes)	22	17	2	4
	Reduction (total %)	8%	8%	5%	14%
	Reduction (% of exhaust PM2.5)	35%	33%	42%	69%
Outer	Reduction (tonnes)	33	22	4	8
	Reduction (total %)	5%	4%	5%	22%
	Reduction (% of exhaust PM2.5)	26%	20%	44%	82%

Table 33: Road transport $PM_{2.5}$ emissions impacts 2025

2025		Total road transport	Cars, vans, minibuses and L-Category vehicles	Coaches and HGVs	Buses
Inner (excluding CCZ)	Reduction (tonnes)	8	5	1	3
	Reduction (total %)	3%	2%	2%	11%
	Reduction (% of exhaust PM2.5)	22%	16%	23%	62%
Outer	Reduction (tonnes)	16	10	1	5
	Reduction (total %)	3%	2%	2%	14%
	Reduction (% of exhaust PM2.5)	18%	11%	24%	73%

Figure 29: Impact of proposals on road transport PM_{10} emissions in inner London 2020-2025

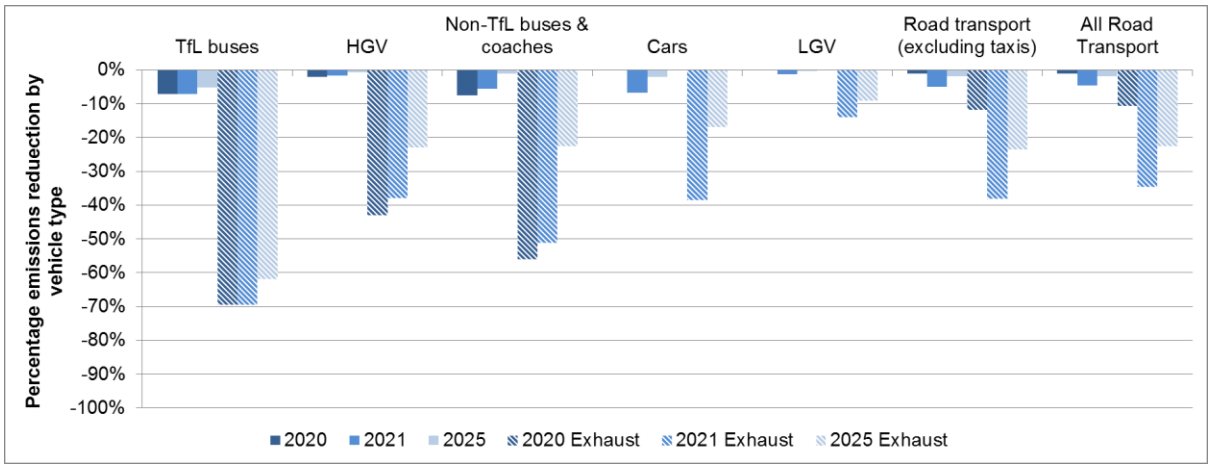


Figure 30: Impact of proposals on road transport PM_{10} emissions in outer London 2020-2025

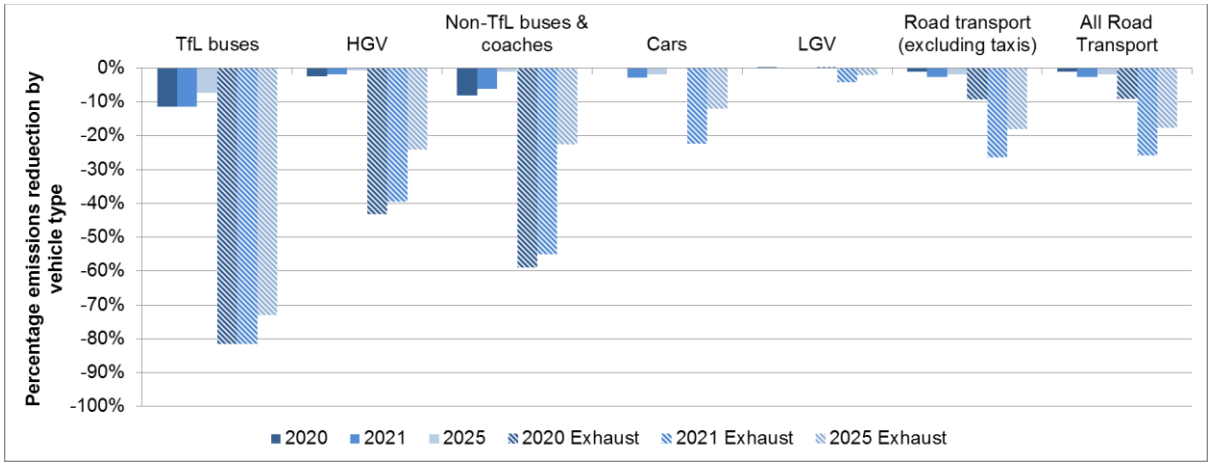


Figure 31: Impact of proposals on road transport $PM_{2.5}$ emissions in inner London 2020-2025

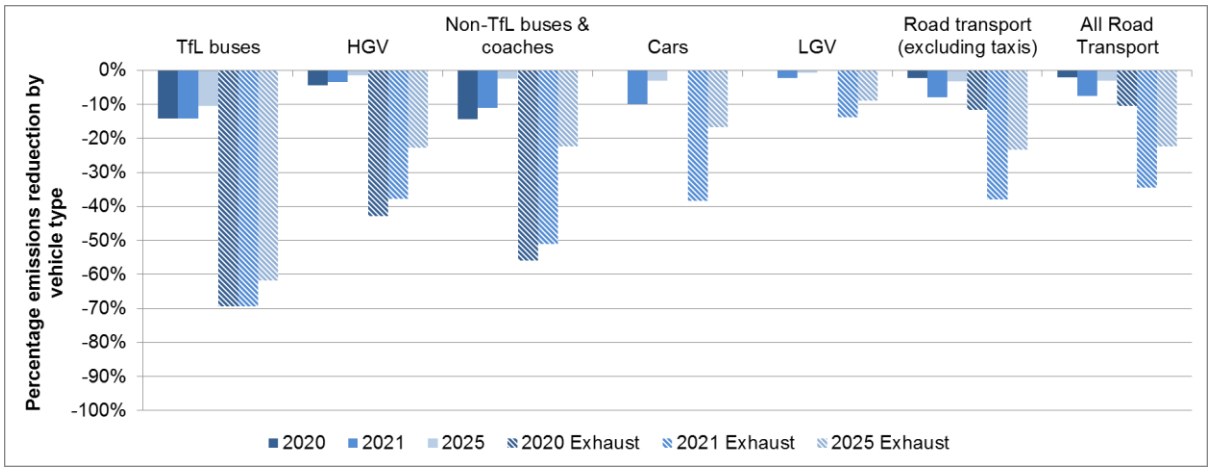
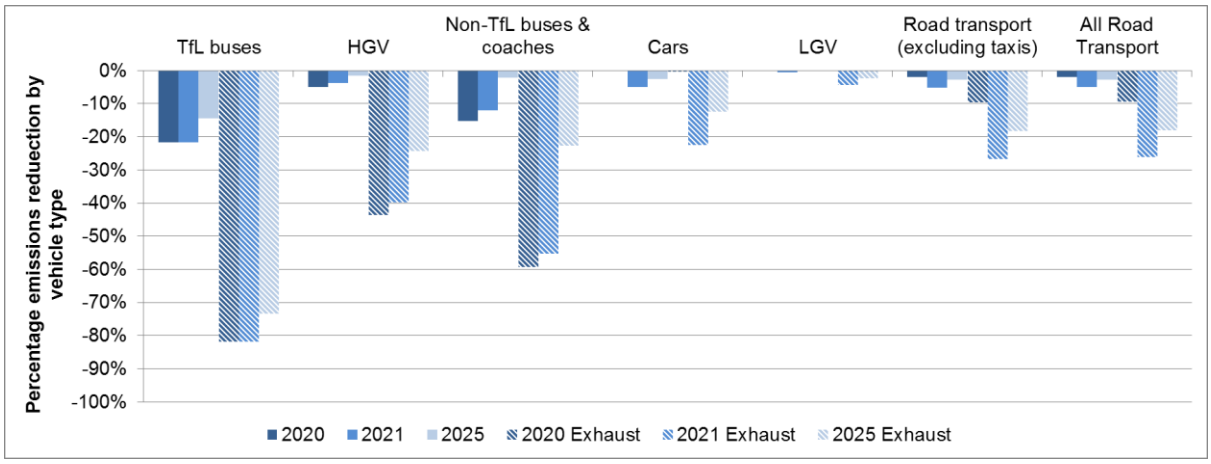


Figure 32: Impact of proposals on road transport $PM_{2.5}$ emissions in outer London 2020-2025



CO_2 impacts

In 2020, CO_2 emissions from larger vehicles such as buses and HGVs are not predicted to change. Whilst improved testing requirements to reach the Euro VI standard for NO_x and PM_{10} mean a small increase in fuel consumption, there will be no overall change in CO_2. Small reductions in CO_2 emissions are forecast in 2021 (about 1.5 per cent), a result of the combined effects of changes in vehicle kilometres for cars and vans, alongside some fuel consumption penalties for Euro VI standards for heavy vehicles.

However, these must be viewed with the much more significant emissions reductions expected in NO_x and PM_{10} that will be achieved through the Euro VI vehicle standards.

Over time, as technology and fuel quality (such as increasing the use of biofuels and the development of hybrid engines) evolve, CO_2 from HGVs will reduce. The requirement for all TfL double-decker buses in central London and all new TfL double-decker buses anywhere in London from 2018 to be hybrid or better, and for single-decker buses in central London to be zero emission means that CO_2 emissions from these vehicles will still reduce.

6.4 Impact on NO_2

NO_2 concentrations

Implementation of the ULEZ proposals would see pollutant concentrations fall across London by 2020, with a greater fall in concentrations in 2021 as the inner London zone is introduced. On average, compared to the baseline for each year, NO_2 concentrations in inner and outer London are forecast to reduce by about five per cent in 2020, eight per cent in 2021, and five per cent in 2025. Some reductions of about three per cent are also forecast for central London, due to the knock-on impacts of reduced emissions from road transport London-wide resulting in a lower contribution in central London.

A more detailed description of the impacts of the proposals at both background and roadside locations, on population exposure, and exceeding road lengths are presented below.

When examining the impact of the scheme, looking at changes in the average concentrations gives a good picture of what is happening in general. However, it is also worth looking at the change in the range of concentrations across London. Figure 33 shows how 80 per cent of the modelled points above the legal limit of 40µg/m3 in 2020 have shifted to below, and that there is a doubling of the points below 22 µg/m^3.

Figure 33: Frequency distribution of changes in concentrations

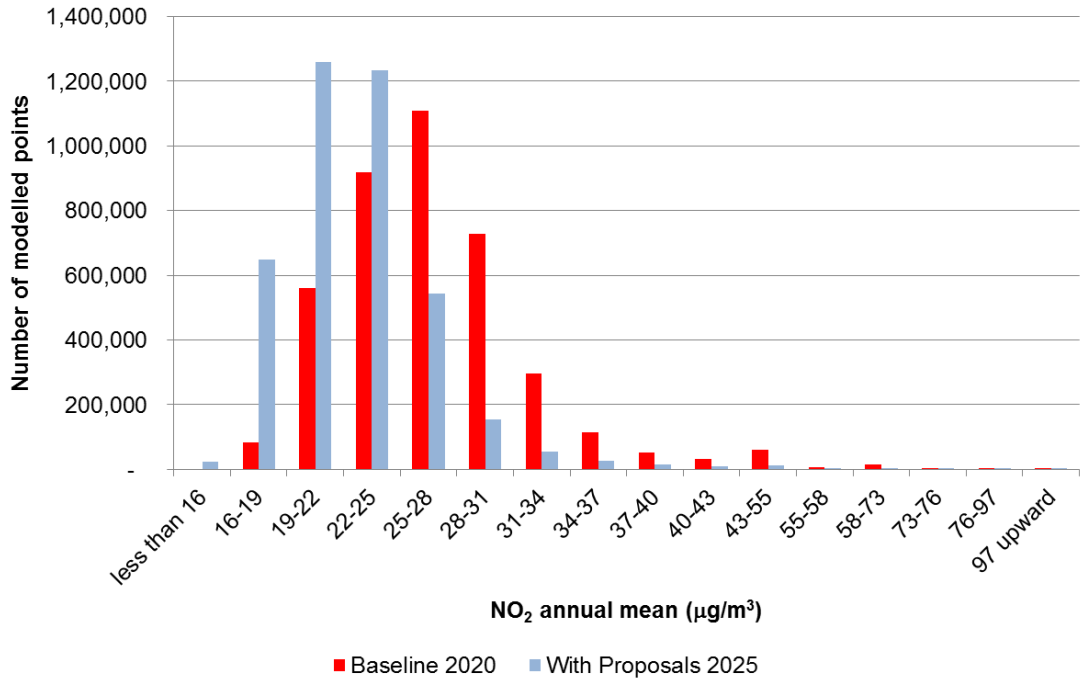


Figure 34, Figure 37 and Figure 41 show maps of the predicted concentrations across London in 2020, 2021 and 2025 as a result of the proposals. Figure 35, Figure 38 and Figure 42 show the difference in concentrations as a result of the Mayors proposals. Figure 36, Figure 40 and Figure 43 shows how roadside concentrations are forecast to change as results of the proposals in 2020, 2021 and 2025 respectively.

Figure 34: NO_2 concentrations with proposals 2020

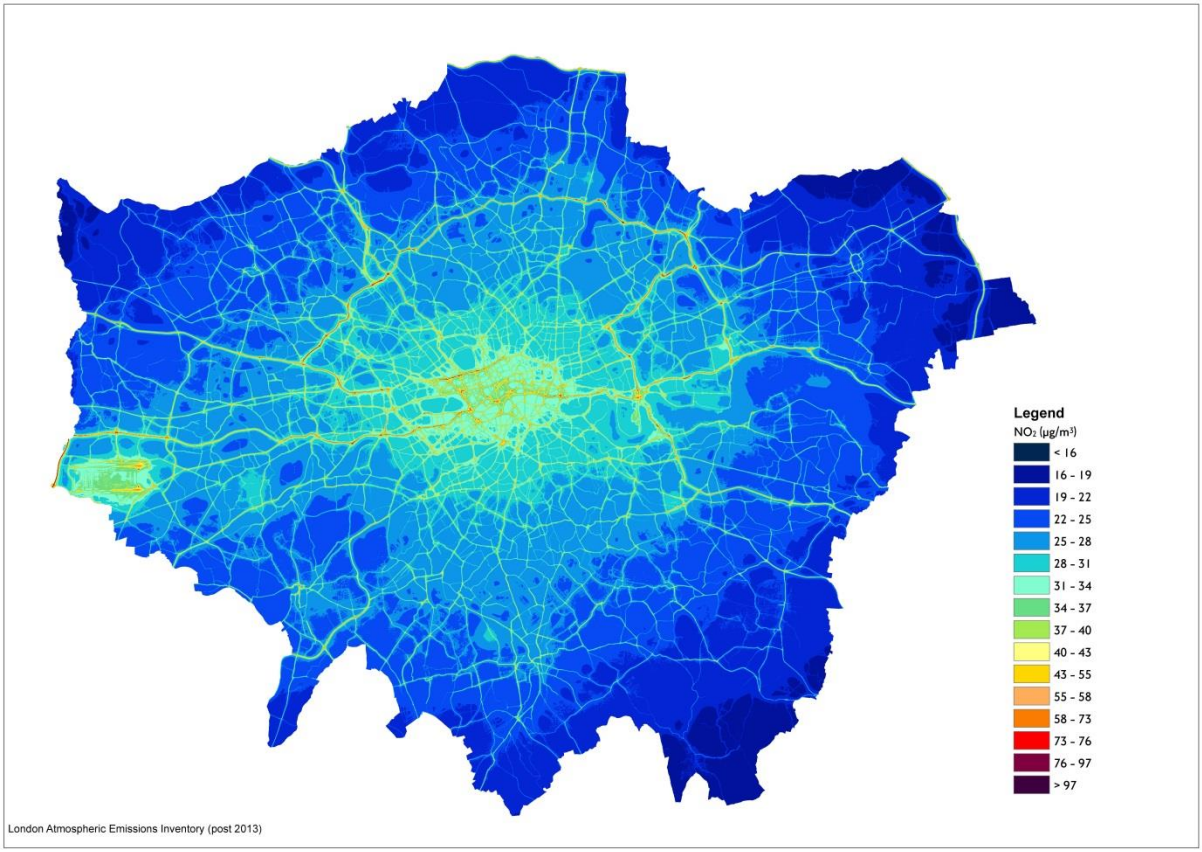


Figure 35: Change in NO_2 concentrations with proposals 2020

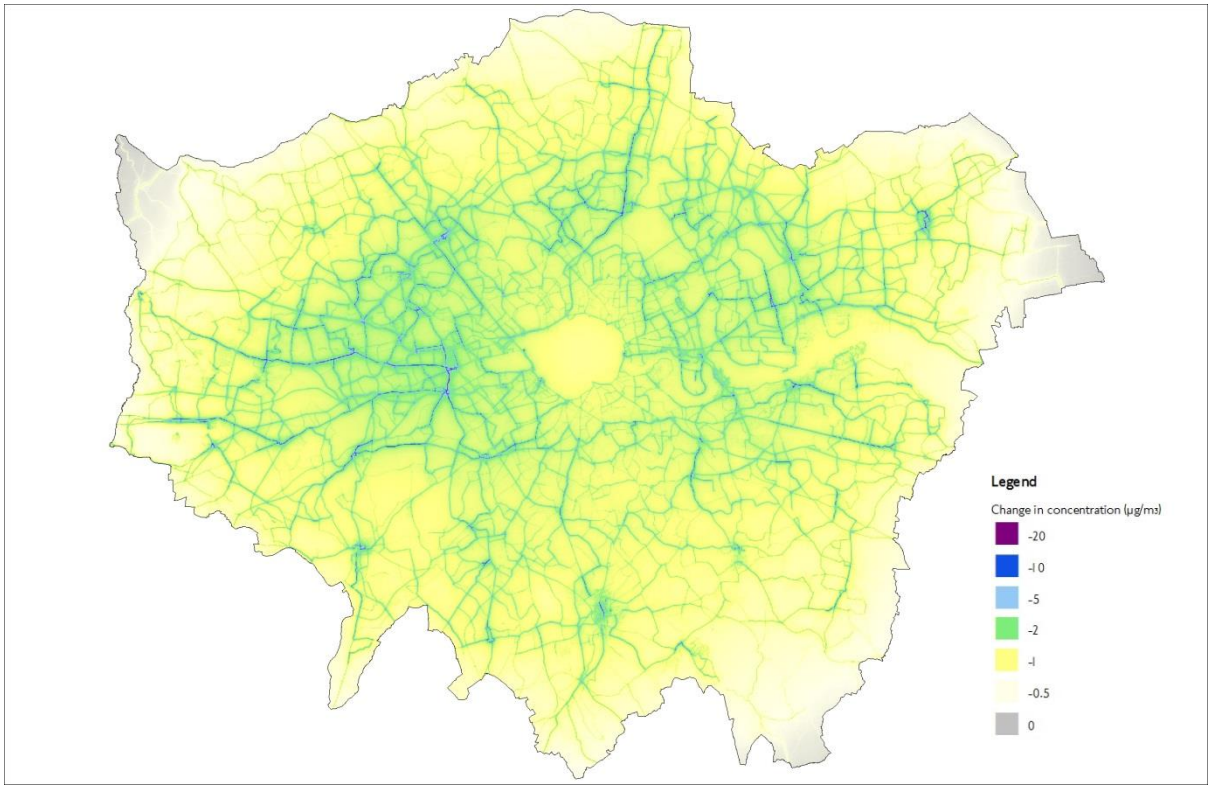


Figure 36: Change in NO_2 roadside concentrations with proposals 2020

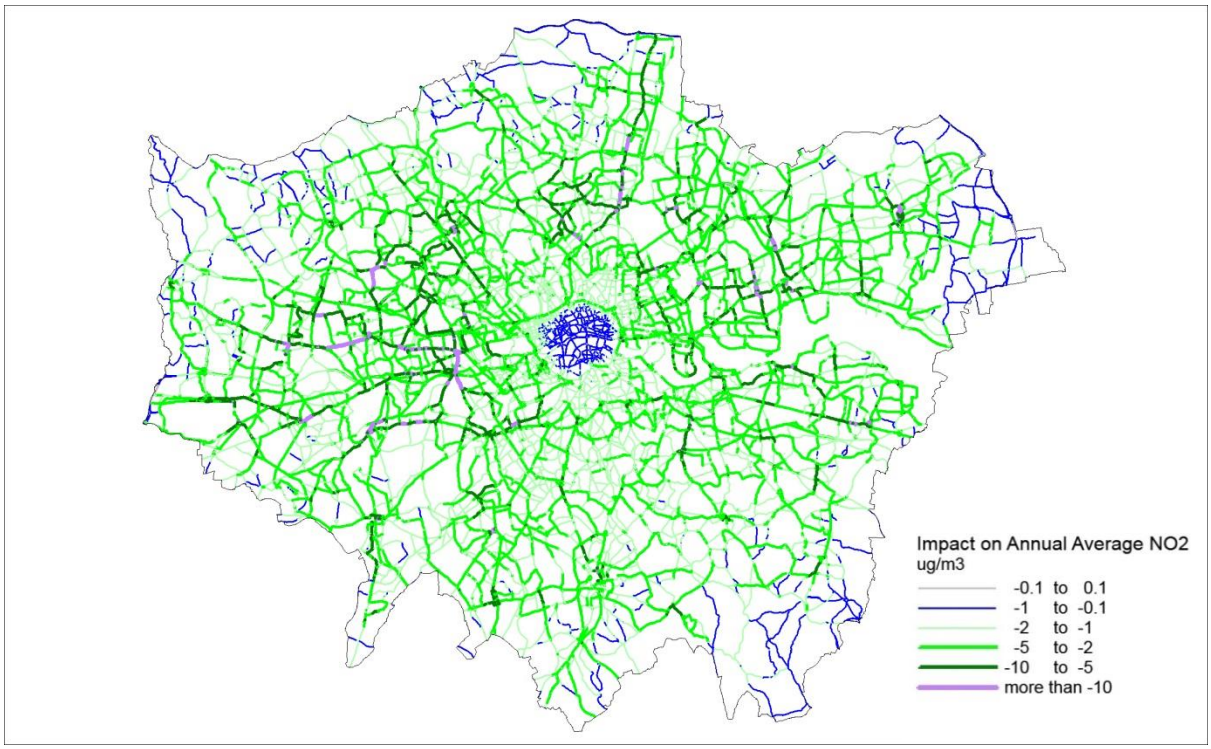


Figure 37: NO_2 concentrations with proposals in 2021

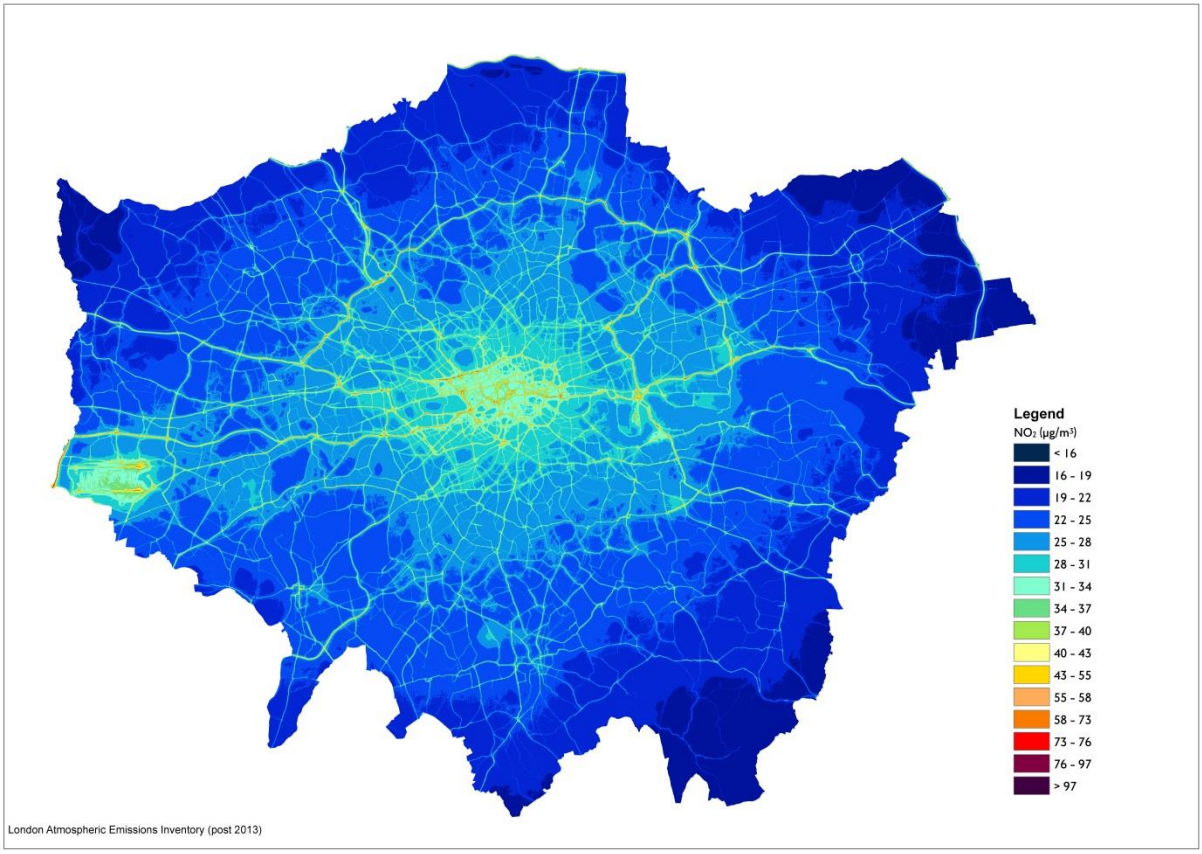


Figure 38: Change in NO_2 concentrations with proposals in 2021

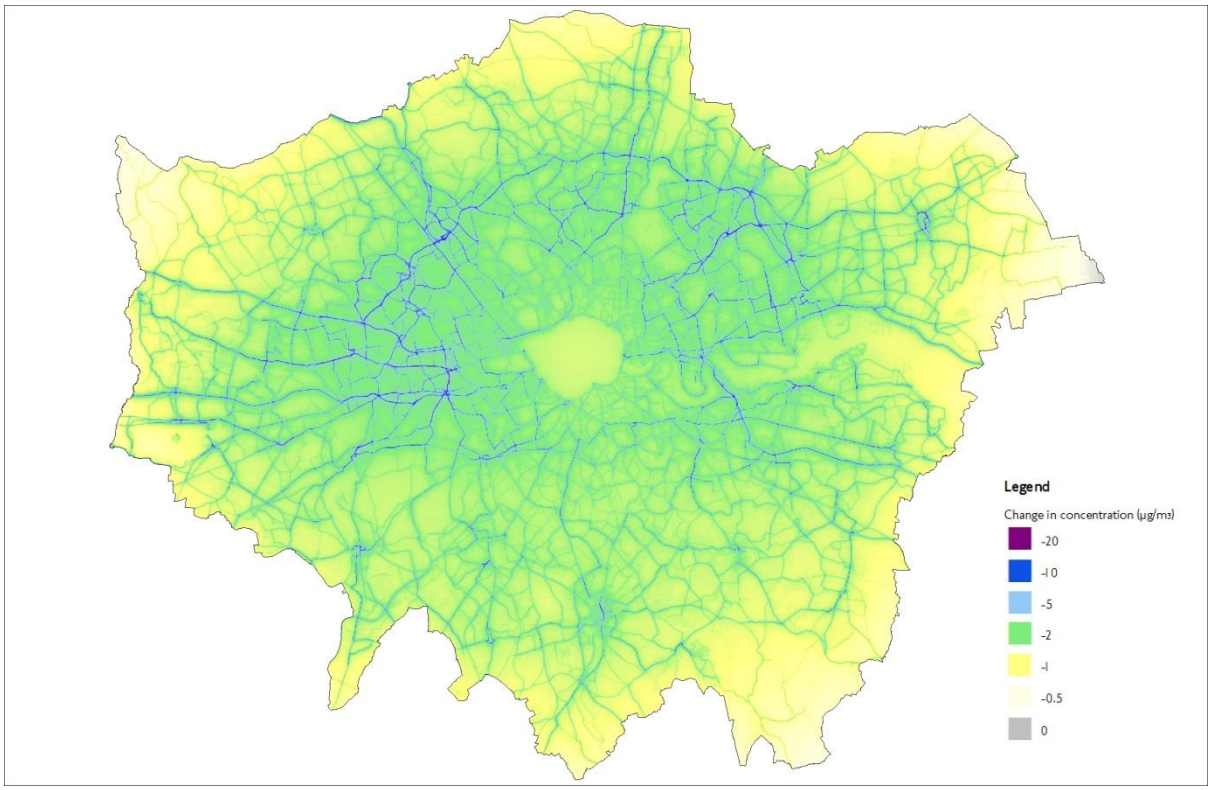


Figure 39: Change in NO_2 concentrations with proposals in inner London in 2021

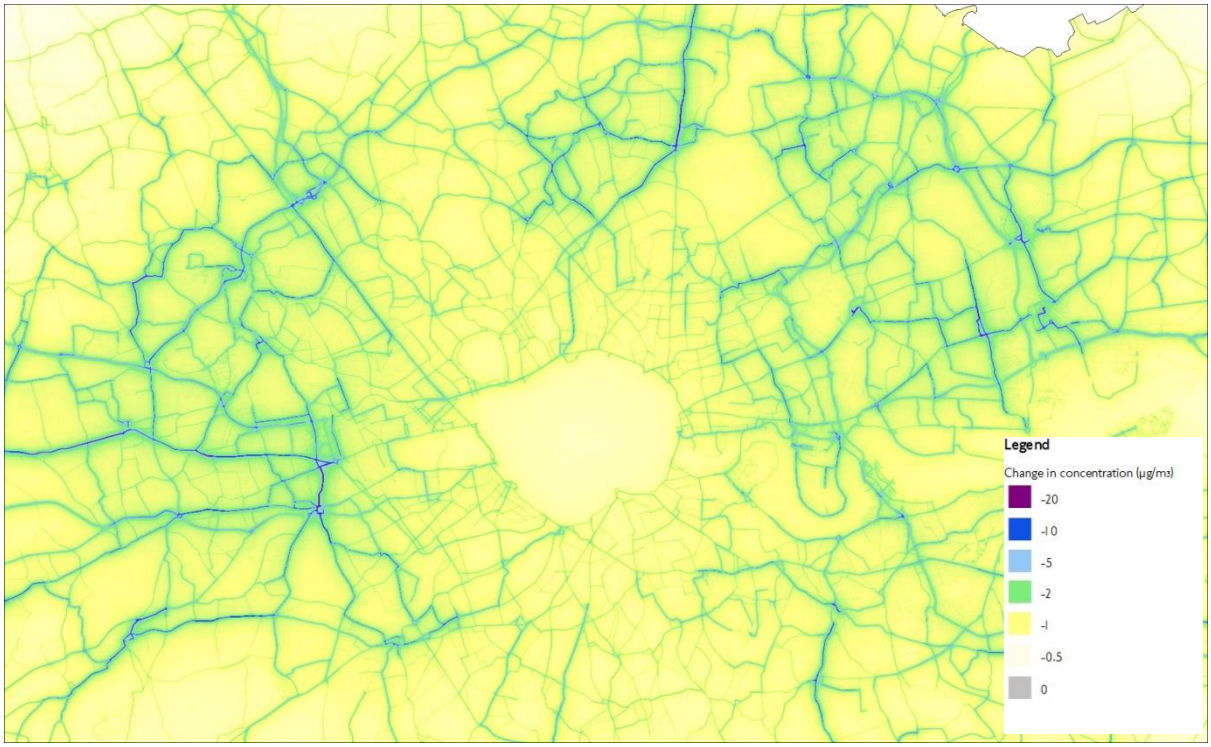


Figure 40: Change in NO_2 roadside concentrations in 2021

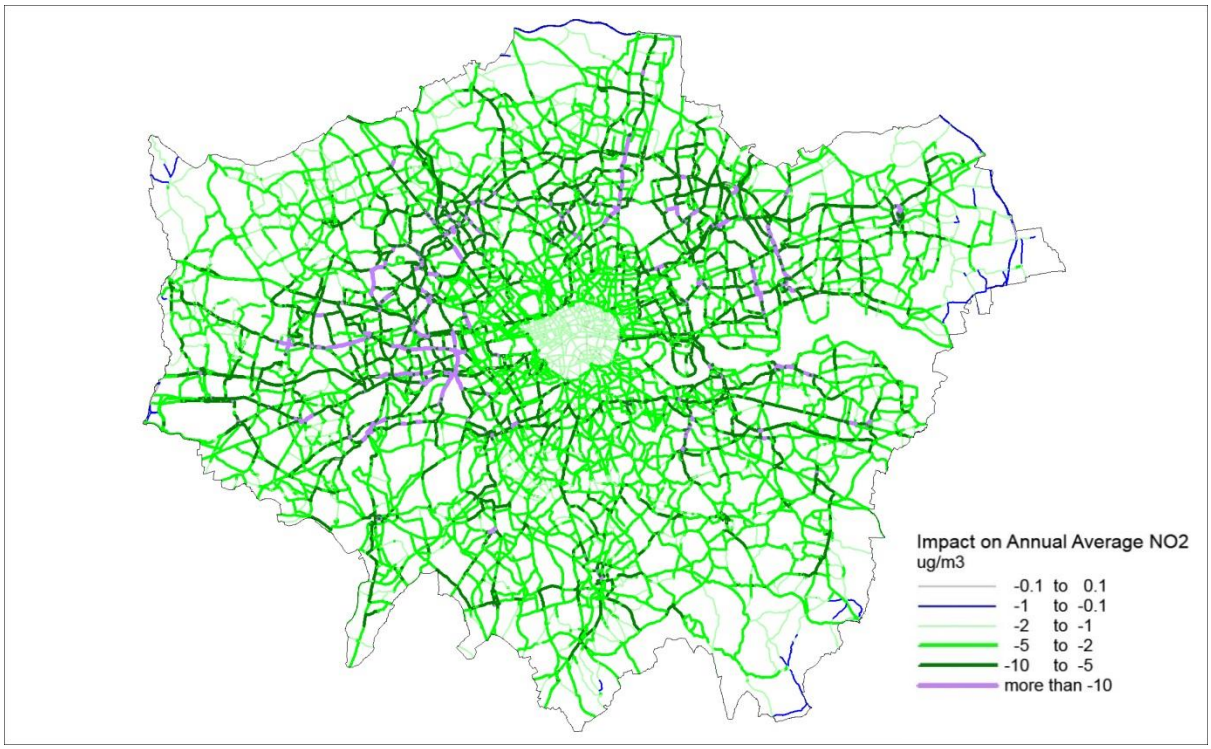


Figure 41: NO_2 concentrations with proposals in 2025

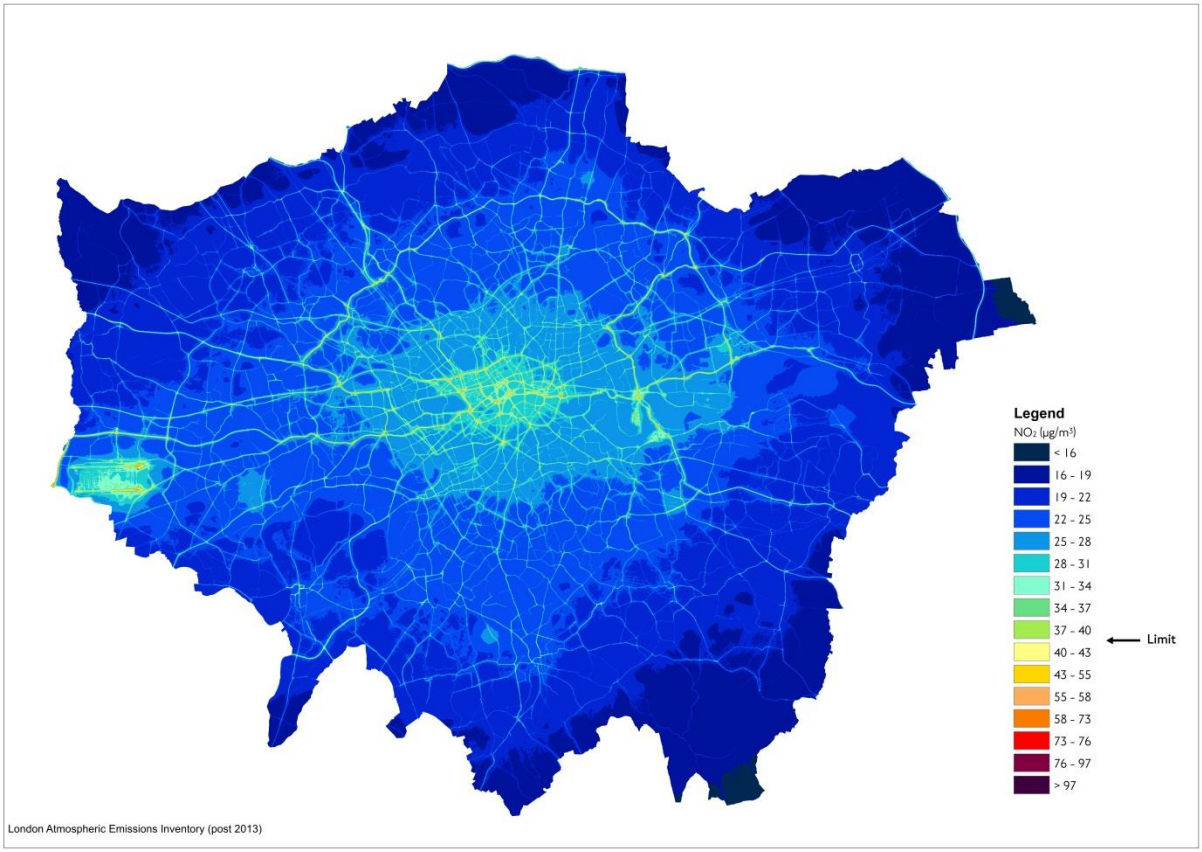


Figure 42: Change in NO_2 concentrations with proposals in 2025

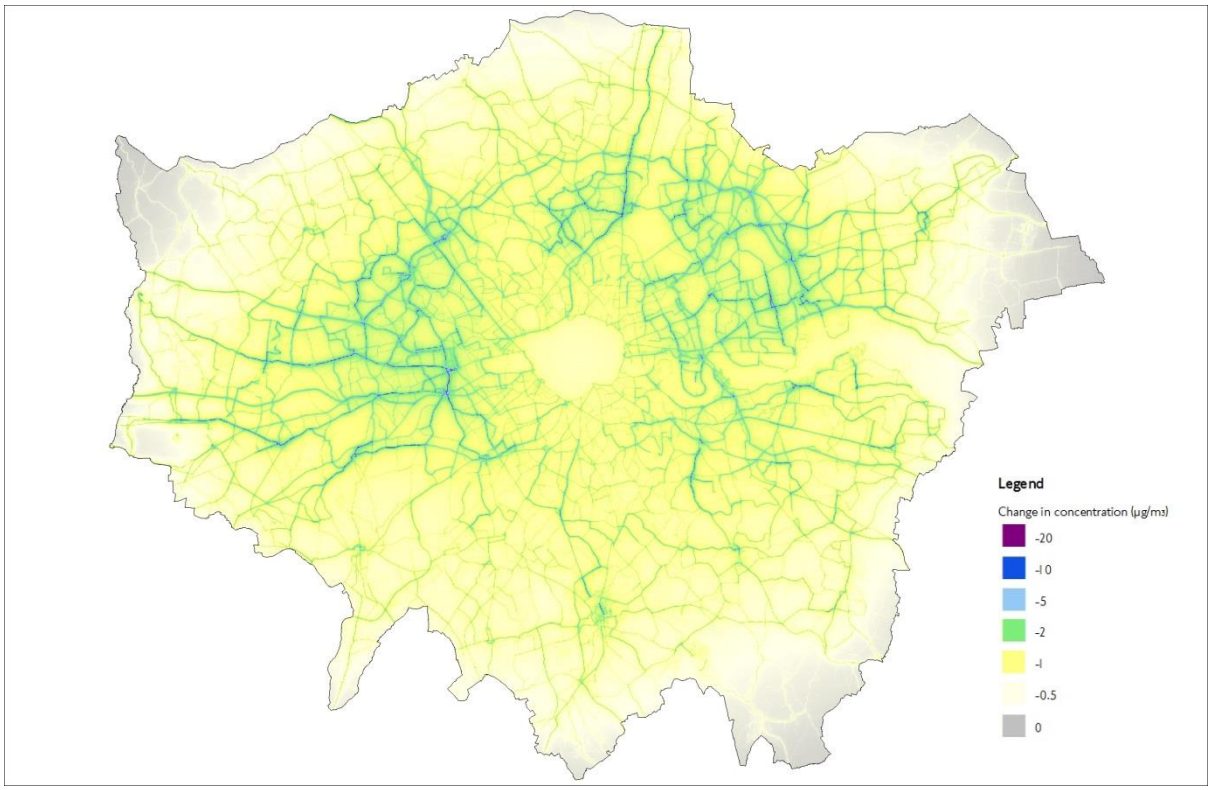


Figure 43: Change in NO_2 concentrations with proposals in inner London in 2025

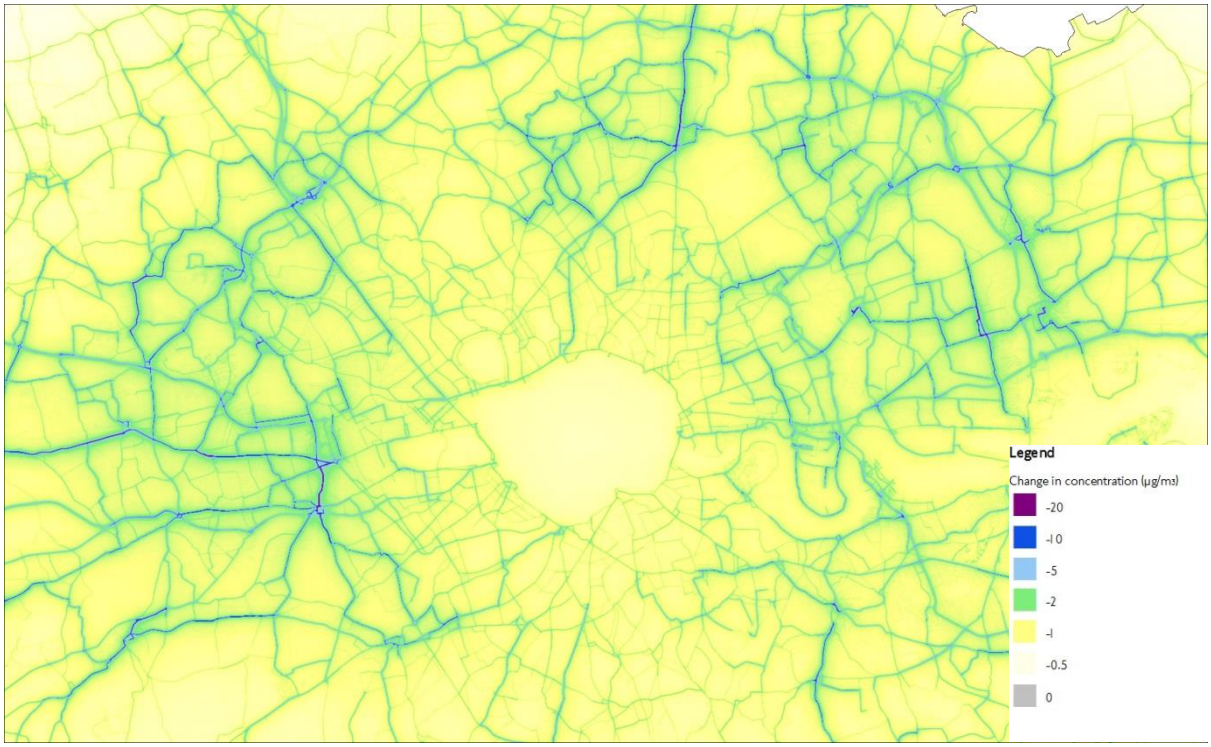
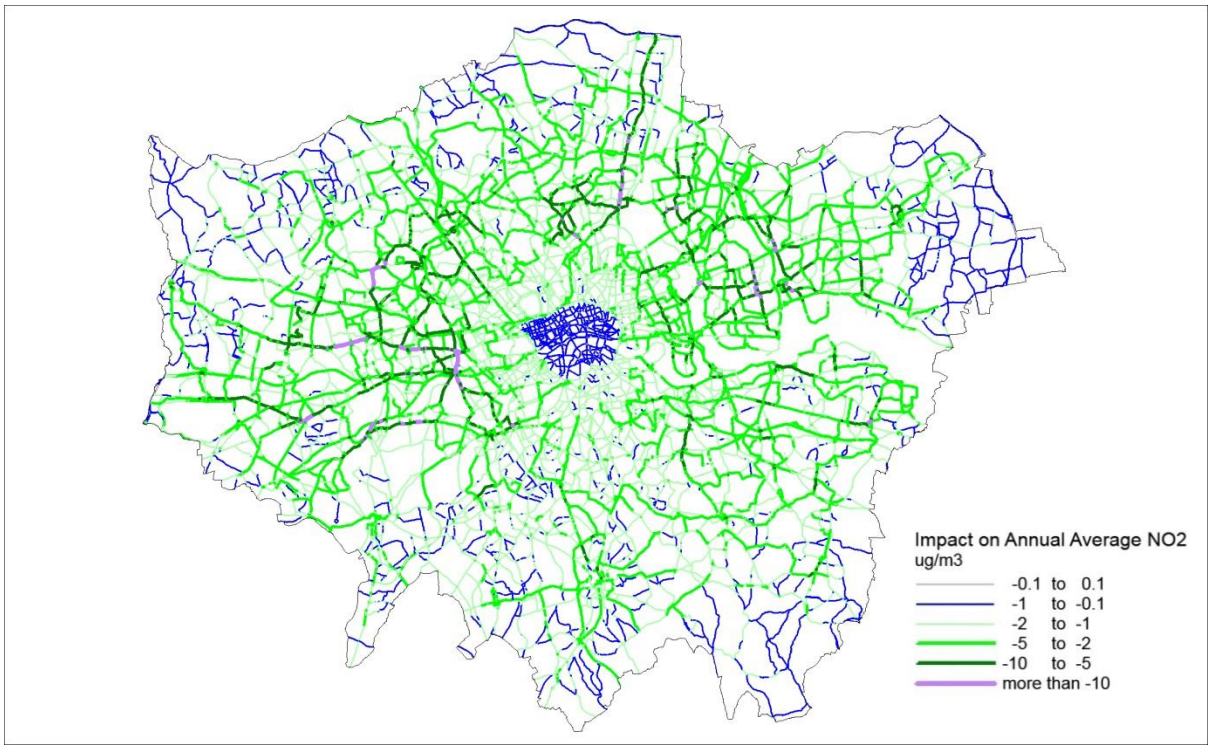


Figure 44: Change in NO_2 roadside concentrations in 2025



The proposals are forecast to reduce the majority of the Capital's roadside concentrations in 2020 by between 2 and 5μg/m^3 (which is between a five and 10 per cent reduction), with some roads forecast to have reductions in the order of 5 to 10μg/m^3 (equivalent to about a 15 per cent reduction). In addition some roads have reductions forecast to be about 15μg/m^3 (or about 20 per cent). Improvements in roadside concentrations, where road transport is the main contributor to high pollution levels, are forecast across all areas of London. Background concentrations are forecast to reduce by between 1 and 1.5μg/m^3 across inner London, which is a reduction of around three per cent.

In 2021, with the introduction of cars and vans to the proposals, forecast reductions in concentrations compared to the baseline are generally greater than those forecast for 2020 due to the high volume of cars and vans on many of London's roads. In 2021, the reductions across the inner zone vary, partly because the introduction of the central ULEZ will have some knock-on impacts of vehicle compliance, and also because of strategic roads in the zone where large numbers of vehicles will have become compliant. There would be an estimated reduction of about 3 to 5μg/m^3 (around a five to 10 per cent reduction) on many roads but the reductions are forecast to be higher alongside more strategic roads in the zone, including around the boundary. In these areas roadside concentrations are forecast to reduce by between 5 to 10μg/m^3. There are also some roads where forecast reductions are even higher, in the order of 12 to 15μg/m^3 (or about a 20 per cent reduction).

In outer London the forecast reductions at the roadside are generally about 3μg/m^3. Background concentrations in 2021 are forecast, on average, to reduce by between 1 and 2μg/m^3 across London.

In 2025, with the full proposals, forecast reductions in concentrations compared to the baseline are still expected as a result of the car and van fleet being cleaner in response to the ULEZ charge. In 2025, there would be an estimated reduction of about 1 to 3μg/m^3 (around a five to 10 per cent reduction) across most of the Capital's roads, although the furthest parts of outer London are forecast to have a reduction of around 0.5μg/m^3. Some larger roads within the boundary and in west London, including those in the vicinity of Heathrow Airport, are forecast to have roadside concentrations reduced further by between 5 and 10μg/m^3. Background concentrations are forecast, on average, to reduce by between 0.5 and 1μg/m^3 across London.

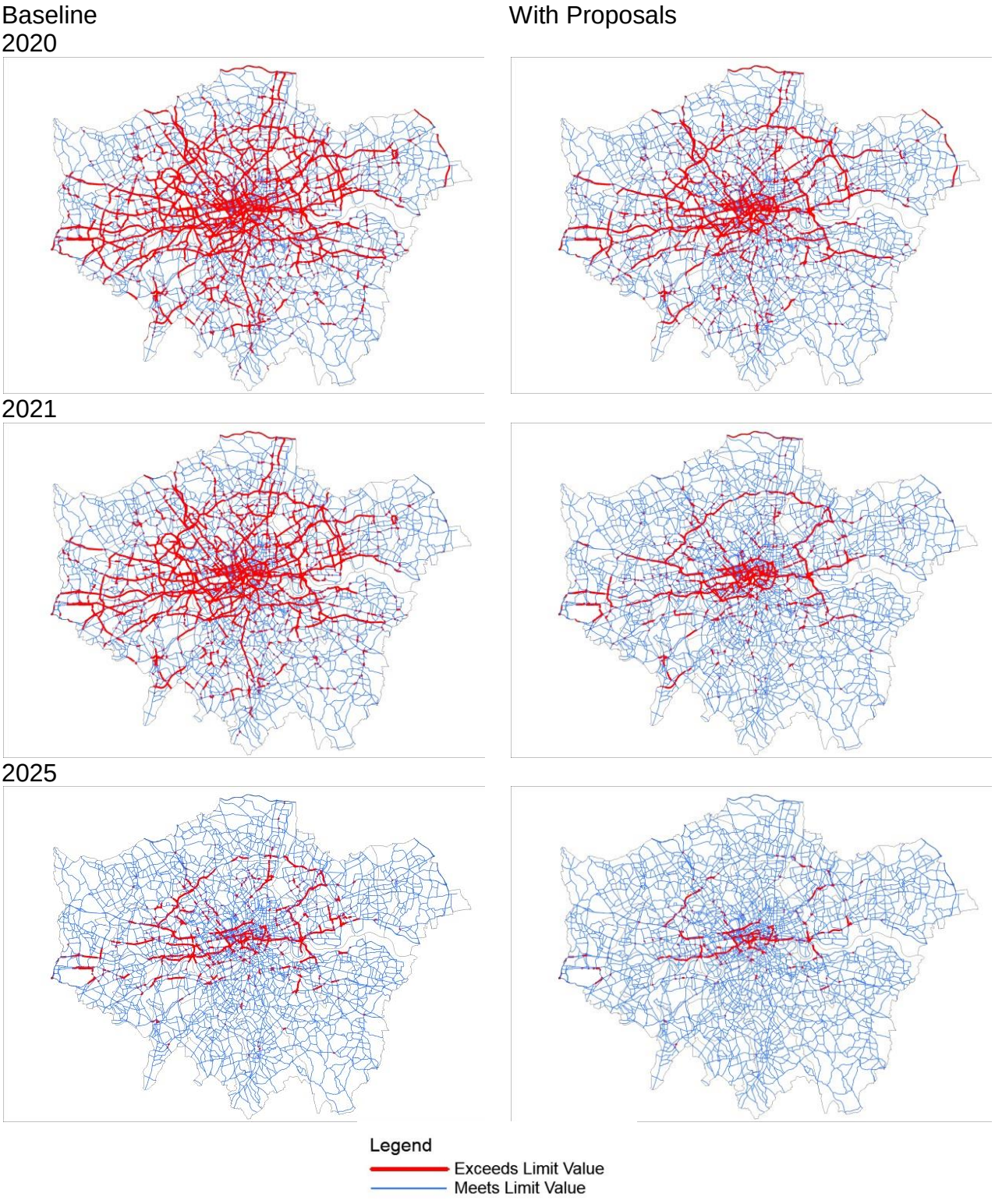
Table 34 shows the impact of the proposals on the estimated proportion of road kilometres exceeding NO_2 concentration limit values, based on concentrations representing roadside locations where pollution is higher. The proposals mean that in 2020 the proportion of road kilometres exceeding the legal limit for NO_2 could nearly halve, from around 40 per cent to 23 per cent, with further reductions in 2021 meaning that only about 12 per cent of road kilometres are estimated to exceed legal limits. This equates to a 65 per cent reduction in 2021.

In 2025, main roads in London are still predicted to exceed the NO_2 annual limit values. Even with the proposals, about 14 per cent in central, four per cent in inner, and one per cent in outer London are forecast to exceed the legal limits. Whilst this is a great improvement towards compliance, more action is needed to reduce concentrations in some areas. These include parts of central London, the North Circular and the A4 through London to the A13, and parts of the A12. However, this could be achieved through targeted strategic action and additional government-led proposals to reduce background concentrations and provide funding for proposals that would increase the levels of compliance. This is set out in the draft LES.

Table 34: Impact of the proposals road kilometres exceeding NO_2 concentration limit values 2020-2025

		Proportion of road kilometres exceeding NO2 limit values at roadside			
		Central	Inner	Outer	London-wide
Baseline	2020	54%	40%	18%	26%
	2021	48%	34%	14%	21%
	2025	17%	10%	3%	5%
With all proposals	2020	48%	23%	9%	15%
	2021	39%	12%	4%	8%
	2025	14%	4%	1%	2%
		Reduction in road kilometres exceeding NO2 limit values			
		Central	Inner	Outer	London-wide
2020		-13%	-44%	-48%	-43%
2021		-19%	-65%	-72%	-64%
2025		-16%	-61%	-76%	-61%

Figure 45: Compliant and non-compliant road links, baseline and with the proposals 2020–2025



Impact on population exposure

Reducing NO_2 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 health conditions will benefit from better air quality earlier.

The number of people living in areas exceeding the NO_2 limit value is projected to decrease across London as a direct result of the implementation of the ULEZ proposals.

In 2020, the ULEZ proposals will mean that over 90,000 people across the Capital will no longer live in areas exceeding the NO_2 limit values (based on population weighted concentrations). Nearly 80,000 of these are within North and South Circular Roads. This will be a 50 per cent reduction in the number of people living in areas exceeding limit values in London.

In 2021, the ULEZ proposals will mean that about 100,000 people will no longer live in areas exceeding the NO_2 limit values when compared to the baseline. This will be a reduction of nearly 80 per cent.

In 2025, without the ULEZ expansion, about 12,000 people are forecast to live in areas of exceedence but this is expected to reduce to about 3,000 with these proposals. This would mean less than one per cent of people in all parts of London would be living in areas exceeding limit values. .

Figure 46 shows how the pattern of exceeding population in London is expected to change as a result of these proposals, whilst Figure 47 shows the exceeding population per borough.

Table 35: Impact of the proposals on populations living in areas exceeding NO_2 limit values in 2020-2025[30]

2020	Estimated total population	Total population in Output Areas exceeding NO_2 limit value		Proportion of population living in areas exceeding NO_2 limits		Change in number of people living in areas of exceedence	Change in proportion of people living in areas of exceedence
		Baseline	With Proposal	Baseline	With Proposal		
Central	209,700	23,600	14,000	11%	7%	-9,600	-41%
Inner	3,781,300	142,100	72,900	4%	2%	-69,200	-49%
Outer	5,080,200	18,500	5,300	<1%	<1%	-13,200	-71%
London-wide	9,071,200	184,200	92,200	2%	1%	-92,000	-50%

2021	Estimated total population	Total population in Output Areas exceeding NO_2 limit value		Proportion of population living in areas exceeding NO_2 limits		Change in number of people living in areas of exceedence	Change in proportion of people living in areas of exceedence
		Baseline	With Proposal	Baseline	With Proposal		
Central	214,500	15,700	6,300	7%	3%	-9,400	-60%
Inner	3,837,000	104,900	23,700	3%	1%	-81,200	-77%
Outer	5,128,600	11,200	400	<1%	<1%	-10,800	-96%
London-wide	9,180,100	131,800	30,400	1%	<1%	-101,400	-77%

[30] Population estimates are rounded.

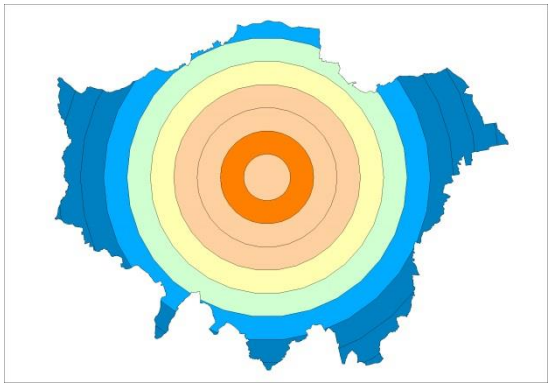
2025	Estimated total population	Total population in Output Areas exceeding NO_2 limit value		Proportion of population living in areas exceeding NO_2 limits		Change in number of people living in areas of exceedence	Change in proportion of people living in areas of exceedence
		Baseline	With Proposal	Baseline	With Proposal		
Central	223,600	700	100	<1%	<1%	-600	-86%
Inner	3,966,900	11,000	3,000	<1%	<1%	-8,000	-73%
Outer	5,260,400	400	0	<1%	0%	-400	-100%
London-wide	9,450,900	12,100	3,100	<1%	<1%	-9,000	-74%

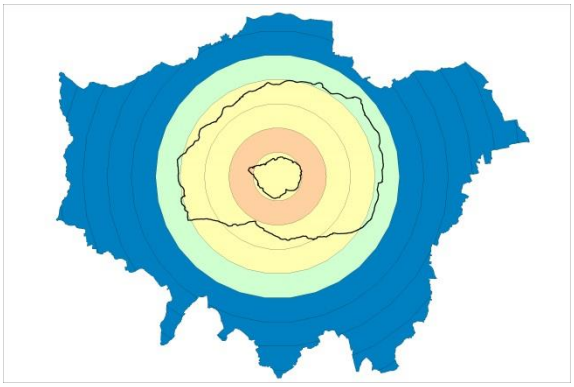
Figure 46: The impact of the proposals on populations living in areas of exceedence 2020–2025

Baseline

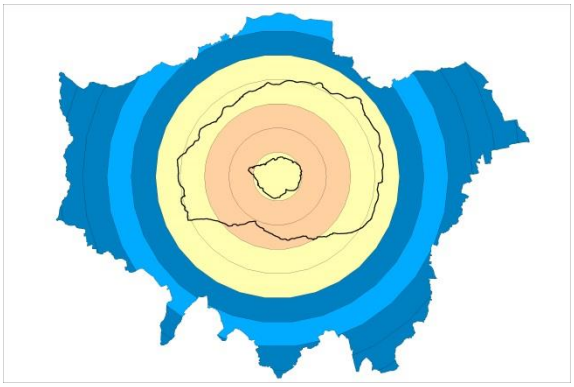
With Proposals

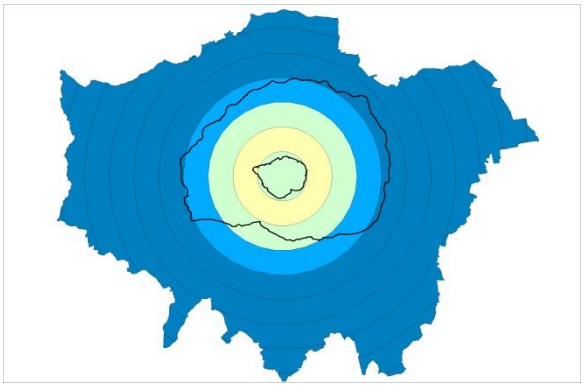
2020



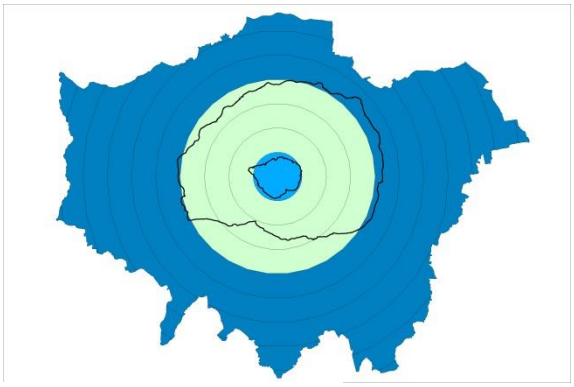


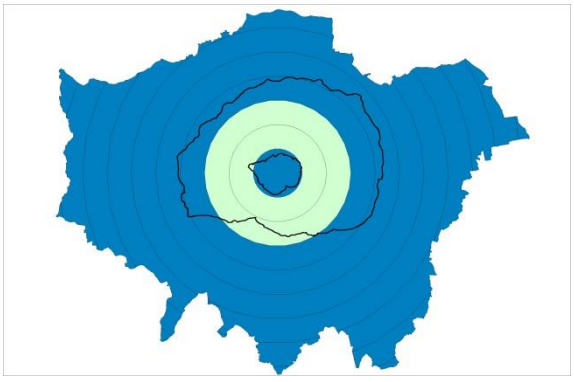
2021





2025





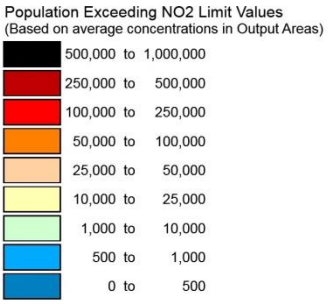
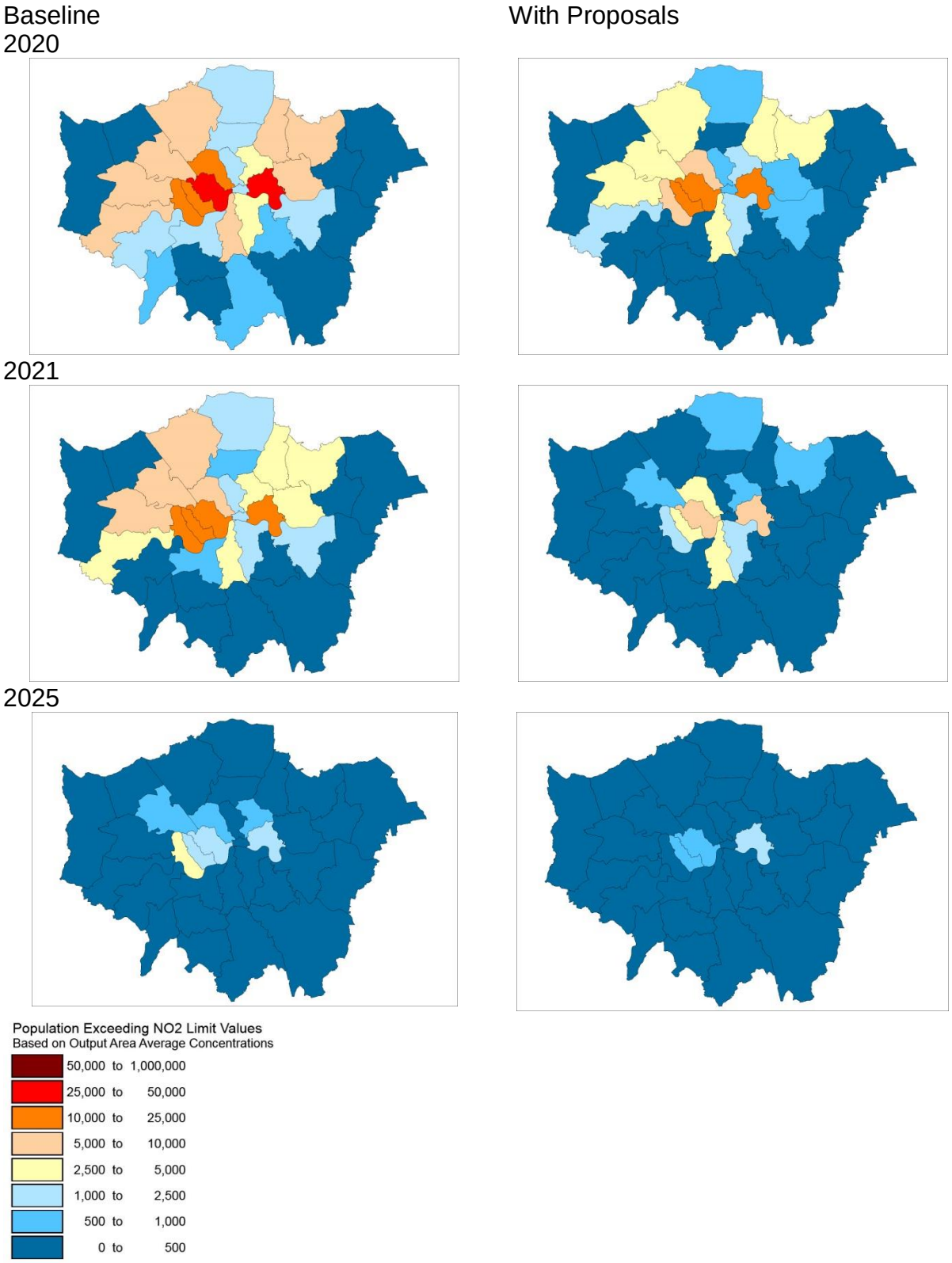


Figure 47: Impact of proposals on population living in areas of exceedence 2020-2025 by borough



Impact on Schools hospitals and Care Homes (sensitive receptors) [31]

There will be a reduction in the number of schools, care homes and hospitals in areas exceeding limit values. This is set out in Table 36. In 2020, as a result of implementing the ULEZ proposals it is expected that 41 fewer schools will be exposed to illegal levels of air pollution in comparison to the 2020 baseline. This equates to a 63 per cent reduction. In 2021, due to the proposals 27 fewer schools will exceed the limit, a 71 per cent reduction. In 2025, three schools are expected to remain above the legal limit in the baseline. Due to the proposals it is expected two of these will no longer be in exceedence.

The majority of the schools which will no longer exceed legal limits due to the ULEZ proposals are located in central and inner zones. Two schools which will drop below the limit due to the proposals sit on the boundary of the expanded ULEZ zone, next to the North Circular. Three schools in outer London will drop below the limit due to the proposals.

In 2020, 14 care homes and one hospital will no longer exceed legal limits due to the proposals. In 2021 the equivalent figures are three hospitals and ten care homes no longer exceeding limits. In the 2025 baseline no hospitals or care homes remain in exceedence.

[31] The database used to calculate the numbers of schools, hospitals and care homes was Addresspoint, an Ordnance Survey product, which was downloaded in July 2017. Both public and private institutions were included and duplicate locations were removed.

'Schools': Schools were defined as levels of education from nursery through to secondary school (Addresspoint 'CLASS' CE02 – CE04SS).

'Care homes': The term 'care home' is used here to represent both care homes and nursing homes (Addresspoint 'CLASS' RI01).

'Hospitals': Hospitals and hospices were included (Addresspoint 'CLASS' CM03, CM03HP).

Table 36: Impact on sensitive receptors 2020-2025

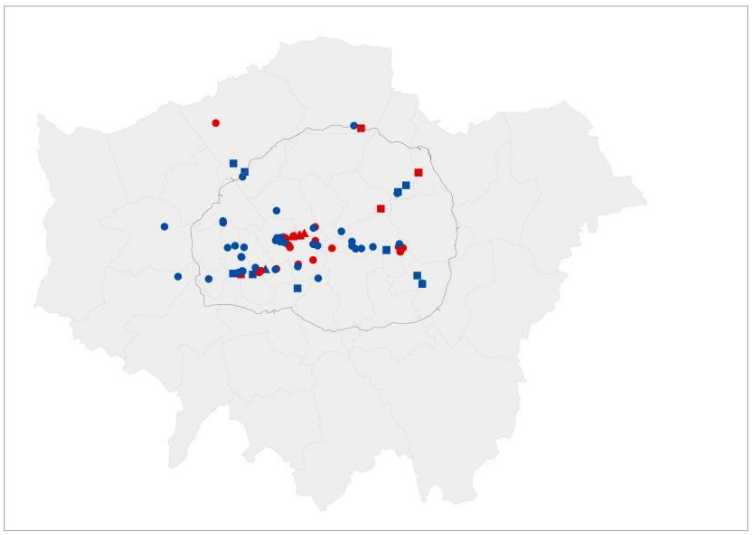
2020	Baseline			With proposals			Change		
Area	No. of schools in areas exceeding NO_2 limit	No. of hospitals in areas exceeding NO_2 limit	No. of care homes in areas exceeding NO_2 limit	No. of schools in areas exceeding NO_2 limit	No. of hospitals in areas exceeding NO_2 limit	No. of care homes in areas exceeding NO_2 limit	Change in no. of schools with proposals	Change in no. of hospitals with proposals	Change in no. of care homes with proposals
Central	14	6	0	8	6	0	-6	0	0
Inner	47	3	17	15	2	5	-32	-1	-12
Outer	4	0	2	1	0	0	-3	0	-2
Total	65	9	19	24	8	5	-41	-1	-14

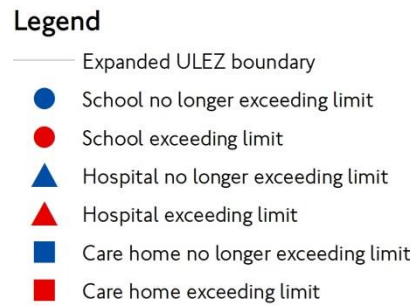
2021	Baseline			With proposals			Change		
Area	No. of schools in areas exceeding NO_2 limit	No. of hospitals in areas exceeding NO_2 limit	No. of care homes in areas exceeding NO_2 limit	No. of schools in areas exceeding NO_2 limit	No. of hospitals in areas exceeding NO_2 limit	No. of care homes in areas exceeding NO_2 limit	Change in no. of schools with proposals	Change in no. of hospitals with proposals	Change in no. of care homes with proposals
Central	7	6	0	3	4	0	-4	-2	0
Inner	29	2	10	8	1	0	-21	-1	-10
Outer	2	0	0	0	0	0	-2	0	0
Total	38	8	10	11	5	0	-27	-3	-10

2025	Baseline			With proposals			Change		
Area	No. of schools in areas exceeding NO_2 limit	No. of hospitals in areas exceeding NO_2 limit	No. of care homes in areas exceeding NO_2 limit	No. of schools in areas exceeding NO_2 limit	No. of hospitals in areas exceeding NO_2 limit	No. of care homes in areas exceeding NO_2 limit	Change in no. of schools with proposals	Change in no. of hospitals with proposals	Change in no. of care homes with proposals
Central	1	0	0	1	0	0	0	0	0
Inner	2	0	0	0	0	0	-2	0	0
Outer	0	0	0	0	0	0	0	0	0
Total	3	0	0	1	0	0	-2	0	0

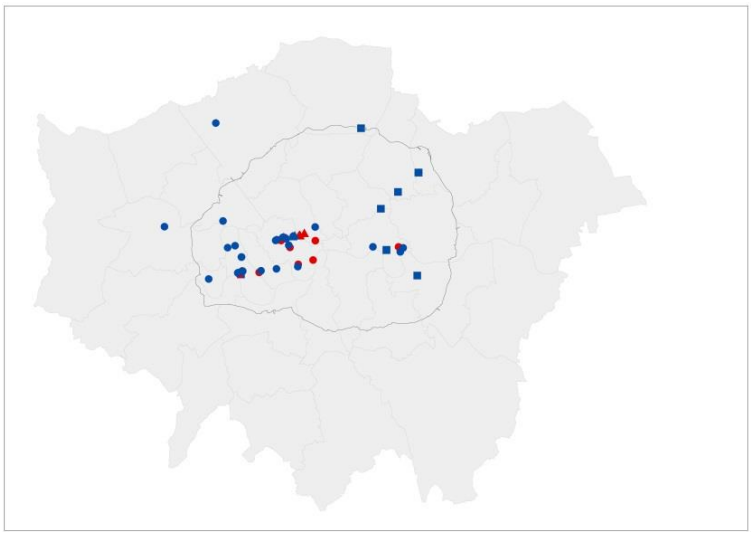
Figure 48: Change in schools, hospitals and care homes in areas exceeding legal limits

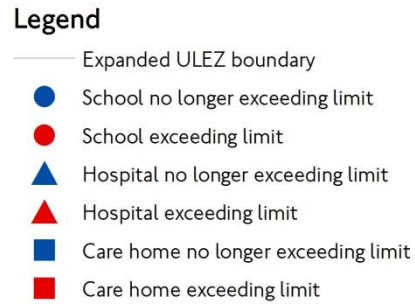
2020



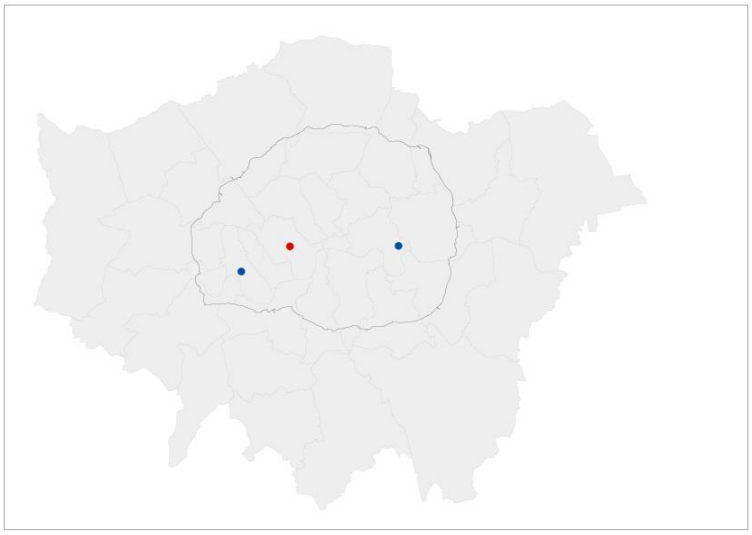


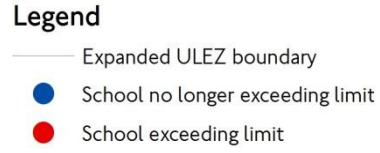
2021





2025





Monetised health impacts

The health benefits of the proposals shown by the reductions in mortality and hospital admissions have been calculated. Full details are provided within the Integrated Impact Assessment.

The improved health outcomes associated with reduced NO_x emissions due to the implementation of the heavy vehicles London-wide charge in 2020 are estimated to have a total monetised benefit of £28.9m London-wide in comparison to the baseline. This will reduce to £21.4m in 2025.

6.5 PM_{10} and $PM_{2.5}$ Concentrations

The proposals will result in reductions in PM_{10} and $PM_{2.5}$ concentrations as set out in the figures below.

Figure 49: PM_{10} concentrations 2020 - 2025 with proposals

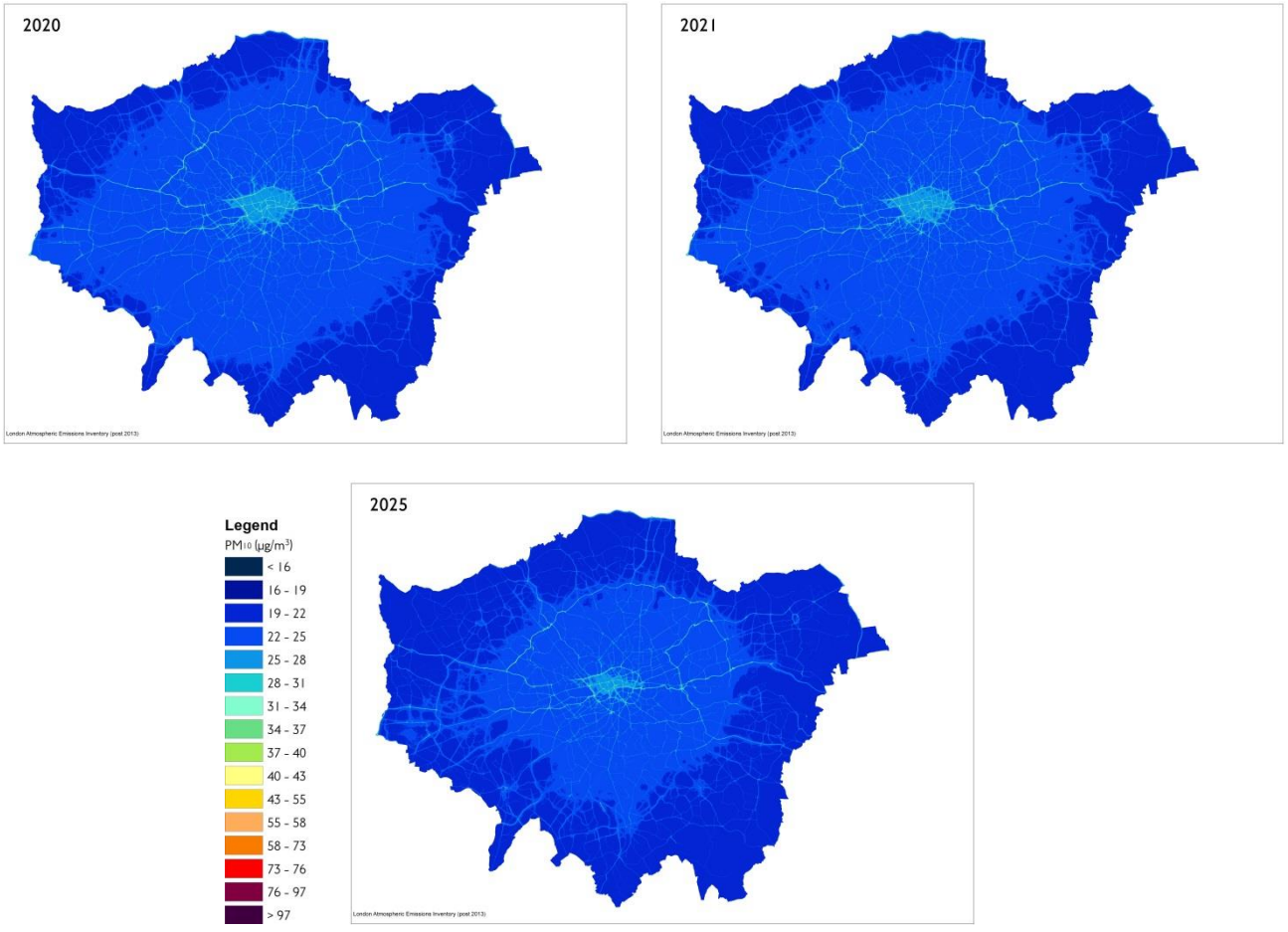
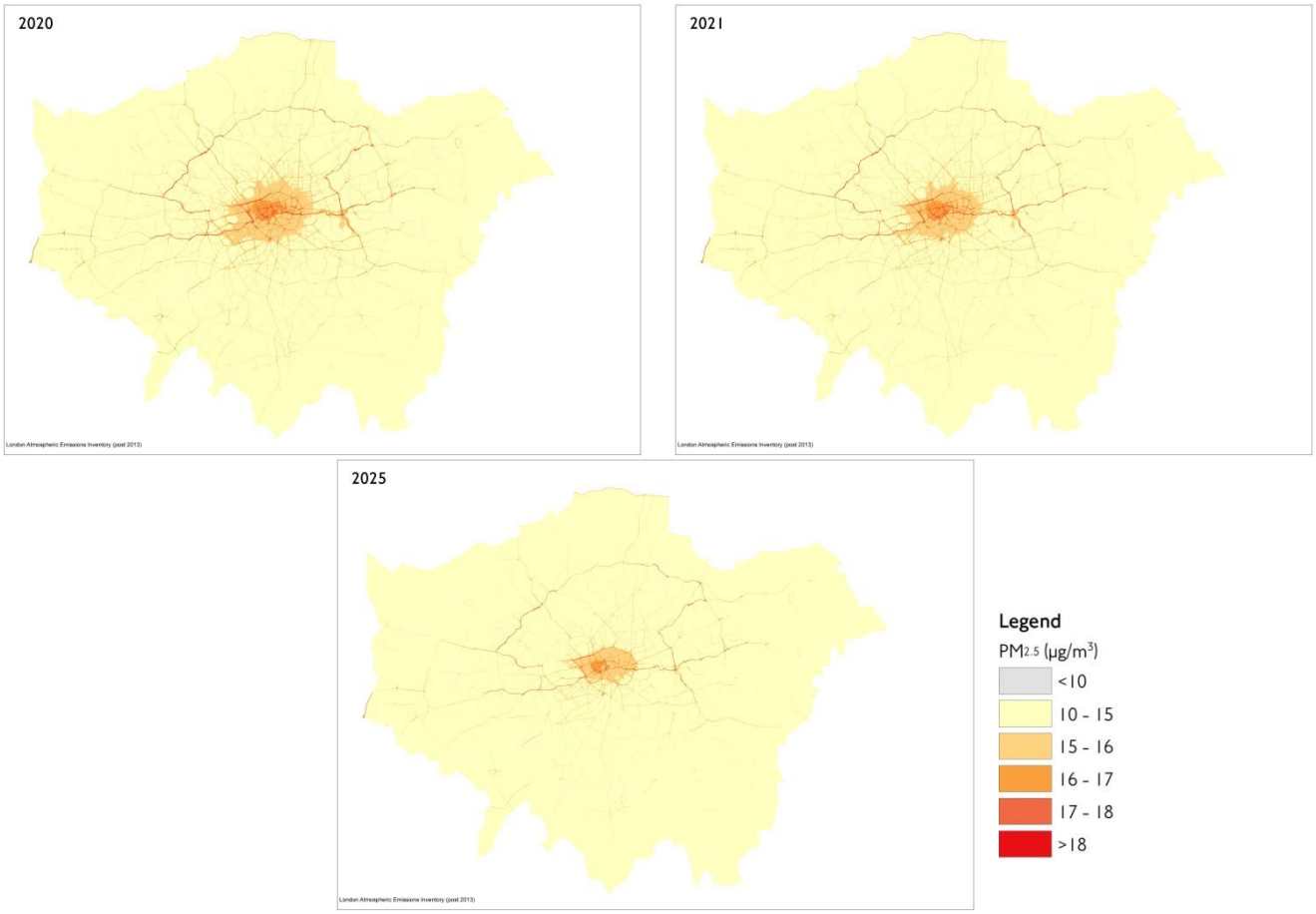


Figure 50: PM2.5 concentrations 2020 –- 2025 with proposals



6.6 Boundary impacts

The boundary to the inner zone could experience both negative and positive impacts. Non-compliant vehicles may use it to avoid the zone but equally vehicles that have been upgraded to be compliant with the proposals may also utilise these routes. Any reduction in trips within the zone (as shown in section 6.3) will also have a knock on reduction onto the boundary road.

The expected pattern of change on the boundary road allowed for the outputs of the assignment modelling to be grouped into areas. Figure 51 shows these groupings

Figure 51: Link level output groupings

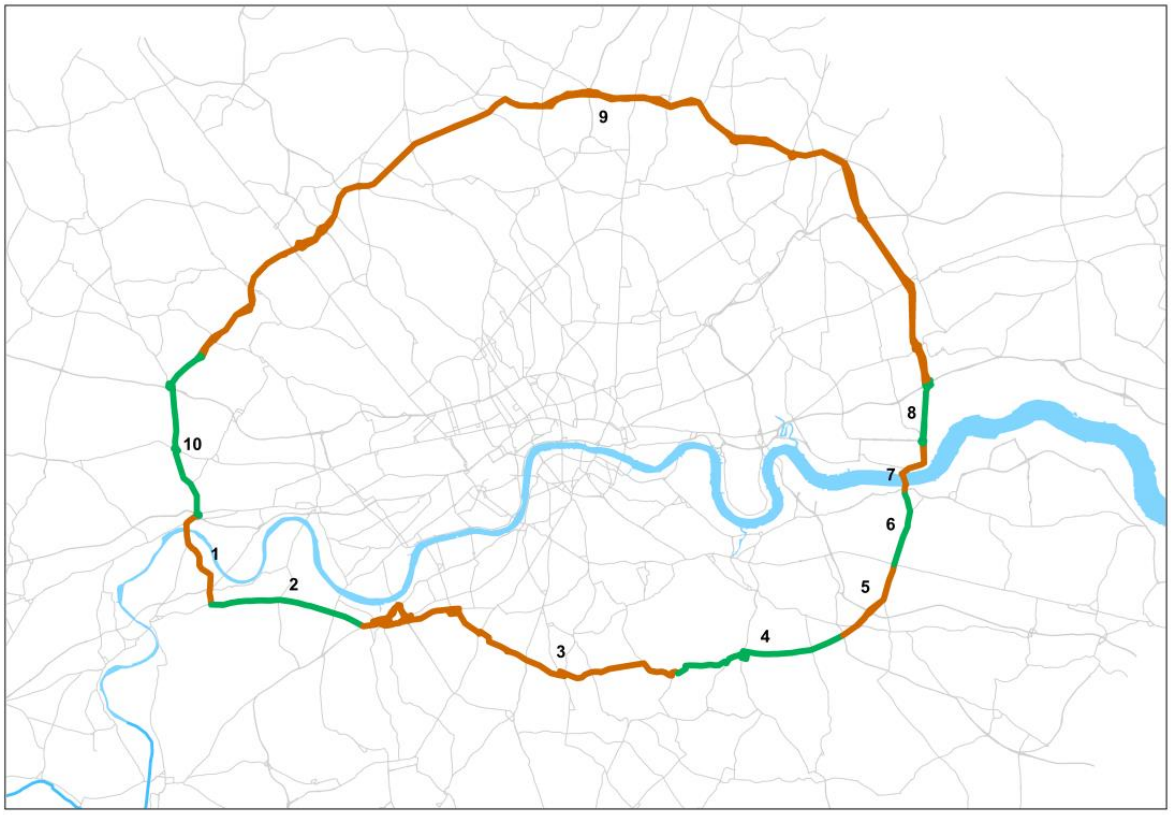


Table 37 shows the impact in 2021, for each segment of the boundary, on the proportion of cars and vans that meet the standard; the overall change in vehicle kilometres and speed, and the change in NO_x emissions.

Table 37: Change in compliance, speed and vehicle km, and emissions on boundary route in 2021

ID	Description	Car Compliance	LGV Compliance	Change in vehicle km compared with 'no ULEZ'	Change in speed compared with 'no ULEZ'	NO_x emissions change
1	West river crossing area (Kew to Richmond)	76%	54%	0%	0%	-26%
2	Upper Richmond Road to Wandsworth	79%	51%	3%	0%	-33%
3	Wandsworth to Forest Hill	89%	68%	-1%	0%	-25%
4	Forest Hill to Horn Park	87%	63%	0%	0%	-24%
5	Horn Park to A2	84%	58%	1%	0%	-24%
6	East river crossing	84%	55%	2%	0%	-30%
7	Approach to Woolwich Ferry to Beckton	69%	45%	1%	0%	-24%
8	Beckton to A13 Newham Way	85%	65%	-2%	0%	-20%
9	Northern section	87%	66%	1%	0%	-23%
10	Stonebridge to Hanger Lane and Kew	85%	65%	-1%	0%	-28%

As a result of the full package of measures there is an overall net benefit on the boundary as a whole with emissions reduction generally within 20 to 30 per cent. However we see variability in emissions reductions around the boundary is a result of estimated car and van compliance alongside changes in traffic flows, but all areas including the approaches to river crossings are forecast to have improvements in road traffic emissions as a result of the full proposals for the expansion of ULEZ. Figure 52 and Figure 53 show the change in NO_2 concentrations for the boundary links.

We forecast that in 2021, concentrations would improve by between 5 to 10 μg/m3 across the majority of the boundary, but all areas of the boundary see improvements in concentrations as result of the full proposals. These improvements continue in 2025 and forecast to be mostly in the range of between 2 to 5 $\mu g/m^3$. In terms of compliance, it is estimated that in 2021 about 70 per cent of the boundary exceeds the limit values for NO_2, and this is estimate to reduce to about 40 per cent with full proposals. Without the proposals, in 2025 about 30 per cent of the boundary is estimated to exceed limit values, and this is forecast to reduce to 10 per cent with the proposals.

Figure 52: Change in NO_2 concentrations around boundary 2021

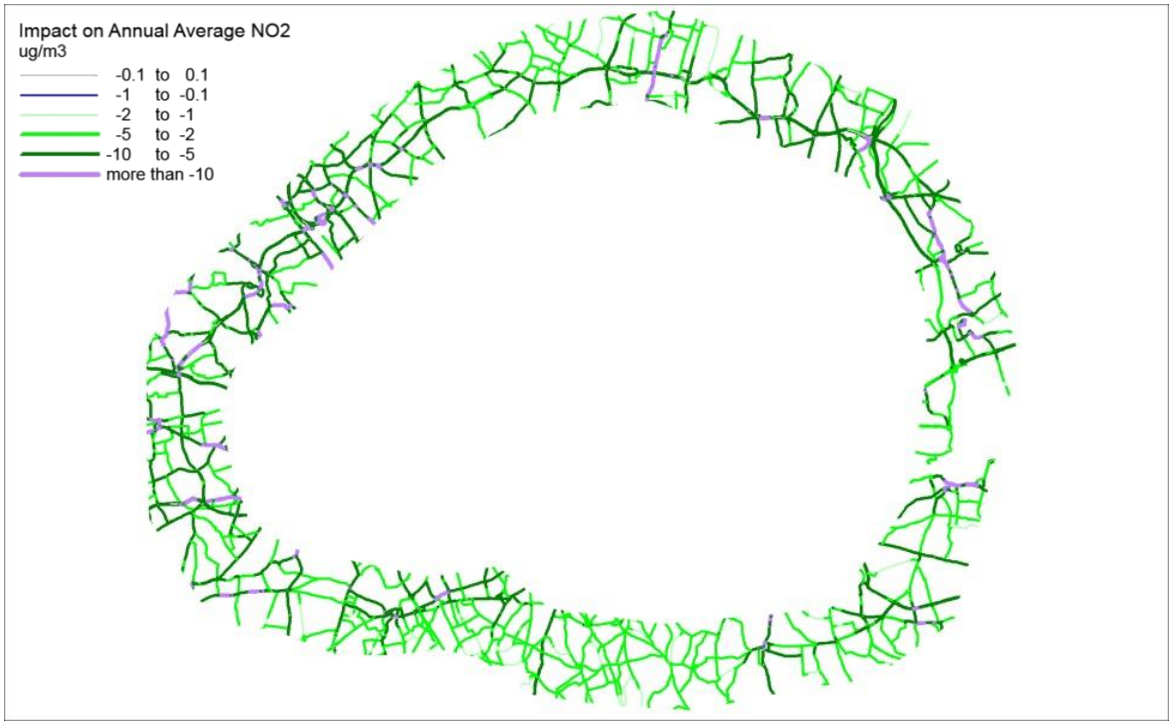
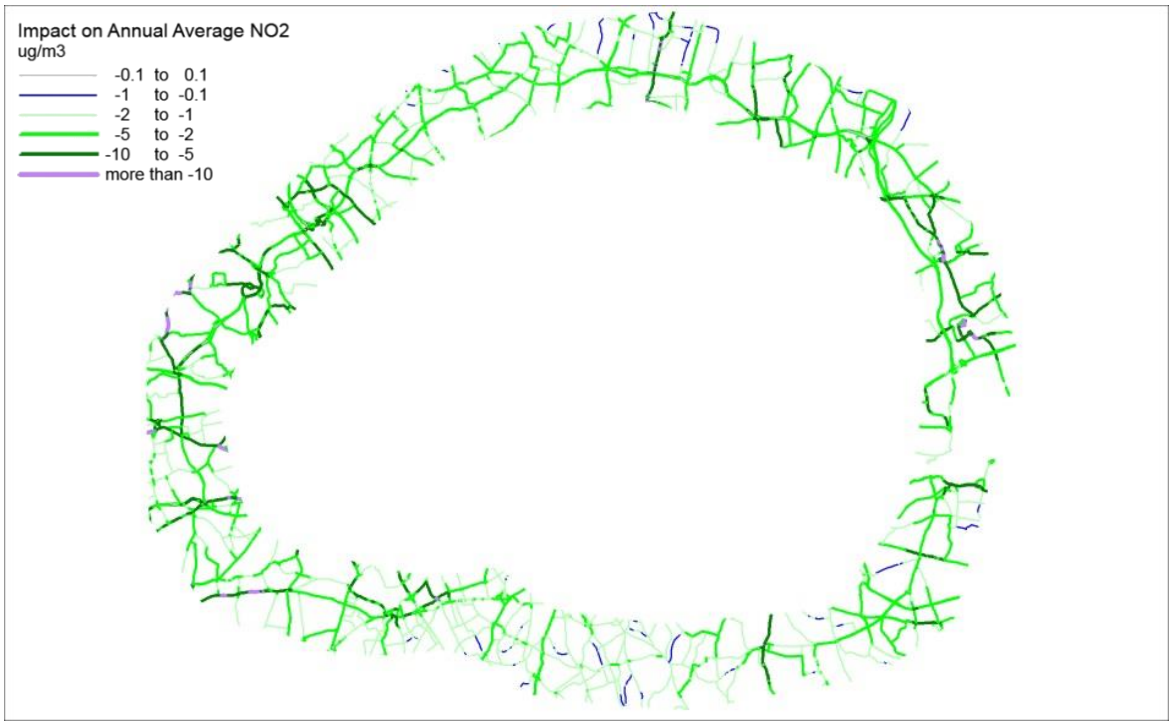


Figure 53: Change in NO_2 concentrations around boundary 2025



6.7 Discussion on a London-wide option for all vehicles

A London-wide option for all vehicles has been carefully considered in response to stakeholder feedback on previous stages of consultation and was discussed in section 5.4 above.

A high level estimate of the emissions savings from a scheme that would apply to all vehicles as been undertaken as a sensitivity test in 2021 and the results are below

Table 38: Sensitivity test on a London-wide option for all vehicles

2021		Total road transport	Cars, vans, minibuses and L-Category vehicles	Coaches and HGVs	Buses
Inner (excluding CCZ)	Reduction (t)	1260	420	250	590
	Reduction (%)	31%	17%	44%	78%
Outer	Reduction (t)	3040	1360	500	1170
	Reduction (%)	34%	20%	50%	87%

However as discussed previously there are parts of outer London that are significantly less well connected by public transport than in the inner zone, and areas with a lower percentage of compliant vehicles. In view of this, and the higher levels of car ownership in outer London, it is unlikely that we would see the same levels of compliance with the standards, or shifts to more sustainable modes as in the inner zone or to achieve the reductions indicated above. We would instead be more likely to see an increase in the proportion that opts to 'stay and pay'.

As has been illustrated earlier the change in the LEZ standards and the expansion of the ULEZ to inner London brings significant benefits to outer London. For the remaining parts of outer London that are in exceedence after the implementation of the expanded ULEZ a more targeted approach at the remaining hotspots is likely to be more appropriate and cost effective.

In the long term, the MTS sets out goals for all of London's transport system to reach zero emissions by 2050. As a shorter-term measure, we do not believe that a London-wide scheme for all vehicles is appropriate.

6.8 Integrated Impact Assessment (IIA)

We commissioned Jacobs Consultancy to carry out an IIA for the expansion of the ULEZ and changes to the LEZ. An assessment was undertaken on the impacts of the proposals as a whole

The full assessment will be provided as a separate document by 11 December 2017 with mitigations proposed. However its key findings are:

Environmental impacts

- Major positive beneficial impacts predicted in reducing NO2 concentrations close to roads that are near, or above, the 40µg/m^3 value in the baseline in 2021
- Major positive beneficial impacts in reducing air pollutant emissions
- Beneficial impacts on protection of biodiversity and cultural heritage as a result
- Slight benefit in reducing CO_2 emissions
- Non-significant benefits in reducing noise
- Slight short term impact on Waste and townscape

Health Impacts

- Positive beneficial impacts through important reductions in health impacts as a result of improved air quality
- Minor benefit through a potential shift towards more active travel
- Neutral impact on Noise, Crime and community safety and Climate Change

Equalities Impacts

- Positive disproportionate beneficial impacts for those living in deprived areas, school age children, older people and pregnant women due to reductions in NO_2 concentrations

- Minor impact on connectivity if operators reduce or limit their services as a result of the ULEZ, and a possible increase in the cost of school trips affecting lower income families
- Potential negative impact on low income workers who own a non-compliant car living in areas with limited public transport who work unsocial hours.
- Potential disproportionate impact on a small number of users of Wheelchair Accessible Vehicles for whom the costs of replacement may be unaffordable.

Economic Impacts

- Neutral impact on attracting and retaining internationally mobile businesses
- Moderate adverse impact on SMEs
- Moderate financial impact on businesses

The Mayor and TfL are keen to hear from all groups affected by the proposals. The Mayor will consider whether modifications to the proposals to provide further mitigation to these impacts are appropriate as part of the consultation process.

Part 4: Future

7.1 Next steps in consultation

This consultation will run for a period of 12 weeks until 28 February 2018. TfL will then analyse the responses and the Mayor will make a decision on whether or not to proceed with the proposals.

The Mayor and TfL are keen to hear from all groups affected by the proposals. The Mayor will consider whether modifications to the proposals are appropriate as part of the consultation process.

7.2 The draft Variation Order

The ULEZ (currently in central London) and the LEZ (Londonwide) are road user charging schemes established by Transport for London under section 295 of the Greater London Authority Act 1999. They are set out in a "Scheme Order"[32] contained as a schedule to the Greater London Low Emission Zone Charging Order 2006, as amended. Implementation of the consultation proposals will involved making changes to the Scheme Order. This is done by TfL making a "Variation Order" to make the necessary changes. The Variation Order will not take effect unless and until it is confirmed by the Mayor, who may make modifications in light of responses to this consultation and other relevant considerations.

A draft Variation Order to implement the changes to the Scheme Order required by the consultation proposals is provided as part of the consultation. A marked-up copy of the Scheme Order showing the changes that would be made by the draft Variation Order is also provided.

The draft Variation Order provides for:

- The Londonwide application of ULEZ emissions standards and charges to heavy vehicles from 26 October 2020. (This is done by incorporating them into the Low Emission Zone, which is referred to as the "Londonwide Zone" in the draft Variation Order.)
- The expansion of the geographical area of the ULEZ from central London (when it starts on 8 April 2019) to Inner London from 25 October 2021. (This referred to as the "Inner Zone" in the draft Variation Order.) In combination with the previous change, all vehicles in Inner London will be covered by ULEZ emissions standards and charges from 25 October 2021.
- The re-naming of the road user charging scheme as the" London Emission Zones Charging Scheme".

[32] The Greater London Low Emission Zone Charging Scheme

After the end of this consultation stage TfL will formally make a Variation Order and submit it to the Mayor to decide whether or not to confirm it, with or without modification.

7.3 Future proposals

Whilst there are significant benefits to the LEZ and ULEZ proposals, it is clear that further action is required at a London-wide, national and international level. More action on $PM_{2.5}$ in particular is needed as Londoners will still remain in areas exceeding recommended WHO $PM_{2.5}$ guidelines, even with the LEZ and ULEZ proposals.

The draft MTS and LES contain long-term policies and proposals to tackle $PM_{2.5}$. They also contain ideas for potential future changes to emissions standards and zones. Any of these changes would be subject to detailed feasibility studies and further consultation.

Appendix A: Explanation of vehicle emissions standards

Background

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.

The emissions 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).

Standards

Euro 1 appeared in 1992 and the standards have progressed to the current Euro 6/VI[33]. 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 tables below set out the implementation dates for each Euro standard, which differ according to vehicle type, between 1990 and 2020.

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

Figure 54: Heavy vehicle Euro standards over time

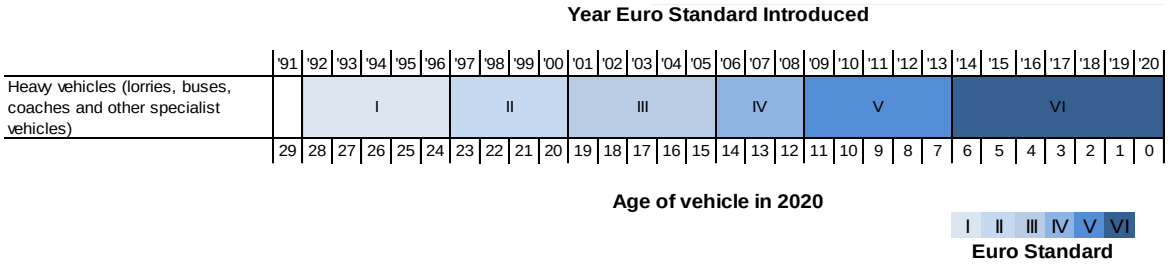
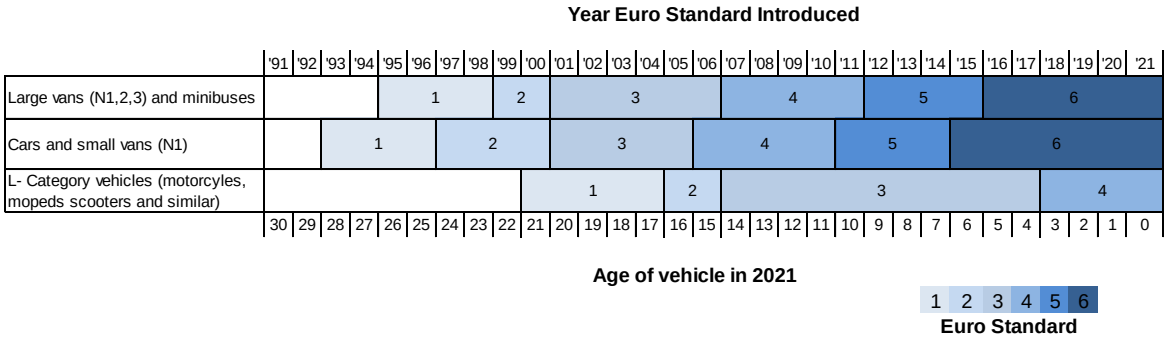


Figure 55: Light vehicle Euro standards over time



Emissions

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 duty 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.

The NO_x and PM limits for Euro 4 and Euro 6/VI vehicles are summarised in the tables below. The vehicle weights included in brackets are the reference mass of the unladen vehicle at the time of type approval testing. In the tables, 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 56: 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 57: 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

On-highway verification

For the latest Euro 6/VI emissions standards, the laboratory-based type approval tests, using the limit values set out above, are verified by on-highway emissions testing of a completed vehicle. This has been the case since 2013 for heavy duty engines where the not-to-exceed limits in the on-highway test have ensured that vehicle exhaust emissions of NO_x and PM are greatly reduced compared to earlier standards. In many cases the emissions from a heavy truck or bus are comparable with those of passenger cars.

For light duty cars and vans, the Euro 6 on-highway verification is in the form of a test protocol known as Real Driving Emissions (RDE). These verification measures are being introduced in a number of stages, which have been loosely termed `Euro 6a to Euro 6d'as follows:

- 2014 Euro 6a new reduced emissions limits
- 2017 Euro 6b new Worldwide Harmonised Light Vehicle Test Cycle (WLTC) implemented
- 2019 Euro 6c conformity factor of 2.1 to be applied to on-highway RDE test results
- 2021 Euro 6d on-highway RDE conformity factor to be reduced to 1.5

At the time of writing, the final details of these measures were still to be confirmed by a vote at the Technical Committee – Motor Vehicles (TCMV) at the European Parliament. It was expected that the measures would be confirmed.

For cars and light goods vehicles, Euro 6a essentially consisted of a reduction in the allowable NO_x emissions from diesel engines of 55 per cent. Emissions of PM and all emissions limits from petrol engines are unchanged from Euro 5.

Euro 6b was the replacement of the New European Driving Cycle (NEDC), widely acknowledged as being unrepresentative, with the WLTC, which is far more transient and representative of real driving conditions.

Euro 6c will introduce RDE testing as a verification of laboratory emissions tests. A test route conforming to detailed criteria is driven with portable emissions

measurement equipment on the vehicle. The average measured emissions must not be more than 110 per cent over the laboratory test limits (conformity factor of 2.1).

Euro 6d will see the conformity factor reduced to 1.5 (50 per cent over the laboratory test limits). This factor allows for variance between portable and laboratory emissions analysers.

Appendix B - Impact of LEZ proposals only

A scenario where only the LEZ is introduced in 2020, with no expansion of ULEZ in 2025 has been assessed. The results for 2021 and 2025 are presented in this chapter (2020 results will be the same as chapter 6).

8.1 Impact on emissions

This section outlines the emissions impact of the scheme in 2021 and 2025. Savings are split between inner London (inside the North and South Circulars) and outer London (outside the zone).

We would not expect significant additional benefits in central London as all vehicles will be subject to the ULEZ in this area in 2019. However there may be some additional benefits as vehicles that travel more frequently in the rest of London but only occasionally in central London may upgrade when they previously would have opted to pay the charge.

NO_x impacts

Indicates the potential year on year NO_x savings from the proposals to strengthen LEZ, with modelled savings up to 2025 and indicative savings to 2030.

Figure 58: NO_x impact of LEZ proposals only

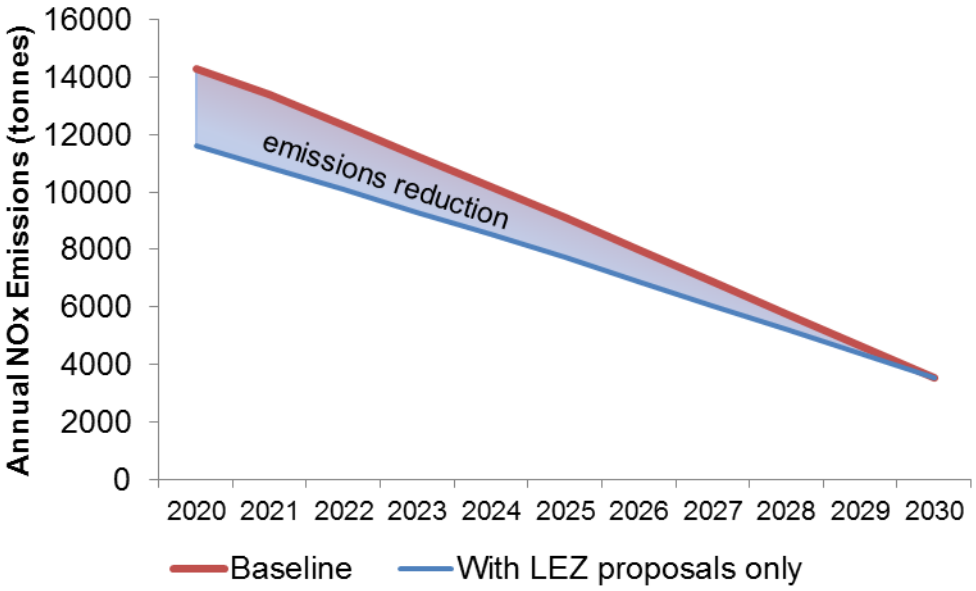


Table 39 and Table 40 show the NO_x emissions savings that would be realised in inner London and outer London broken down by vehicle class. An expansion of the ULEZ standards for heavies only would mean Londoners in inner and outer London experience the benefits in emissions reductions. In 2021 there would be a reduction

of road transport emissions of NOx of 21 % in inner London and 19% in outer London. A total reduction road transport NOx of 19% London-wide.

Table 39: NO_x impacts of LEZ only proposal 2021

2021		Total road transport	Coaches	Buses	HGVs
Inner (excluding CCZ)	Reduction (t)	840	90	590	160
	Reduction (%)	21%	54%	78%	40%
Outer	Reduction (t)	1670	170	1170	340
	Reduction (%)	19%	59%	87%	47%

Table 40: NO_x impact of LEZ only proposal 2025

2025		Total	Coaches	Buses	HGVs
Inner (excluding CCZ)	Reduction (t)	510	20	430	60
	Reduction (%)	18%	26%	73%	24%
Outer	Reduction (t)	880	30	730	120
	Reduction (%)	15%	27%	81%	29%

PM_{10} and $PM_{2.5}$ impacts

Table 41 and Table 42 show the PM emissions savings that would be realised in inner London and outer London broken down by vehicle class.

In 2021 there would be a reduction in road transport PM_{10} of one per cent in inner and outer London. For $PM_{2.5}$ the reduction is about two per cent.

In total there would be a reduction in road transport PM_{10} and $PM_{2.5}$ emissions of one per cent across London.

Whilst the impacts on PM emissions are comparatively smaller than for NO_2, due to the majority of these emissions sources coming from tyre and brake particles any reductions in PM_{10} and $PM_{2.5}$ emissions are important for bringing forward health benefits for Londoners by improving air quality.

Table 41: PM_{10} Impact of LEZ only proposal 2021

2021		Total	Coaches	Buses	HGVs
Inner (excluding CCZ)	Reduction (t)	6	1	4	1
	Reduction (total %)	1%	6%	7%	2%
	Reduction (% of exhaust PM_{10})	11%	51%	69%	38%
Outer	Reduction (t)	13	1	9	3
	Reduction (total %)	1%	6%	11%	2%
	Reduction (% of exhaust PM10)	10%	55%	82%	40%

Table 42: PM10 Impact of LEZ only proposal 2025

2025		Total	Coaches	Buses	HGVs
Inner (excluding CCZ)	Reduction (t)	4	0	3	0
	Reduction (total %)	1%	1%	5%	1%
	Reduction (% of exhaust PM10)	11%	22%	62%	23%
Outer	Reduction (t)	7	0	5	1
	Reduction (total %)	1%	1%	7%	1%
	Reduction (% of exhaust PM10)	9%	23%	73%	24%

Table 43: PM2.5 Impact of LEZ only proposals 2021

2021		Total	Coaches	Buses	HGVs
Inner (excluding CCZ)	Reduction (t)	6	1	4	1
	Reduction (total %)	2%	11%	14%	3%
	Reduction (% of exhaust PM2.5)	11%	51%	69%	38%
Outer	Reduction (t)	12	1	8	3
	Reduction (total %)	2%	12%	22%	4%
	Reduction (% of exhaust PM2.5)	10%	55%	82%	40%

Table 44: PM2.5 Impact of LEZ only proposal 2025

2025		Total	Coaches	Buses	HGVs
Inner (excluding CCZ)	Reduction (t)	3	0	3	0
	Reduction (total %)	1%	3%	11%	1%
	Reduction (% of exhaust PM2.5)	11%	22%	62%	23%
Outer	Reduction (t)	6	0	5	1
	Reduction (total %)	1%	2%	14%	2%
	Reduction (% of exhaust PM2.5)	9%	23%	73%	24%

CO_2 impacts

CO_2 emissions from larger vehicles such as buses and HGVs are predicted to increase very slightly but as a percentage change this equates to less a tenth of a percent. This is because the increased testing requirements to reach the Euro VI standard for NO_x and PM_{10} 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 PM_{10} that are achieved through the Euro VI vehicle standards. Over time, as technology and fuel quality (such as increasing biofuels proportions)

evolve, CO_2 from HGVs will reduce. The requirement for all TfL double decker buses in the CCZ and all new TfL double decker buses anywhere in London from 2018 to be hybrid or better means that CO_2 emissions from these vehicles will still reduce.

8.2 Impact on concentrations

Implementation of the LEZ only proposals would see concentrations fall across London in 2021 and 2025, although with lower benefits than the full package of proposals.

NO_2 impacts

Figure 59 and Figure 60 show maps of the predicted concentrations across London in, 2021 and 2025 with the LEZ changes only.

Figure 59: NO_2 concentrations in 2021 with LEZ changes only

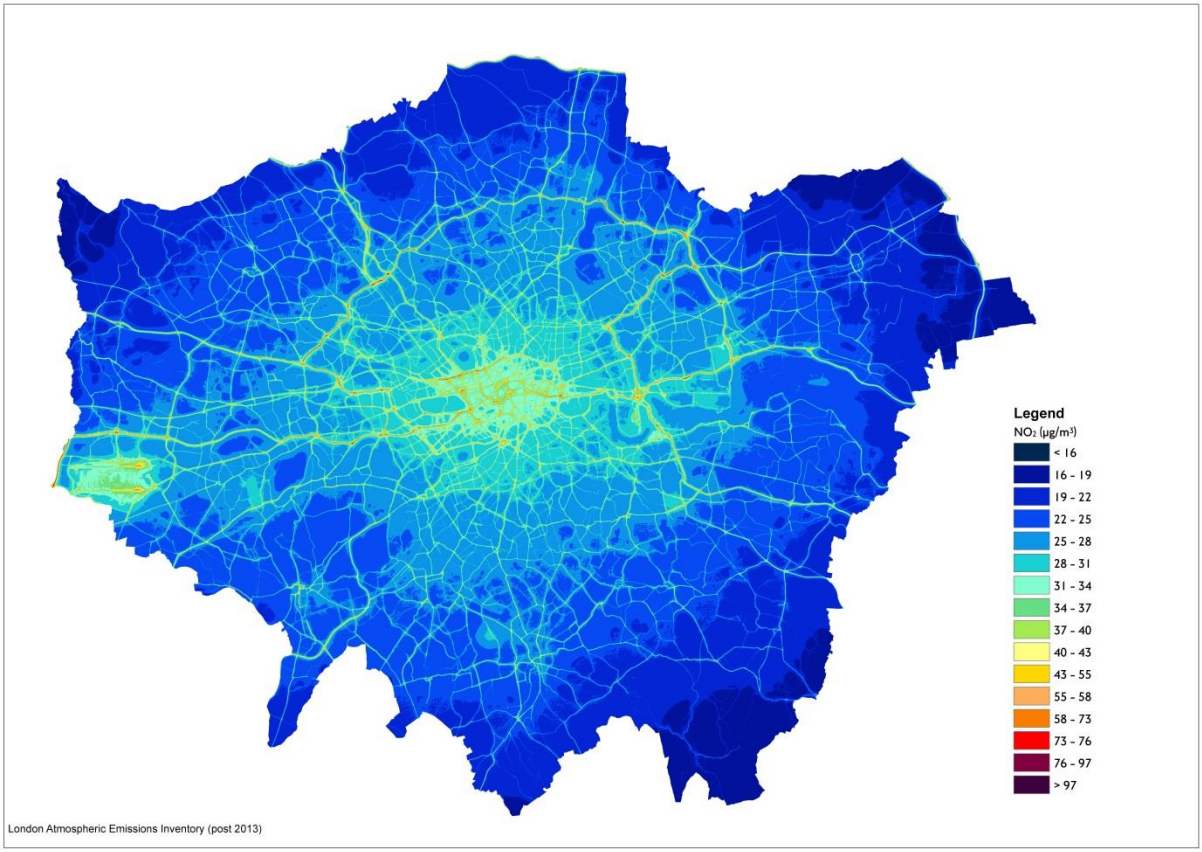


Figure 60: NO_2 concentrations in 2025 with LEZ changes only

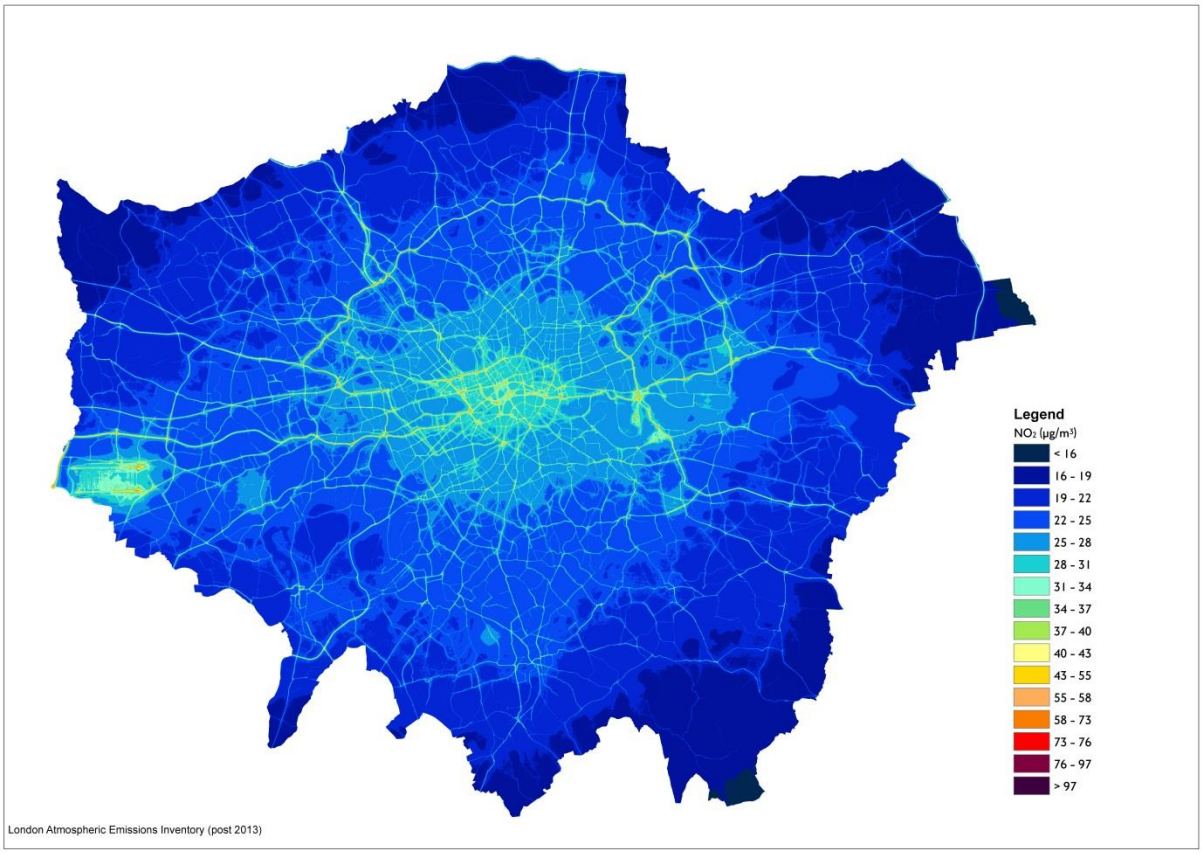


Table 45 shows the impact of the proposals on the number of road kilometres exceeding NO_2 concentration limit values. Whilst there are still significant reductions from the LEZ only proposal, there remain significant areas London-wide in exceedence of the legal NO_2 limits. Additional action would be required, such as the proposed expansion of ULEZ.

Table 45: Impact of the LEZ proposal on road kilometres exceeding NO_2 concentration limit values

	Proportion of road km exceeding NO_2 limit values at roadside			Reduction in road kilometres exceeding NO_2 limit values		
	Baseline 2021	With policies 2021	Baseline 2025	With policies 2025	With policies 2021	With policies 2025
Central	48%	42%	17%	15%	-11%	-11%
Inner	34%	18%	10%	6%	-47%	-46%
Outer	14%	7%	3%	1%	-49%	-55%
London-wide	21%	12%	5%	3%	-45%	-45%

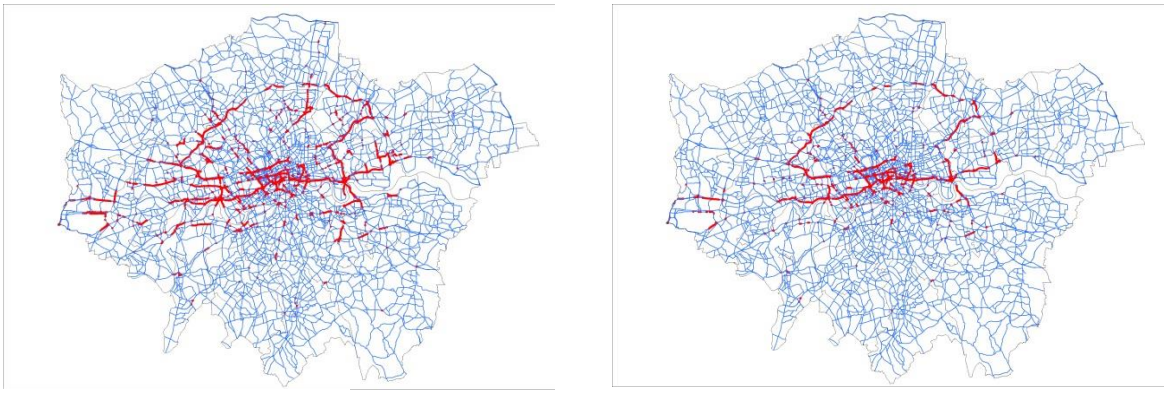
Figure 61: Impact of LEZ proposals on road lengths exceeding legal limits

Baseline

With Proposals

2021

2025



PM10 and PM2.5 concentrations

PM10 and PM2.5 concentrations reduce as a result of the LEZ only policy, although to a lesser extent than the combined package of measures

Figure 62: PM10 concentrations with LEZ proposals only 2021 – 2025

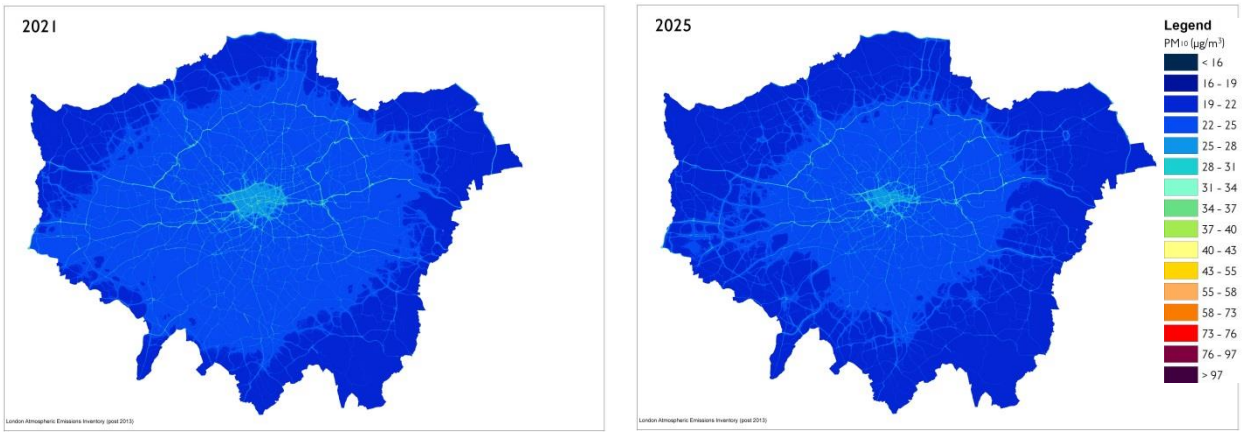
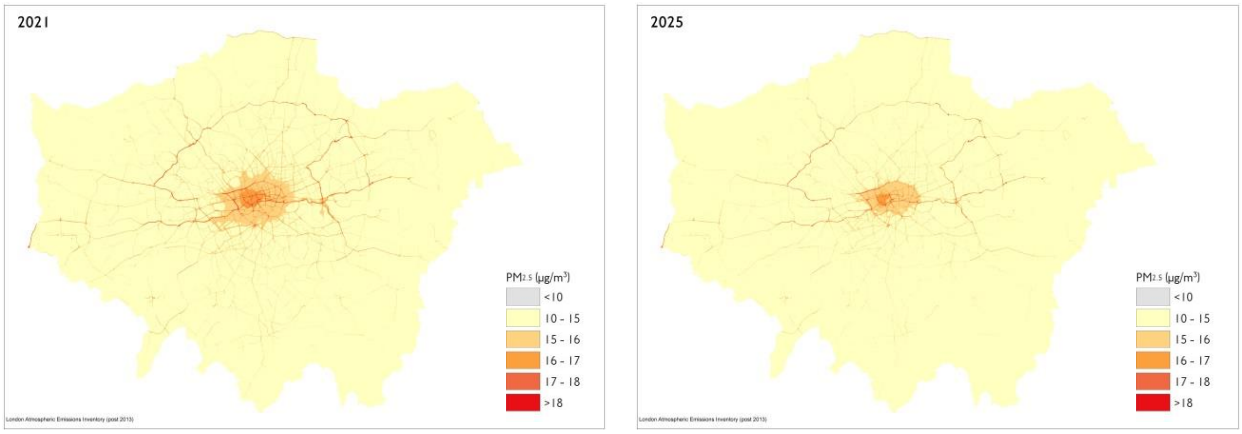


Figure 63: PM2.5 concentrations with LEZ proposals only 2021-2025



8.3 Impact on population exposure

Reducing NO_2 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 NO_2 limit value is projected to decrease across London. The ULEZ proposals will mean that over 67 thousand people across London, will no longer live in areas exceeding the NO_2 limit values (based on population weighted concentrations) in 2021. This is a 52 per cent reduction in the number of people living in areas exceeding limit values in London.

Table 46: Baseline population in areas of exceedence 2021-2025

Baseline	Estimated total population		Total population in Output Areas exceeding NO_2 limit value		Proportion of population living in areas exceeding NO_2 limits	
	2021	2025	2021	2025	2021	2025
Central	214,500	223,600	15,670	677	7%	<1%
Inner	3,837,000	3,966,900	104,880	11,027	3%	<1%
Outer	5,128,600	5,260,400	11,218	432	0%	<1%
London-wide	9,180,100	9,450,900	131,768	12,137	1%	<1%

Table 47: Population living in areas of exceedence with LEZ only proposal

LEZ proposals only	Total population in Output Areas exceeding NO_2 limit value		Proportion of population living in areas exceeding NO_2 limits	
	2021	2025	2021	2025
Central	8,600	100	4%	<1%
Inner	53,700	4,900	1%	<1%
Outer	1,600	0	0%	0%
London-wide	63,900	5,000	1%	<1%

Table 48: Impact of the LEZ proposals only on population living in areas of exceedence

LEZ proposals only	Change in number of people living in areas of exceedence		Change in proportion of people living in areas of exceedence	
	2021	2025	2021	2025
Central	-7,100	-600	-45%	-86%
Inner	-51,200	-6,100	-49%	-55%
Outer	-9,600	-400	-86%	-100%
London-wide	-67,900	-7,100	-52%	-59%

Table 49: Impact on Schools hospitals and Care Homes in areas exceeding legal limits 2021

2021	Baseline			With LEZ proposals only			Change		
Area	No. of schools in areas exceeding NO_2 limit	No. of hospitals in areas exceeding NO_2 limit	No. of care homes in areas exceeding NO_2 limit	No. of schools in areas exceeding NO_2 limit	No. of hospitals in areas exceeding NO_2 limit	No. of care homes in areas exceeding NO_2 limit	Change in no. of schools with proposals	Change in no. of hospitals with proposals	Change in no. of care homes with proposals
Central	7	6	0	4	5	0	-3	-1	0
Inner	29	2	10	12	1	4	-17	-1	-6
Outer	2	0	0	0	0	0	-2	0	0
Total	38	8	10	16	6	4	-22	-2	-6

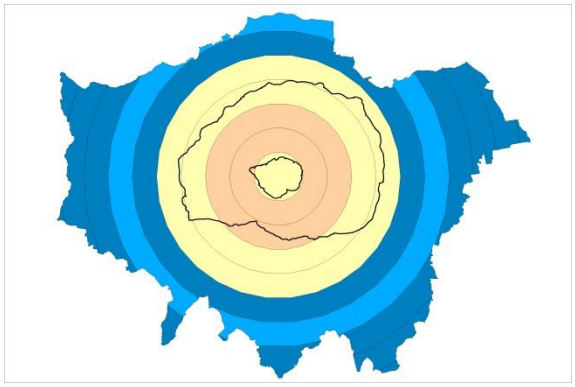
Table 50: Impact on Schools hospitals and Care Homes in areas exceeding legal limits 2025

2025	Baseline			With LEZ proposals only			Change		
Area	No. of schools in areas exceeding NO_2 limit	No. of hospitals in areas exceeding NO_2 limit	No. of care homes in areas exceeding NO_2 limit	No. of schools in areas exceeding NO_2 limit	No. of hospitals in areas exceeding NO_2 limit	No. of care homes in areas exceeding NO_2 limit	Change in no. of schools with proposals	Change in no. of hospitals with proposals	Change in no. of care homes with proposals
Central	1	0	0	1	0	0	0	0	0
Inner	2	0	0	0	0	0	-2	0	0
Outer	0	0	0	0	0	0	0	0	0
Total	3	0	0	1	0	0	-2	0	0

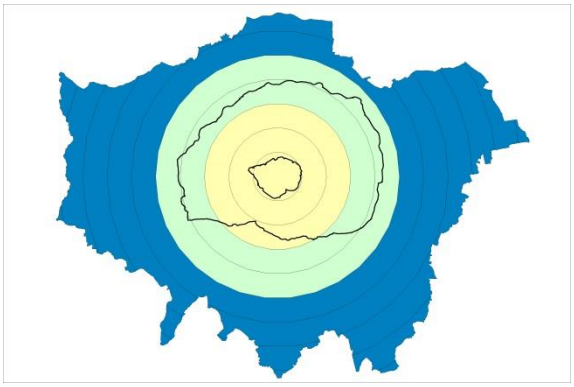
The table below indicates the change in the number of people living in areas exceeding legal limits as a result of the proposals.

Table 51: Impact of LEZ proposal only on population in exceedence 2021-2025

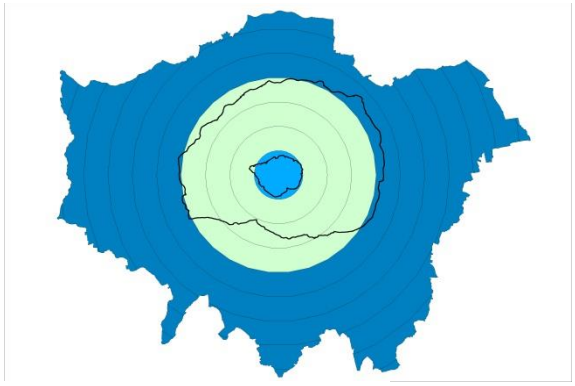
Baseline 2021

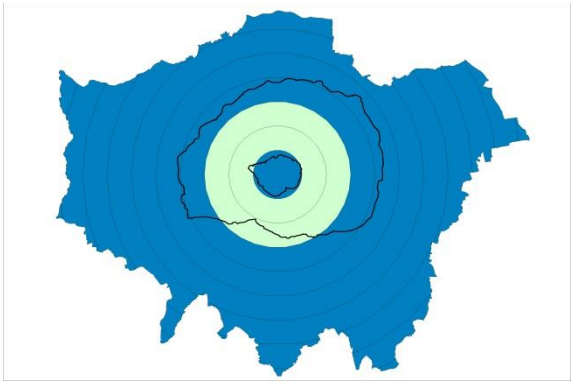


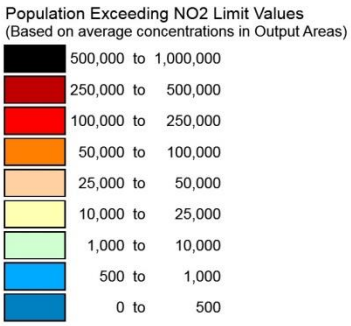
LEZ proposal only



2025







Monetised Health Impacts

The health benefits of the reductions in mortality and hospital admissions have been calculated. Full details are provided within the Integrated Impact Assessment.

The improved health outcomes associated with reduced NO_x emissions due to the implementation of the heavy vehicles London-wide charge in 2020 are estimated to have a total monetised benefit of £28.9m London-wide in comparison to the baseline, reducing to £15.0m in 2025 in comparison to the baseline

8.4 Integrated Impact Assessment (IIA)

We commissioned Jacobs Consultancy to undertake an IIA for the expansion of the ULEZ and changes to the LEZ. An assessment was undertaken on the impacts of the LEZ only policy

The full assessment is provided as a separate document and its key findings are as follows

Environmental impacts

- Positive beneficial impacts in reducing air pollutant emissions
- Beneficial impacts on protection of biodiversity and cultural heritage as a result
- Non-significant benefits in reducing noise
- Non significant impacts on CO_2 and Waste

Health Impacts

- Positive beneficial impacts through important reductions in health impacts as a result of improved air quality
- Minor benefit through a potential shift towards more active travel
- Neutral impact on Noise, Crime and community safety and Climate Change

Equalities Impacts

- Positive beneficial impacts for those living in deprived areas, school age children, older people and pregnant women due to reductions in NO_2 concentrations
- Minor impact on connectivity if operators reduce or limit their services as a result of the ULEZ, and a possible increase in the cost of school trips affecting lower income families

Economic Impacts

- Neutral impact on attracting and retaining internationally mobile businesses
- Moderate adverse impact on SMEs
- Moderate financial impact on businesses

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 payment card

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

CC, CCZ – Congestion Charge, Congestion Charging zone: 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

CO_2 (carbon dioxide): Principal greenhouse gas related to climate change

CCMES (Mayor's Climate Change Mitigation and Energy Strategy): Statutory document outlining the Mayoral plans to reduce CO_2 emissions and encourage renewable energy

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

Environment Impact Assessment (EIA): Assessment that Identifies and assesses the impacts across a range of environmental issues as a result of the changes to the LEZ and ULEZ 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 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 electrics that have an attached petrol or diesel engine to power the battery engine

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

Greenhouse gas: Gases that absorb heat, contributing to climate change. The most significant of which is CO_2

Health Impact Assessment (HIA): Assessment that Identifies and assesses the impact on the health and well-being of the population of Greater London and the ability to access health-related facilities and services as a result of the changes to the LEZ and ULEZ. The assessment also addresses equalities 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, environment and the economy arising from the proposed changes to the LEZ and ULEZ

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

LEZ (London-wide Low Emission Zone): A charging zone across most of Greater London for vehicles that do not meet emissions standards for PM_{10}

LGV (light goods vehicle): Also known as Light Commercial vehicle. Vehicles 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 plan to reduce air pollution

NO_x (nitrogen oxides): A generic term for nitrogen dioxide (NO_2) and nitrogen monoxide (NO), which can form NO_2 in the atmosphere. Euro standards set limits for vehicles emissions of NO_x

NO_2 (nitrogen dioxide): A gas formed by combustion, identified as an air pollutant harmful to human health. The European limit values measure concentrations of NO_2 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 the 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

PM_{10} (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 articulate matter; also subject to EU limit values

Sensitive receptors: Sensitive receptors include, but are not limited to, hospitals, schools, day-care facilities, elderly housing and convalescent facilities. These are areas 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

Trip Production and Attraction: A production zone is a location from which trips are generated or produced. These are usually residential locations. An attraction zone is a location that generates the need to travel. These are usually non-residential locations such as workplaces or retail locations. Productions and attractions are a different way of talking about trips from origins and destinations. For example, when travelling between home and work in either direction the trip production is always the residential location and the attraction is always the workplace.

VED (Vehicle Excise Duty): Annual charge levied for vehicles to use the public highway. Banded according to engine size or CO_2 emissions

Zero emission capable vehicle (ZEC): A vehicle that is constructed to be capable of operating in zero emission mode for at least part of its operating cycle. The zero emission 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