MAYOR OF LONDON

CENTRAL LONDON ULTRA LOW EMISSION ZONE – TEN MONTH REPORT

April 2020

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City Hall
The Queen's Walk
More London
London SE1 2AA
www.london.gov.uk
enquiries 020 7983 4000
minicom 020 7983 4458
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Foreword

On 8 April 2019 the Mayor of London launched the world's first Ultra Low Emission Zone (ULEZ). Data indicates in the first ten months of the scheme it had a significant and immediate impact – although further analysis will be needed to fully assess the long-term impacts.

This report includes data from February 2017 (when the Mayor confirmed the toxicity charge (T-charge) and the change in the vehicle fleet began), March 2019 (the month before the scheme was introduced) and April 2019 – January 2020 (the first ten months of the scheme).

The report has been published to provide important context for the changes reported in London's air quality as a result of COVID-19 measures. This information is important as there is emerging evidence linking air pollution with an increased vulnerability to the most severe impacts of COVID-19.

The period covered in this report pre-dates changes associated with COVID-19. These subsequent changes are addressed in a separate document available here: https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/estimation-changes-air-pollution-during-covid-19-outbreak-0

Further information on the impact of ULEZ and the other air quality measures delivered by the Mayor will be published in due course.

Key Findings

On 8 April 2019 the Mayor of London launched the world's first Ultra Low Emission Zone (ULEZ).

Key findings from the first ten months of operation are:

- Trend analysis shows that concentrations of NO_2 at roadside sites in the central zone in February 2020 are 39 μgm^{-3} less that in February 2017, when changes associated with the ULEZ began. This is a **reduction of 44 per cent**. This is over double the reduction at inner roadside sites, of 18 μgm^{-3}, and four times the reduction at roadside sites in outer London. The smallest improvement was recorded at urban background sites in outer London, 6 μgm^{-3}. This underlines the need for expanding the central London ULEZ to the North and South Circular roads in 2021
- After the first ten months of operation, in January 2020 the **average compliance rate with the ULEZ standards was 79 per cent** in a 24 hour period (77 per cent in congestion charging hours). This is significantly higher than 39 per cent in February 2017 and the 61 per cent in March 2019 during congestion charging hours
- Analysis to determine the directly attributable impact of the ULEZ shows that, for the period January to February 2020, NO_2 concentrations at roadside locations in central London were on average 29 μgm^{-3} lower, equating to **a reduction of 37 per cent**, compared to a scenario where there was no ULEZ
- Preliminary estimates indicate that by the end of 2019 NO_x emissions from road transport in the central zone have **reduced by 35 per cent (230 tonnes)** compared to a scenario where there was no ULEZ. This is on track to achieve a 45 per cent reduction in the first year of the scheme
- Preliminary estimates indicate that by the end of 2019 CO_2 emissions from road transport in the central zone have **reduced by 6 per cent (12,300 tonnes)** compared to a scenario where there was no ULEZ

- None of the air quality monitoring stations located on ULEZ boundary roads have measured an increase in NO_2 concentrations since the introduction of the ULEZ indicating no issue with the displacement of traffic and related emissions
- Preliminary analysis of traffic flows indicate that the introduction of the central London ULEZ has contributed to a **reduction in traffic flows in central London from May 2019 to January 2020 of between 3 – 9 per cent** when compared to 2018. Further analysis is needed to better understand long term complex changes in traffic flows as a result of ULEZ
- From March 2019 to January 2020 there was a large reduction in the number of older, more polluting, non-compliant vehicles detected in the zone: **some 17,400 fewer on an average day, a reduction of 49 per cent** in congestion charging hours. This is higher than the 13,500 reduction reported after 6 months
- There was a **41 per cent decrease** in the proportion of vehicles in the central zone that were non-compliant from March 2019 to January 2020 in congestion charging hours

To fully understand the impact of the scheme it is necessary to take into account pre-compliance (i.e. people and businesses preparing ahead of time for the start of the new scheme). With this in mind, the changes between February 2017 and January 2020 were as follows:

- There was a large reduction in the number of older, more polluting, non-compliant vehicles detected in the zone: **a reduction of 44,100 vehicles on an average day, equating to a 71 per cent reduction**
- There was a **96 per cent increase** in the proportion of vehicles detected in the central zone that were compliant from February 2017 to January 2020
- The average 24 hour compliance rate for all vehicles was 79 per cent in January 2020. However, there was a large discrepancy between different vehicle types. HGVs have the highest compliance of any vehicle groups (excluding TfL buses which were 100% compliant from the start of the scheme) with 90 per cent. Taxis had the lowest compliance rate with only 29 per cent.

Introduction

On 8 April 2019 the Mayor of London launched the world's first Ultra Low Emission Zone (ULEZ) in central London. This chapter of the report evaluates the impact of the scheme in its first ten months of operation (to the end of January 2020). Whilst we can determine a number of different impacts within this timeframe, further ongoing analysis will be required to understand the full impacts of the scheme over a longer period of time – particularly in relation to establishing long term changes in air quality.

A number of measures are used to assess the impacts of introducing the ULEZ. Here we evaluate the impact on air pollution concentrations, air pollution emissions, traffic flows and vehicle compliance.

What is the Ultra Low Emission Zone (ULEZ)?

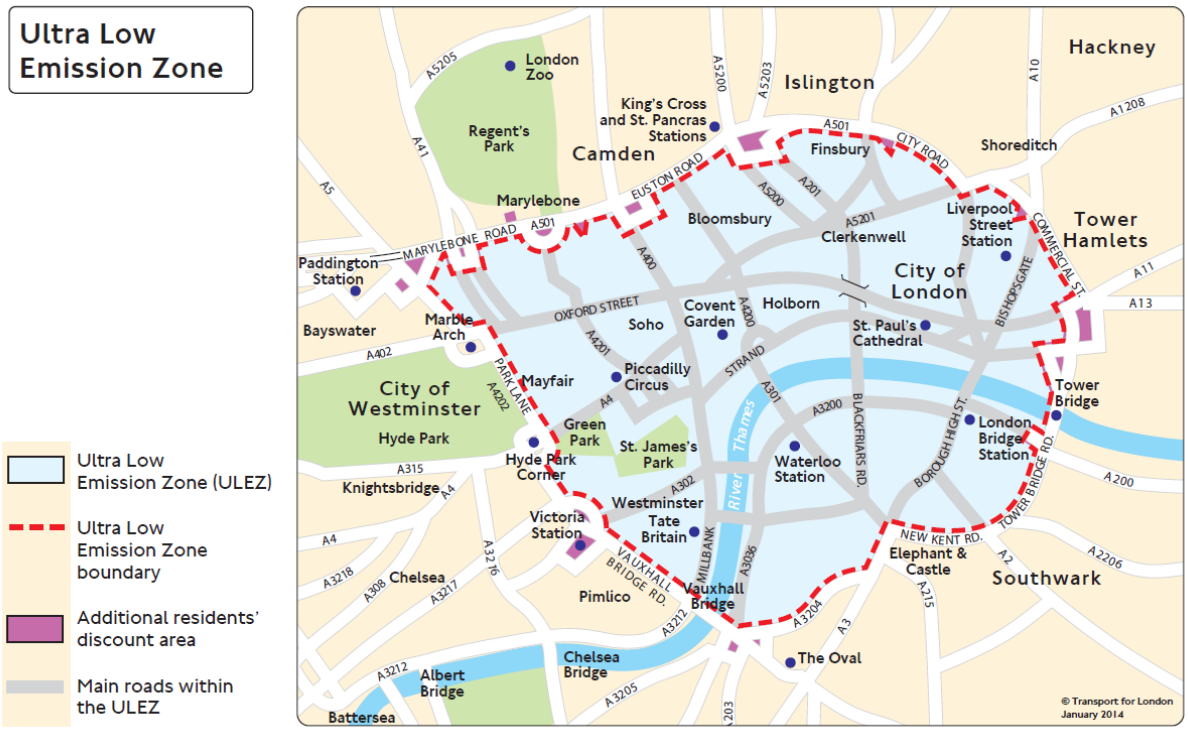

Figure 1. Map of the central London Ultra Low Emission Zone

The central London ULEZ started on 8 April 2019 and operates in the existing central London Congestion Charge Zone. Figure 1 is a map of the area covered by the central ULEZ. Unlike the Congestion Charge (which operates Monday to Friday between 07:00 and 18:00) the ULEZ operates 24 hours a day, every day of the year except Christmas Day (25 Dec). Vehicles must meet strict emission standards to drive in the ULEZ area:

- Euro 4 for petrol cars and vans (vehicles less than fourteen years old in 2019)
- Euro 6 for diesel cars (vehicles less than five years old in 2019)
- Euro 6 for diesel vans (vehicles less than four years old in 2019)
- Euro 3 for motorcycles and other L-category vehicles
- Euro VI for lorries, buses and coaches

Vehicles that do not meet these standards must pay a charge:

- £12.50 per day for cars, motorcycles and vans
- £100 per day for lorries, buses and coaches

All Transport for London (TfL) buses operating in the zone meet the ULEZ standards. The ULEZ replaced the T-Charge in central London and is in addition to the Congestion Charge. Alongside the ULEZ, the Private Hire Vehicle exemption to the Congestion Charge was removed on 8 April 2019 and the Ultra Low Emission Discount was replaced by the new Cleaner Vehicle Discount.

To find out more about the ULEZ or to check if your vehicle is affected please visit:

https://tfl.gov.uk/modes/driving/ultra-low-emission-zone.

This is the fourth report evaluating the impacts of the scheme. The first three reports are available from:

- Central London Ultra Low Emission Zone – First Month Report
- Central London Ultra Low Emission Zone – Four Month Report
- Central London Ultra Low Emission Zone – Six Month Report

An updated evaluation will be published once twelve months of data are available.

Assessing the impacts of ULEZ

The purpose of the ULEZ is to improve air quality in and around central London by reducing the number of older more polluting vehicles that enter the central zone. The impact of the ULEZ can be assessed using a number of different metrics including:

- Air quality monitoring[1]
- Modelling of vehicle emissions
- Number of vehicles and compliance rates
- Traffic flow data

Air pollution concentrations are affected by many different factors including the weather and regional contributions from outside London, as well as impacts from other local schemes, therefore analysis of air quality monitoring data will need to continue over time.

Vehicle compliance refers to the number of vehicles that "comply" or meet the ULEZ emission standards. Non-compliant vehicles do not meet the strict ULEZ emissions standards and have either:

- Paid the daily charge
- Incurred a penalty charge
- Not been required to pay the daily ULEZ charge as they are eligible for a 100% discount or exemption

[1] At this stage air quality data is from the London Air Quality Network and Air Quality England Network. This is because both provide data going back many years. The newly established Breathe London network will also be used for ULEZ evaluation in a separate report using different techniques.

Limitations of this analysis

To assess the impact of the scheme we have compared the number of vehicles detected in the zone and compliance rates in February 2017 and March 2019 – January 2020. In February 2017 the Mayor confirmed the introduction of the T-charge as a stepping-stone for the ULEZ and this can be seen as the start of the accelerated change in the vehicle fleet as Londoners and businesses prepared for the new schemes and buses on routes in central London began to be upgraded to become ULEZ compliant. In addition, the removal of the exemption from the Congestion Charge for private hire vehicles also commenced on 8 April 2019. TfL have also introduced new licensing requirement for private hire vehicles (PHVs) so that as of 1 January 2020:

- PHVs under 18 months old must be zero emission capable and meet the Euro 6 emissions standard when licensed for the first time
- PHVs over 18 months old must have a Euro 6 (petrol or diesel) engine when licensed for the first time

March 2019 is the month before the ULEZ was introduced and January 2020 is the latest available full month of data.

The ULEZ is a 24 hour scheme, however, prior to the start of the scheme in April 2019 data could only be collected during congestion charging (CC) hours – 07:00 to 18:00, Monday to Friday. When assessing the impact of the first ten months of ULEZ compared to historic months, comparison has been made based on CC hours to ensure the comparison is fair. 24 hour data for the months since the scheme has been in operation has also been provided.

As mentioned, the removal of the exemption from the Congestion Charge for private hire vehicles coincided with the launch of the ULEZ. This may also have had an effect on traffic volumes and air quality within the zone, but it is too early at this stage to separate the respective effects.

Disruptions to traffic flow in the central zone in April 2019

As explained in a previous iteration of this report, there were a number of non-typical events in central London in April 2019. These included:

- Road works (leading to signed diversions into the ULEZ)
- The Extinction Rebellion climate protests, leading to further diversions into the central zone and an unknown impact on the number of motorists choosing to drive in central London
- Easter Holidays and Bank Holidays. The timing of the introduction of ULEZ was specifically chosen to target a “quiet” week when there would be fewer vehicles in the zone

As a result, only a limited number of days were used for analysis of the first month of the scheme. Data for April 2019 presented in this report is the average over “typical days” only. However, using only typical days exclusively in the month of April has little effect on the results.

As the scheme started on 8 April, the first iteration of this report covered the period from 8 April to 5 May 2019 (to provide 4 calendar weeks of “typical days” data). For consistency this report has taken the same approach.

Unique vehicles detected in zone and relation to traffic flow

Vehicle volumes within this report relate to the daily number of confirmed unique vehicles detected in central London. Unique vehicle volumes will be different in scale to changes in traffic volumes entering or within central London for a number of reasons:

- Unique vehicle volumes do not take into account how a vehicle is used. For example, a proportion of traffic is associated with a minority of vehicles that make multiple trips a day within the zone, e.g. delivery vehicles, private hire vehicles and taxis
- Trips made wholly within the zone are currently less likely to be captured by an Automatic Number Plate Recognition (ANPR) camera than trips crossing the boundary (for which all entry and exit points are monitored). There is currently less incentive for internal trips to cease as local residents have a 100% ULEZ discount grace period until 24th October 2021
- Analysis of changes in traffic data based on automatic traffic count sites in London is compared to the same months in 2018. However, traffic exhibits seasonal variation and further analysis will be undertaken once a full year of traffic data is available

If you want to know about estimates for changes in traffic in both central London and pan-London please see the latest Travel in London report, which looks at various sets of data for understanding traffic flow including that from TfL's automatic traffic counters: https://tfl.gov.uk/corporate/publications-and-reports/travel-in-london-reports

Further analysis is ongoing in order to understand the impacts of ULEZ including trends in changes in compliance, traffic flows, and air quality.

Air pollution concentrations

Around half of London's NO_x emissions are from road transport[2]. The purpose of the ULEZ is to improve air quality in and around central London by reducing the number of older, more polluting vehicles that enter the central zone. This will reduce the amount of NO_x emitted, which in turn will reduce nitrogen dioxide (NO_2) concentrations in the zone. Bringing London closer to compliance with the legal air quality limit values for NO_2 is a key aim of the scheme.

The analysis presented here uses data from London's automatic monitoring network. This data is publicly available from the London Air Quality Network and Air Quality England websites. Full details of the methodology for this chapter can be found in the Central London Ultra Low Emission Zone Six Month Report.

In this analysis monthly average concentrations are used to calculate trends in the period from 2010 to end of February 2020. It should be noted that measurement data from late 2019 and early 2020 have not yet been ratified. As a result, these may be subject to change following equipment tests undertaken as part of the routine audit and servicing of air quality monitoring sites.

Trends in nitrogen dioxide (NO_2)

The ULEZ was introduced part way through 2019, therefore evaluating changes with respect to the ULEZ required analysis on a shorter timescale than a year. To address this we evaluate the change in quarterly (three month) average NO_2 concentrations. It is important to note that Table 1 presents an average across several sites of each type in each zone. Data presented in Table 1 is quarterly as opposed to annual, so is not directly comparable to annual air quality limits.

[2] London Atmospheric Emissions Inventory 2016 (LAEI 2016)

This analysis evaluates the change in quarterly average NO_2 since February 2017, when changes associated with the ULEZ began. The additional analysis estimated the proportion of reductions in NO_2 that are directly attributable to ULEZ.

Table 1 lists the quarterly average concentrations of NO_2 in London from January 2016 to February 2020 grouped by site type and London zone. The biggest reduction in average concentrations between the beginning of 2017 and February 2020 is at central roadside sites, 39 μgm^{-3}, equating to a 44 per cent reduction. This is over double the reduction at inner roadside sites of 18 μgm^{-3}, and four times the reduction at roadside sites in outer London. The smallest improvement was recorded at urban background sites in outer London, 6 μgm^{-3}.

Table 1. Quarterly average NO_2 from January 2017 to February 2020

Period	Average NO_2 [μgm^{-3}]					
	Roadside Central	Background Central	Roadside Inner	Background Inner	Roadside Outer	Background Outer
Jan – March 17	89	37	54	34	46	29
April – June 17	87	36	53	34	45	29
July – Sept 17	86	36	52	33	45	29
Oct – Dec 17	83	35	51	33	44	28
Jan – March 18	81	35	50	32	44	28
April – June 18	78	34	49	31	43	28
July – Sept 18	75	34	48	31	42	27
Oct – Dec 18	71	33	46	30	41	27
Jan – March 19	67	33	45	29	40	26
April – June 19	63	32	43	29	39	26
July – Sept 19	59	32	42	28	38	25
Oct – Dec 19	54	32	40	27	37	25
Jan – Feb 20*	50	31	38	27	36	24
Reduction *(Q1 2017 – Q1 2020)* **[μgm^{-3}]**	39	6	16	7	10	5
Reduction *(Q1 2017 – Q1 2020)* **[per cent]**	44%	16%	30%	21%	22%	17%

*Data available to 1 March 2020

Again, this is not comparable to the annual mean limit, as seen in a previous chapter there were still many sites in 2019 in inner and outer London that exceeded the legal air quality limit value for annual mean NO_2 of 40 μgm^{-3}.

As mentioned previously, air pollution is influenced by many complex factors. Additional analysis has been undertaken to ensure the trends reported in Table 1 were not a product

of weather or seasonal factors. This additional analysis attributes the proportion of the recent reduction in NO_2 concentrations within the central zone which are attributable to the ULEZ.

Changes in NO_2 attributable to the ULEZ

The ULEZ is one of the many policies to reduce air pollution in London. Other policies include the Londonwide Low Emission Zone (for heavy vehicles), investment in new cleaner buses and Zero Emission Capable (ZEC) licensing requirements for taxis and PHVs (in addition to ULEZ measures), as well as progressively tighter EU-wide exhaust controls for new vehicles. As a result, it is not straight forward to isolate the impact of the ULEZ. For this analysis the trends in outer London (largely away from the influence of the ULEZ in central London) were used as a predictor of the change in central and inner London if the ULEZ was not in place. The change in outer London reflects the "natural churn" of the fleet, as vehicles are replaced by their owners. The changes measured in central London far exceed natural churn. Comparing the measured trends in central and outer London reveals the additional changes within the central zone, which provide an estimate for the impact of the ULEZ.

Detecting the additional change within the ULEZ by comparing trends in the zone to those in outer London has both strengths and weaknesses. Key amongst the strengths are the ease of analysis, allowing data to be analysed as it is produced, and the large number of measurement sites involved. Another strength is the use of outer London data that also acts, to some extent, as a control for the weather and seasonal factors that can confound this type of analysis. The key weakness stems from differences in the vehicle fleets in the ULEZ area compared with outer London. Traffic in the ULEZ area has a greater proportion of certain vehicle types, such as taxis, and proportionally fewer private cars than outer London[3]. Interventions on these vehicle types from other Mayoral policies would have a different impact in the ULEZ area than outside, even in the absence of the ULEZ.

Another potential limitation to the analysis presented in this chapter is changes in the number and location of monitoring sites across London over the 10-year period. More

[3] London Atmospheric Emission Inventory (LAEI) 2016, Greater London Authority 2018

detail on this can be found in the Central London Ultra Low Emission Zone Six Month Report.

A technique often used to isolate the proportion of pollution that relates to traffic sources is to subtract the background concentration from the roadside concentration. This is referred to as the "roadside increment"[4]. Changes in the roadside increment, or traffic contribution, in outer London were used as a predictor of the changes in a "no ULEZ" scenario for roadside sites in central and inner London - the rate of change in outer London is an approximation of what would see in central London if there were no ULEZ policy. The analysis in this section follows the exact method for calculating the "no ULEZ" trend that can be found in the Appendix of the Central London Ultra Low Emission Zone – Six Month Report.

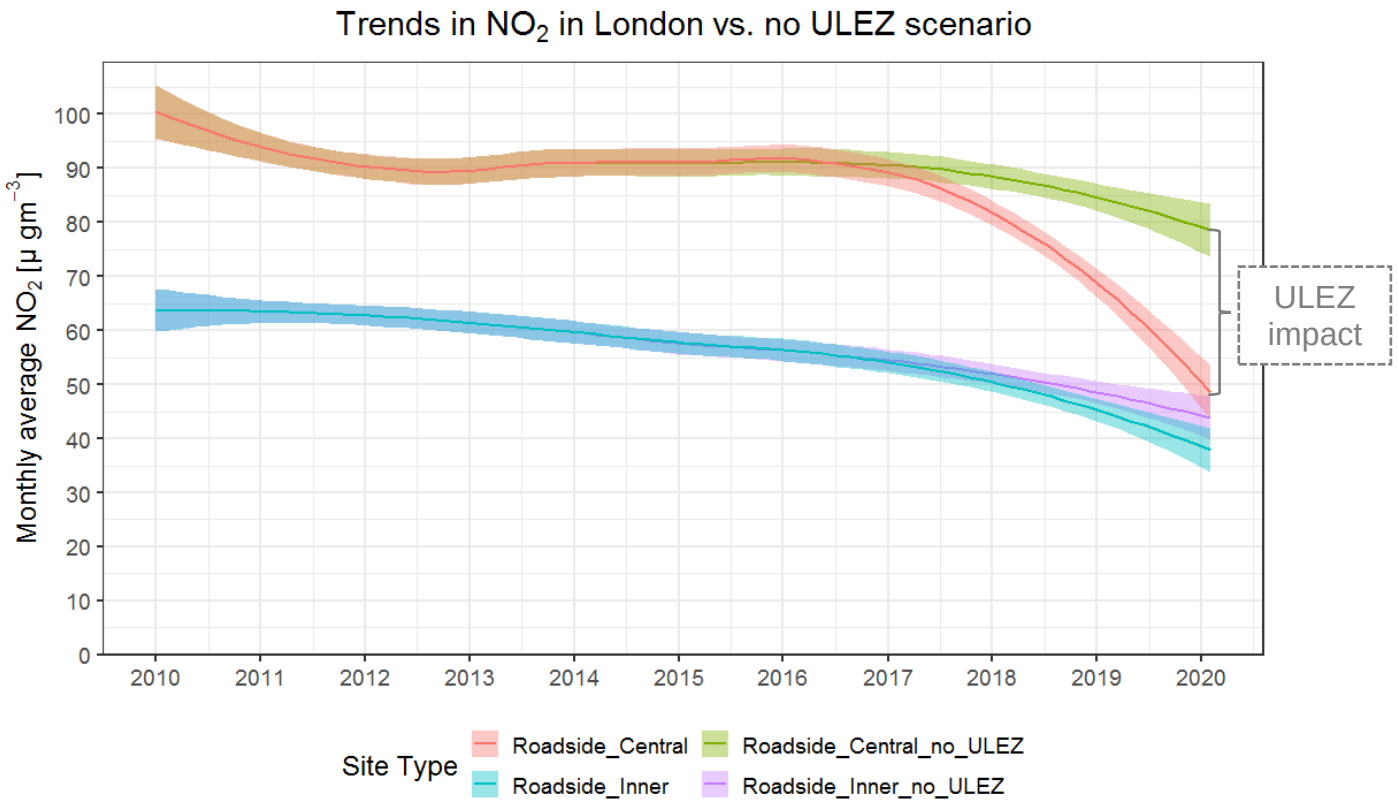

Figure 2: Monthly average NO_2 concentrations in London with and without ULEZ

[4]Font, A. & Fuller, G. (2016) Did policies to abate atmospheric emissions from traffic have a positive effect in London? Environmental Pollution, Volume 218, November 2016, Pages 463-474

Figure 2 shows the monthly average NO_2 at roadside sites in central and inner London as well as a “no ULEZ” scenario estimate for each. The “no ULEZ” reflects changes in central and inner London were they to follow the same trend as roadside sites in outer London. The divergence between the measured concentrations and “no ULEZ” scenario is much more pronounced in central London than in inner London. This shows there was a reduction in roadside concentrations in central and inner London that was far greater than the reduction measured at outer London sites.

Table 2 presents the difference between the trend in actual roadside measurements and the scenario where there was no ULEZ over three-month periods since April 2019. This can be understood as the reduction at central and inner London sites that is in addition to the changes measured at outer London roadside sites.

Table 2: Estimated reduction in NO_2 concentrations as a result of ULEZ

Period	Reduction central London roadside compared to “no ULEZ”		Reduction inner London roadside compared to “no ULEZ”	
	[μgm^{-3}]	[per cent]	[μgm^{-3}]	[per cent]
Jan – March 19	17	20%	3	7%
April – June 19	20	24%	4	9%
July – Sept 19	23	29%	5	10%
Oct – Dec 19	26	33%	5	12%
Jan – Feb 20*	29	37%	6	13%

*Data available to 1 March 2020

In January to February 2020, the most recent period for which data is available, the ULEZ is estimated to have reduced mean NO_2 concentrations at roadside sites by 29 μgm^3, a reduction of 37 per cent compared to the scenario where “no ULEZ” is in place.

A smaller reduction of 13 per cent was estimated at roadside sites in inner London. This is expected, since many vehicles driven in the ULEZ also travel in this area. This is the area that will benefit most from the expansion of the Ultra Low Emission Zone to the North and South circular roads in 2021.

Trends in NO_2 on boundary roads

When charging schemes, such as the ULEZ or Congestion Charge, are introduced in part of a city it is always important to measure the impact of the scheme not only in the zone itself, but also in the surrounding area.

There are four established air quality monitoring stations on the central London ULEZ boundary roads. Figure 3 shows that, similar to sites within the central zone, sites on the ULEZ boundary roads measured a continued downward trend in concentrations since 2017.

No sites on the boundary roads have experienced an increase in the trend of monthly average NO_2 since the scheme was introduced in April 2019. (Note, these boundary sites are categorised as inner, as opposed to central, sites).

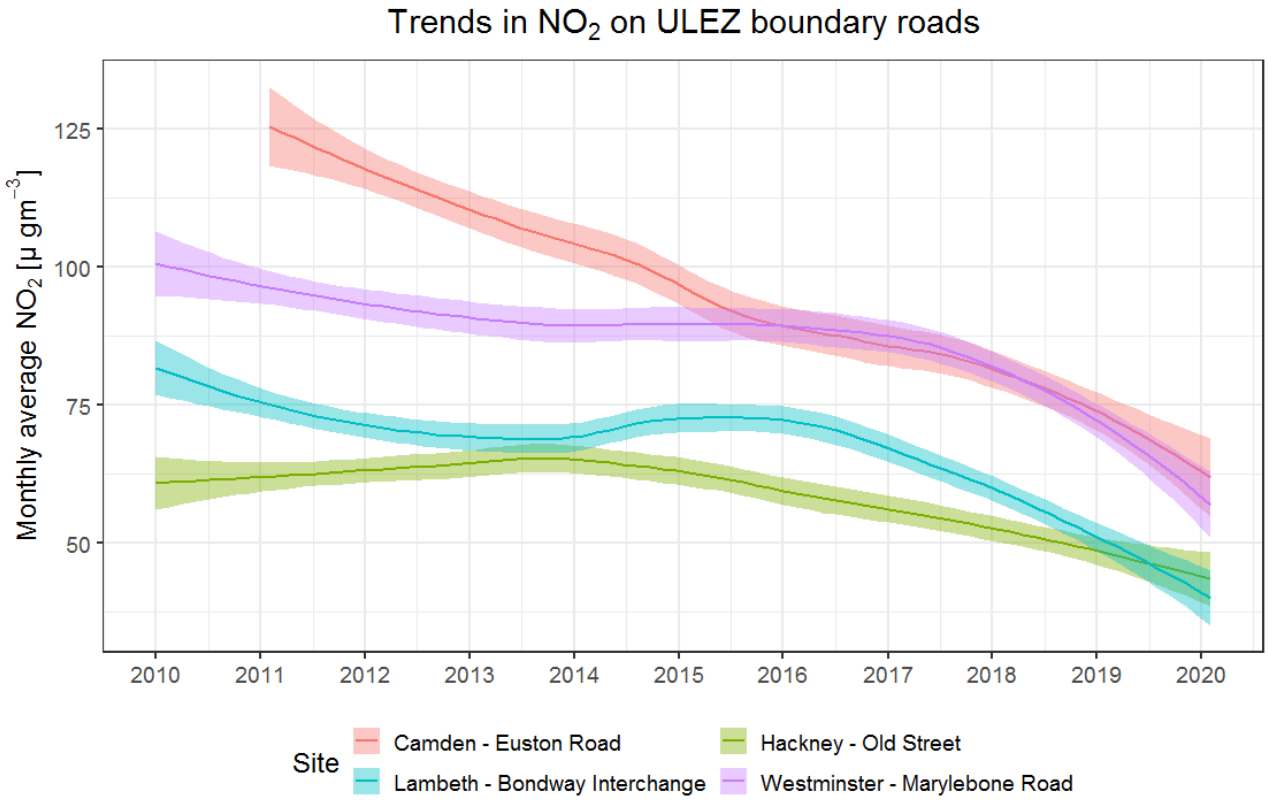

Figure 3: Monthly average NO_2 concentrations at sites on ULEZ boundary roads

This is a strong indication that there has been a positive impact on air pollution on the ULEZ boundary roads. A full picture of the impact on boundary roads will be available later in 2020 (once more data is available and the ULEZ has been in operation a full year).

Trends in fine particulate matter ($PM_{2.5}$)

As mentioned previously in this report, road transport is the largest single source of particulate matter in London, accounting for around 30 per cent of emissions. However,

unlike NO_2, over half of London's concentrations of $PM_{2.5}$ come from regional, and often transboundary (non-UK) sources outside of London. There is also a large proportion of $PM_{2.5}$ emitted within London that the Mayor does not currently have the powers to address, for example wood burning. In addition, a growing proportion of road transport $PM_{2.5}$ emissions are now non-exhaust emissions including road wear, resuspension of road dust and tyre and brake wear.

Table 3. Quarterly average $PM_{2.5}$ from January 2017 to February 2020

Period	Average $PM_{2.5}$ [μgm^{-3}]					
	Roadside Central	Background Central	Roadside Inner	Background Inner	Roadside Outer	Background Outer
Jan – March 17		15	14	12	13	11
April – June 17		14	14	12	13	11
July – Sept 17		14	14	12	12	11
Oct – Dec 17		14	14	11	12	11
Jan – March 18		14	13	11	12	11
April – June 18		13	13	11	12	11
July – Sept 18		13	13	11	12	11
Oct – Dec 18		13	13	11	12	11
Jan – March 19		12	12	11	12	11
April – June 19		12	12	10	12	10
July – Sept 19		11	12	10	11	10
Oct – Dec 19		11	12	10	11	10
Jan – Feb 20*		11	11	9	11	10
Reduction *(Q1 2016 – Q1 2020)* **[μgm^{-3}]**		4	3	3	2	1
Reduction *(Q1 2016 – Q1 2020)* **[per cent]**		27%	21%	25%	15%	9%

Table 3 shows the quarterly average $PM_{2.5}$ grouped by zone and site type. Since changes associated with the ULEZ began in February 2017 there has been a 27 per cent reduction in quarterly average $PM_{2.5}$ emission in background sites located in central London. It is likely these will have been influenced by the reduction in traffic emissions, as was seen in annual average PM_{10}.

Air pollution emissions

Emissions from road transport have been modelled to estimate how NO_x emissions from vehicles have changed since the ULEZ was introduced. Full details of the methodology can be found in the Central London Ultra Low Emission Zone Six Month Report. Emissions reductions are calculated as the reduction in emissions using current compliance rates compared to a "no ULEZ" scenario for the period October to December 2019. These are estimates based on the first three quarters of operations, a full update after a full year will be included in a report evaluating the first 12 months of the scheme.

Reductions in NO_x emissions

Preliminary estimates indicate that between October to December 2019 NO_x emissions from road transport reduced by 35 per cent (or 230 tonnes of NO_x) compared to a scenario where there was no ULEZ. Modelling completed by TfL as part of the ULEZ consultation process estimated that introducing the ULEZ would result in a 45 per cent reduction in NO_x emissions from road transport in the central zone. After the first three quarters of a year in operation the ULEZ is on track to meet its 45 per cent target.

Reductions in $PM_{2.5}$ emissions

Similarly, it has been estimated that between October to December 2019 $PM_{2.5}$ emissions from road transport reduced by 15 per cent (6 tonnes) compared to a no ULEZ scenario. As discussed, total $PM_{2.5}$ emissions are more sensitive to changes in vehicle kilometres due to the dominance of non-exhaust particles. This will be addressed by policies in the Mayor's Transport Strategy that will reduce traffic volumes by encouraging mode shift from car to walking, cycling and using public transport., The Mayor aims for 80 per cent of all trips in London to be made on foot, by cycle or using public transport by 2041.

Reductions in CO_2 emissions

CO_2 emissions in the central zone are estimated to have reduced by 6 per cent (12,300 tonnes) compared to a scenario with no ULEZ in place. This is equivalent to the lifetime

carbon savings of over 800 solar PV installations in London. CO_2 emissions are also more sensitive to changes in vehicle kilometres due to the dependence on fuel use.

Summary of emissions reductions

Table 4 presents the summary of emissions reductions by pollutant. In future analysis, once more data is available, fleet composition estimates will be revised to take account of a full year of data and consider other changes in vehicle types, such as fuel type, and further assessment of traffic flows. Further emissions calculations will be carried out for a one-year evaluation report including the impact of the central London ULEZ on road transport NO_x, $PM_{2.5}$ and CO_2 emissions in both inner and outer London.

Table 4. Summary of emissions reductions in central zone

Pollutant	Comparison to "no ULEZ" scenario, Oct – December 2019	
	Reduction [tonnes]	Reduction [per cent]
NO_x	230	35%
$PM_{2.5}$	6	15%
CO_2	12,300	6%

Traffic flows

Transport for London uses automatic traffic count data at representative sites across London to monitor changes in traffic flows. These sites provide total traffic flows (for all vehicles) for each hour of the day. In this analysis the sites have been averaged over each month to allow estimates of changes in traffic flows in central, inner and outer London to be determined.

Traffic flows change across the year reflecting seasonal patterns such as holiday periods. Therefore, the best way to evaluate a change in traffic flow is to compare to the same period in previous years. In Table 5 monthly data for 2019 has been compared to 2018 and the percentage change in average flows calculated.

Table 5: Change in average 24 hour traffic flows in London from 2018 to 2019

	All days of week			Weekdays			Weekends		
Comparison 2019 to 2018	Central	Inner	Outer	Central	Inner	Outer	Central	Inner	Outer
January	0%	-1%	2%	0%	-1%	2%	-1%	-1%	2%
February	0%	-1%	2%	0%	-1%	2%	0%	-2%	2%
March	2%	2%	4%	1%	2%	3%	4%	3%	6%
April	-2%	-2%	2%	-2%	-1%	2%	-3%	-2%	1%
May	-3%	-1%	1%	-2%	-2%	1%	-6%	0%	1%
June	-5%	0%	0%	-5%	0%	0%	-6%	1%	0%
July	-5%	-1%	1%	-5%	-2%	1%	-5%	0%	1%
August	-8%	-4%	1%	-7%	-4%	0%	-9%	-3%	3%
September	-9%	-2%	0%	-9%	-2%	0%	-11%	-1%	0%
October	-9%	0%	-2%	-8%	0%	-2%	-11%	-1%	-2%
November	-7%	0%	-2%	-6%	0%	-2%	-9%	0%	-2%
December	-6%	-1%	0%	-5%	-1%	0%	-8%	-1%	0%
January	-8%	0%	0%	-7%	0%	0%	-10%	0%	1%

The table shows that in early 2019 there was very little change in average traffic flows in central and inner London when compared to 2018, whilst there was around 2 per cent increase in outer London. Traffic in inner and outer London between April and July varied by up to a couple of percent compared to the same months in 2018. However, after March

reductions in average traffic flows of around 3 – 9 per cent are reported in central London when compared to the previous year. Similar estimates have been seen across both weekdays and weekends.

This is an indication that the introduction of the ULEZ is contributing to a reduction in traffic flows in central London. Across the year the average change comparing 2019 to 2018 is estimated to be a 4.5 per cent reduction in central London. However, it is too soon to fully attribute these changes solely to ULEZ, as more data is required for analysis over a longer period.

When comparing weekdays, a similar pattern is seen – whereby changes in central London in 2018 are greater than those for inner London. For weekends, the difference appears to be greater still. This is likely to reflect the fact that weekends are now subject to a charge for the first time, unlike congestion charging which only affects weekdays.

Analysis of changes in traffic flows across different times of the day has also been analysed. The results are similar to those seen for 24 hour data. However, the data suggests more substantial differences between 2018 and 2019 in the evening, late evening and night time hours – which are hours where charges have not been applied before.

Traffic flow changes are still preliminary, and data will continue to be collected over the coming months in order to understand if trends are sustained, and how these vary across the different times of day and weekends, and on specific roads across the network.

Number of vehicles and compliance rates

FIRST MONTH – changes in vehicle numbers and compliance (March 2019 – April 2019)

Table 6 compares vehicle numbers and compliance rates for the month immediately before the scheme was introduced (March 2019) and the scheme's first month of operation (April 2019). As explained earlier in this chapter, this excludes non-typical days.

The changes below capture the more immediate effect following the launch of the scheme and do not take into account those who changed their behaviour ahead of time in preparation for the scheme.

Table 6. Average number and proportion of compliant vehicles detected in the zone per 'typical' day during CC hours March 19 – April 19

Month	Number of vehicles driving in the charging zone per day during CC hours			Proportions of vehicles driving in the charging zone during CC hours	
	Unique vehicles detected in zone*	Non-compliant vehicles	Compliant vehicles	Non-compliant vehicles	Compliant vehicles
Mar - 19	91,035	35,578	55,457	39.1%	60.9%
Apr – 19	89,380	26,195	63,185	29.3%	70.7%
Change	-1,655	-9,383	7,728	Decrease of 9.8 percentage points	Increase of 9.8 percentage points
% change	-1.8%	-26.4%	13.9%	-25.0%	16.1%

*not representative of traffic flow

Key impacts of the first month of the scheme compared to the previous month:

- In the first month of operation (excluding non-typical days) the compliance rate with the ULEZ standards in congestion charging hours was around 71 per cent. This is much higher than the 61 per cent in March 2019
- There was a large reduction in the number of older, more polluting, non-compliant vehicles detected in the zone: some 9,383 fewer on an average 'typical' day, a reduction of over a quarter

FIRST TEN MONTHS – changes in vehicle numbers and compliance (March 2019 – January 2020)

Table 7 compares vehicle numbers and compliance rates for the month immediately before the scheme was introduced (March 2019) and the scheme's first ten months of operation. This excludes non-typical days for April 2019. The table below captures the more immediate effect following the launch of the scheme and does not take into account those who changed their behaviour ahead of time in preparation for the scheme, this is captured in the pre-compliance data presented later in this report.

Table 7. Average number and proportion of unique compliant vehicles detected in the zone during CC hours March 19 – January 20

Month	Number of vehicles driving in the charging zone per day during CC hours			Proportions of vehicles driving in the charging zone during CC hours	
	Unique vehicles detected in zone*	Non-compliant vehicles	Compliant vehicles	Non-compliant vehicles	Compliant vehicles
March 19	91,035	35,578	55,457	39.1%	60.9%
April 19	89,380	26,195	63,185	29.3%	70.7%
May 19	88,796	25,610	63,186	28.8%	71.2%
June 19	87,113	24,549	62,564	28.2%	71.8%
July 19	83,899	23,054	60,844	27.5%	72.5%
August 19	80,128	21,133	58,994	26.4%	73.6%
Sept 19	85,854	22,133	63,721	25.8%	74.2%
Oct 19	82,776	21,239	61,537	25.7%	74.3%
Nov 19	84,797	21,222	63,575	25.0%	75.0%
Dec 19	84,032	20,533	63,499	24.4%	75.6%
Jan 20	78,754	18,182	60,572	23.1%	76.9%
Change March 19 – Jan 20	-12,281	-17,396	5,115	Decrease of 16 percentage points	Increase of 16 percentage points
% change	-13%	-49%	9%	-41%	26%

*not representative of traffic flow

Key impacts of the first ten months of the scheme compared to March 2019 (the month before the scheme was implemented):

- In January 2020 the compliance rate with the ULEZ standards was 77 per cent. This is much higher than the 61 per cent in March 2019.

- From March 2019 – January 2020 there was a large reduction in the number of older, more polluting, non-compliant vehicles detected in the zone: some 17,396 fewer on an average day, a reduction of around 49 per cent.

- There was around a 41 per cent decrease in the proportion of vehicles in the central zone that were non-compliant between March 2019 and January 2020.

PRE- COMPLIANCE – changes in vehicle numbers and compliance (February 2017 – March 2019)

Table 8 below shows the change in the number of vehicles detected in the zone and the compliance level between February 2017 and March 2019. This data was released in April 2019 to coincide with the launch of the scheme[5].

Table 8. Average number and proportion of unique compliant vehicles detected in the zone per day during CC hours February 17 – March 19

Month	Number of vehicles driving in the charging zone per day during CC hours			Proportions of vehicles driving in the charging zone during CC hours	
	Unique vehicles detected in zone*	Non-compliant vehicles	Compliant vehicles	Non-compliant vehicles	Compliant vehicles
Feb 17	102,493	62,310	40,184	60.8%	39.2%
March 19	91,035	35,578	55,457	39.1%	60.9%
Change Feb 17 – March 19	-11,458	-26,732	15,273	Decrease of 21.7 percentage points	Increase of 21.7 percentage points
% change	-11%	-43%	38%	-35.7%	55.4%

*not representative of traffic flow

As Table 8 indicates, the proportion of compliant vehicles detected in the Central London ULEZ zone rose from 39 per cent in February 2017 (when the Mayor confirmed the introduction of the T-charge) to 61 per cent in March 2019. This represents a 55 per cent increase in the proportion of compliant vehicles detected in the zone.

[5] https://www.london.gov.uk/press-releases/mayoral/ulez-launches-in-central-london

The proportion of vehicles that are compliant is the best way of comparing changes in the vehicle fleet, given the number of unique vehicles detected in the zone also changed over this period.

PRE- COMPLIANCE and LATEST MONTH – changes in vehicle numbers and compliance (February 2017 – January 2020)

Table 9 shows the change in vehicle compliance from February 2017 to January 2020. This is presented as an absolute change in the number of vehicles detected, the change in the percentage of vehicles that are compliant, and also the change in the proportion of vehicles that are compliant.

Table 9. Average number and proportion of unique compliant vehicles detected in the zone during CC hours February 17 – January 20

Month	Number of vehicles driving in the charging zone per day during CC hours			Proportions of vehicles driving in the charging zone during CC hours	
	Unique vehicles detected in zone*	Non-compliant vehicles	Compliant vehicles	Non-compliant vehicles	Compliant vehicles
Feb 17	102,493	62,310	40,184	60.8%	39.2%
Jan 20	78,754	18,182	60,572	23.1%	76.9%
Change Feb 17 – Jan 20	-23,739	-44,128	20,388	Decrease of 38 percentage points	Increase of 38 percentage points
% change	-23%	-71%	51%	-62%	96%

*not representative of traffic flow

Key findings for the first ten months of the scheme compared to February 2017, taking pre-compliance into account:

- From February 2017 to January 2020 there was a large reduction in the number of older, more polluting, non-compliant vehicles detected in the zone: some 44,128 fewer on an average day, a reduction of 71 per cent.
- There was a 96 per cent increase in the proportion of vehicles detected in the zone that met the ULEZ standards between February 2017 and January 2020. As mentioned previously, the proportion of vehicles that are compliant is the best way of

comparing changes in the vehicle fleet, given the number of unique vehicles detected in the zone also changed over this period.

Comparison between congestion charge hours and 24 hour data

To ensure a fair comparison with historic data the previous analysis compares data for CC hours only. Table 10 below includes vehicle numbers and compliance rates for CC hours and 24 hour average daily vehicles detected in the zone for January 2020. The 24 hour compliance rate in January 2020 was 79 per cent.

Table 10. Comparison of average unique daily vehicles for January 2020 for CC hours and 24 hour data

Time	Number of vehicles driving in the charging zone per day			Proportions of vehicles driving in the charging zone	
	Unique vehicles detected in zone*	Non-compliant vehicles	Compliant vehicles	Non-compliant vehicles	Compliant vehicles
CC hours	78,754	18,182	60,572	23.1%	76.9%
24 hour	106,664	22,255	84,409	20.9%	79.1%

*not representative of traffic flow

As was the case in the preceding months, the majority of unique vehicles detected in the zone (around three quarters) were detected during CC hours. There was a slight increase in compliance rate between CC hours and 24 hour data, this indicates that vehicles entering the zone in the evening and on weekends were less likely to be older more polluting vehicles.

Table 11. Average number and proportion of unique compliant vehicles detected in the zone over a 24 hour period from April 2019 – January 2020

Month	Number of vehicles driving in the charging zone per day			Proportions of vehicles driving in the charging zone	
	Unique vehicles detected in zone*	Non-compliant vehicles	Compliant vehicles	Non-compliant vehicles	Compliant vehicles
April 19	121,664	32,137	89,527	26.4%	73.6%
May 19	117,289	30,146	87,144	25.7%	74.3%
June 19	118,021	29,434	88,588	24.9%	75.1%
July 19	116,082	28,562	87,520	24.6%	75.4%
August 19	108,932	25,802	83,130	23.7%	76.3%
Sept 19	116,601	27,044	89,557	23.2%	76.8%
Oct 19	114,035	26,240	87,795	23.0%	77.0%
Nov 19	116,930	26,366	90,564	22.5%	77.5%
Dec 19	113,597	25,293	88,304	22.3%	77.7%
Jan 20	106,664	22,255	84,409	20.9%	79.1%

*not representative of traffic flow

Table 11 above shows the number of unique vehicles detected in the zone and compliance rate for an average day (24 hours) from April to January 2020. For all months the 24 hour compliance rate was higher than the CC hours compliance rate.

As discussed, data before April 2019 was collected during congestion charging (CC) hours only and we are therefore unable to compare 24 hour data to a time before the ULEZ was introduced

Charge payments and penalty charges

On an average day in January 2020 around 22,255 non-compliant, unique vehicles were detected in the zone. Of these:

- Around 10,628 (48 per cent) paid the charge (2,611 ULEZ web or call centre payments, 5,142 Auto Pay payments and 2,875 ULEZ Fleet charge payments)
- Around 1,894 (9 per cent) were in contravention of the scheme and incurred a penalty charge
- Around 9,733 (44 per cent) were not required to pay the daily ULEZ charge as they are eligible for a 100% discount or exemption

Compliance by vehicle type

Table 12 shows the daily average 24 hour compliance rate in January 2020 broken down by vehicle type.

Table 12. 24 hour compliance rate in January 2020 by vehicle type

Vehicle type	Number of vehicles driving in the charging zone per day			Proportions of vehicles driving in the charging zone	
	Unique vehicles detected in zone*	Non-compliant vehicles	Compliant vehicles	Non-compliant vehicles	Compliant vehicles
All Vehicles	106,664	22,255	84,409	20.9%	79.1%
Cars	78,684	13,968	64,716	17.8%	82.2%
Cars (excluding taxis)	*69,724*	*7,609*	*62,115*	*10.9%*	*89.1%*
Taxis only[6]	*8,961*	*6,359*	*2,602*	*71.0%*	*29.0%*
Vans	18,808	6,837	11,971	36.4%	63.6%
HGVs	3,376	327	3,049	9.7%	90.3%
TfL buses	1,621	0	1,621	0%	100%
Non-TfL Bus/Coach	452	105	347	23.2%	76.8%
Other *	2,847	154	2,693	5.4%	94.6%
Unknown	877	865	12	**	**

*Other vehicle category includes motorbikes, mini-buses, TfL buses and non-road going vehicles
**Unknown means vehicle type cannot be determined (e.g. foreign vehicles). These default to non-compliant unless registered.

Table 12 shows the highest compliance rate is for HGVs at 90 per cent, next is car (excluding taxis) with a compliance rate of 89 per cent. The data shows that the compliance rate for cars in general is very high, but when grouped with taxis it falls to 82 per cent.

The Mayor has taken steps to support taxi drivers in the move to cleaner cabs with TfL's Taxi Delicensing Scheme launched in 2017 offering payments of up to £5,000 to retire the oldest taxis from London licensing. The scheme was enhanced in 2019 to offer top level payments of £10,000. There are now over 3,370 ZEC taxis. In late 2019 the first ever fully

[6] Taxis refers to black cabs only and does not include Private Hire Vehicles

electric London black cab, the Dynamo, was launched and by February there were already 18 in circulation.

To ensure London returns to being on track to reduce emissions from taxis by 65 per cent by 2025, TfL confirmed last year that the age limit for black cabs will be reduced to 12 years for Euro 3, 4 and 5 taxis by 2022. From November 2019, the current 15-year age limit will apply to the anniversary of the date when the vehicle was licensed, with a proposed reduction in the age limit to 14 years from November 2020 and an annual reduction of one year each year until the 12-year age limit is reached. Euro 6 taxis, taxis converted to liquid petroleum gas (which reduces NOx emissions from taxis by over 70 per cent) and ZEC taxis will retain the 15-year age limit. TfL retains the ability to grant exemptions to the age limit requirements on a case by case basis.

For more information please see the Taxi and Private Hire pages of the TfL website.

Appendix 1: Methodology

The method for this report is the same as that included in the Appendix of the Central London ULEZ - Six Month Report.

We are grateful to Dr Gary Fuller, King's College London who kindly provided peer review support and comments on this methodology.

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