

LOW EMISSION BUS ZONES: EVALUATION REPORT

September 2019



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Introduction

In August 2016 the Mayor of London announced London's first Low Emission Bus Zone programme. A total of twelve Low Emission Bus Zones are now in operation across London. This report reviews the impact of the Low Emission Bus Zone programme on air quality emissions and concentrations and is an update to the [Low Emission Bus Zones: Evaluation of the first seven zones report](#) published in November 2018.

What is a Low Emission Bus Zone?

Low Emission Bus Zones are bus corridors that are used by only buses with top-of-the-range engines and exhaust systems that meet or exceed the highest Euro VI emissions standards¹.

The zones have been prioritised in the worst air quality hotspots outside central London where buses contribute significantly to road transport emissions. Since April 2019 all TfL buses operating in the central London Ultra Low Emission Zone meet or exceed the Euro VI standard. All the Low Emission Bus Zones meet the following criteria:

- Buses are forecast to still be contributing 40 per cent or more of road transport NOx in 2020
- pollutant concentrations were above legal limits for NO₂ and are forecast to continue to exceed in 2020; and
- Outside of the central Ultra Low Emission Zone (where all the buses have been cleaned up for the start of the ULEZ in April 2019).

The first zone was introduced along Putney High Street in March 2017 and was followed by a second between Brixton Road and Streatham High Road in December 2017.

All 12 zones are now completed much sooner than the planned delivery date of 2020. The emissions reductions from the Low Emission Bus Zones form a central part of the Mayor's far-reaching plans for a drastic clean-up of London's toxic air. By October 2020, all of London's buses will either meet or exceed the Euro VI standard, meaning the whole of London will be a Low Emission Bus Zone.

¹ Due to the length of the zones there are locations where non-compliant buses cross or travel for a short distance along a Low Emission Bus Zone, even though they do not serve a bus stop within the zone.

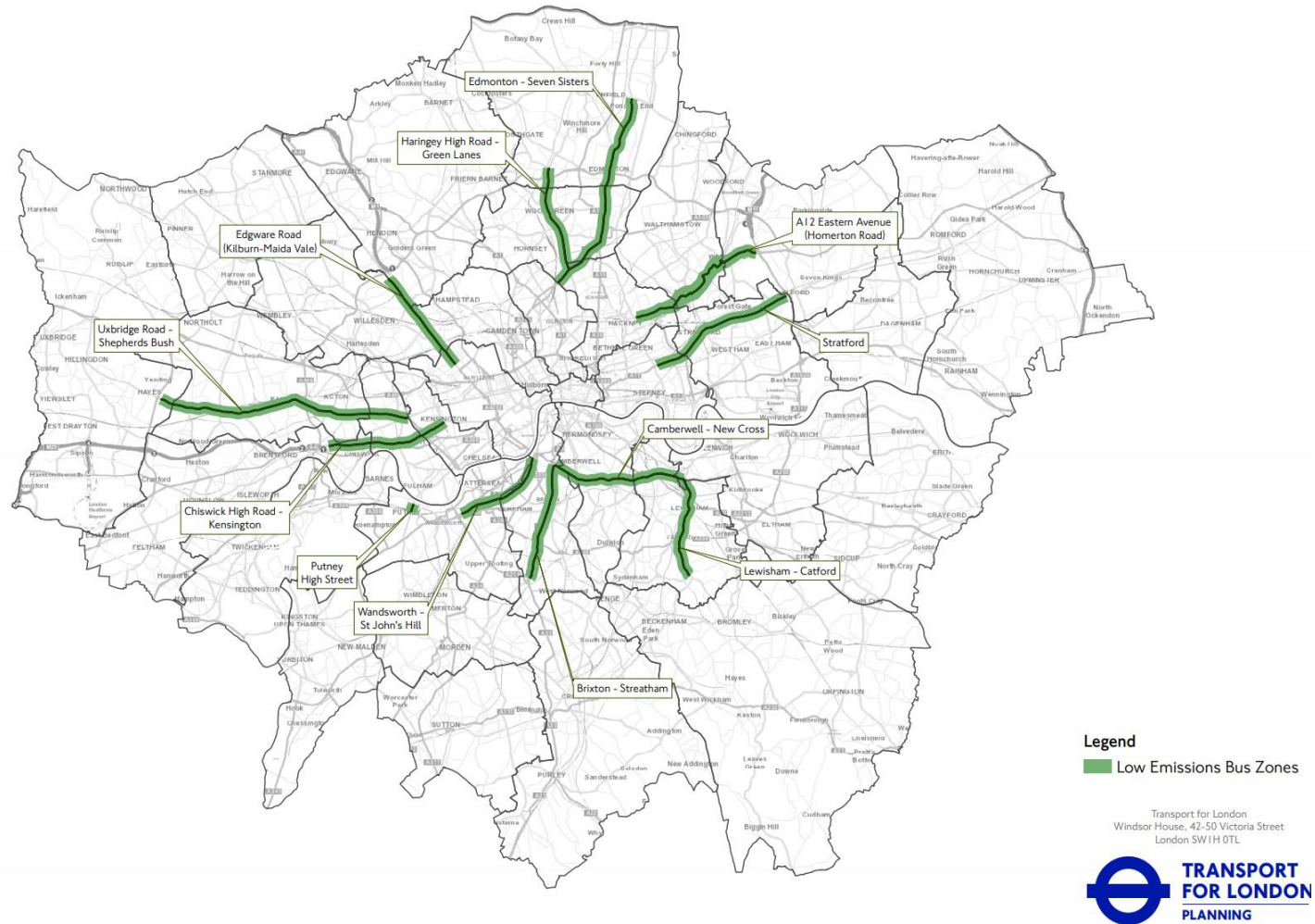


Figure 1: Map of the twelve Low Emission Bus Zones

Low Emission Bus Zone locations and completion dates

Putney High Street from Putney Station to Putney Bridge Road – completed October 2017

Brixton to Streatham from Brixton Road, along Brixton Hill, Streatham Hill and Streatham High Road – completed October 2017

Camberwell to New Cross from Camberwell New Road, along Peckham High Street to New Cross Road – completed July 2018

Wandsworth to St John's Hill from Lavender Hill to Wandsworth Road – completed July 2018

Haringey from High Road to Green Lanes – completed July 2018

A12 Eastern Avenue from Homerton High Street along Homerton Road, Warren Road, Gainsborough Road, Cambridge Park Road to Eastern Avenue – completed September 2018

Edgware Road (Kilburn to Maida Vale) from Cricklewood Broadway via Shoot-Up Hill to Kilburn High Road – completed October 2018

Lewisham to Catford from Bromley Road, along Lewisham High Street to Lewisham Road – completed December 2018

Edmonton to Seven Sisters from Hertford Road High Street via Fore Street to Seven Sisters Road – completed April 2019

Stratford from Mile End Road to Romford Road – completed May 2019

Chiswick High Road to Kensington from Chiswick High Road via Hammersmith Broadway to Kensington High Street – completed June 2019

Uxbridge Road to Shepherds Bush from Uxbridge Road via Ealing Broadway, The Vale to Uxbridge Road – completed August 2019

In addition, since April 2019 all buses entering the **Central London Ultra Low Emission Zone** either meet or exceed the strictest Euro VI standards.

Summary of data

Estimated annual NO_x emissions reductions

Table 1. Reduction in NO_x emissions as a result of the Low Emission Bus Zone

	Emissions in 2016 before LEBZ [tonnes]	Emissions in 2019 after LEBZ [tonnes]	Saving [tonnes]	Reduction [%]
Putney High Street	20	3	17	87%
Brixton to Streatham	82	9	73	89%
Camberwell to New Cross	104	11	93	90%
Wandsworth to St. John's Hill	53	5	48	91%
High Road to Green Lanes	86	7	79	92%
A12 Eastern Avenue	59	5	54	91%
Edgware Road	43	5	39	90%
Lewisham to Catford	118	12	107	90%
Edmonton to Seven Sisters	106	10	96	91%
Stratford	87	8	78	90%
Chiswick High Road to Kensington	78	7	71	91%
Uxbridge Road to Shepherds Bush	138	11	127	92%
Total	974	92	881	91%

For context, in 2016 the entire London bus fleet emitted 3083 tonnes of NO_x. The LEBZ programme has reduced the London wide bus fleet emissions by 29 per cent. By October 2020 all buses in

London will meet the LEBZ standards resulting in a 90 per cent reduction in NO_x emissions from buses London wide compared to 2016.

NO₂ concentration reductions (where monitoring data available)

Table 2 and **Table 3** show the reductions in annual and hourly NO₂ concentrations reported at air quality monitoring stations located within a Low Emission Bus Zone. We are only able to include data from a Low Emission Bus Zone where a monitoring station is located nearby. The London boroughs are responsible for installing, maintaining and operating these monitoring stations.

Table 2: Reduction in annual average NO₂ concentrations at monitoring sites in Low Emission Bus Zones

Route	Monitoring site	Annual average in 2016 [$\mu\text{g m}^{-3}$]	Average in 2019 to date [$\mu\text{g m}^{-3}$]*	Reduction
Putney High Street	Putney High Street (Façade)	98	60	39%
Brixton to Streatham	Lambeth Brixton Road	118	60	49%
Camberwell to New Cross	Lewisham New Cross	46	39	15%
Wandsworth to St. John's Hill	Wandsworth Lavender Hill	43 [†]	35	19%
Lewisham to Catford	Lewisham Catford	43 [†]	33	23%
Edmonton to Seven Sisters	Haringey Town Hall	43	37	14%
Stratford	Newham Cam Road	42	24	43%
Chiswick High Road to Kensington	Hounslow Chiswick	50	38	24%
Uxbridge Road to Shepherds Bush	Hammersmith & Fulham Shepherd's Bush	79	57	28%

*For 2019 data is averaged for the year to 15 August with the exception of Brixton Road (which is operated and maintained by Lambeth) which was offline for the first few months of the year. Brixton Road 2019 data is from the period 26 April – 15 August. This will be updated to an annual figure once more data is available

[†] For Wandsworth Lavender Hill and Lewisham Catford there was not sufficient data capture to report an annual average for 2016. Instead the figure quoted is the annual average for 2017. Both zones were not fully complete until 2018.

Numbers of hours exceeding NO₂ hourly limit [200 µg m⁻³]

Table 3: Reduction numbers of hours exceeding NO₂ hourly limit [200 µg m⁻³] in Low Emission Bus Zones (year to date)

Route	Monitoring site	Hours in 2016 (to date)*	Hours in 2019 (to date)*	Reduction
Putney High Street	Putney High Street (Façade)	289	1	99.7%
Brixton to Streatham	Lambeth Brixton Road	77	0	100.0%
Camberwell to New Cross	Lewisham New Cross	0	0	n/a
Wandsworth to St. John's Hill	Wandsworth Lavender Hill	23	0	100.0%
Lewisham to Catford	Lewisham Catford	0	0	n/a
Edmonton to Seven Sisters	Haringey Town Hall	0	0	n/a
Stratford	Newham - Cam Road	0	0	n/a
Chiswick High Road to Kensington	Hounslow - Chiswick	0	0	n/a
Uxbridge Road to Shepherds Bush	Hammersmith & Fulham Shepherd's Bush	25	2	92.0%

* This data was compiled on 15 August 2019. To ensure data is comparable, all exceedances listed in the table above occurred between 1 January – 15 August in the respective year.

† For Brixton Road only exceedances that occurred between 26 April – 15 August in the respective year are included (for both 2016 and 2019) to ensure data is comparable

Buses will only be one part of the traffic contributing to local pollution concentrations. Therefore, the resulting scope for any reductions in pollution concentrations as a result of the introduction of a Low Emission Bus Zone will vary by location. The reductions reported may also capture the benefits of other air quality policies, such as the introduction of the central London Ultra Low Emission Zone.

There are a number of reasons different monitoring sites may record different levels of reduction since the implementation of the Low Emission Bus Zones. These include;

- Though all Low Emission Bus Zones are in areas where buses account for at least 40 per cent of NO_x emissions some of the zones (such as Putney High Street) will have a higher percentage emissions from buses than others. It is therefore likely the impact on concentrations will be higher at these zones
- Some zones may also be impacted by other policies making concentrations reductions higher in these zones
- The siting of the monitoring station can have a big impact on the concentrations recorded. Monitoring sites are placed varying distances from the kerb of the road, sites located further from the kerb will be influenced more by non-road transport sources and therefore likely to report lower reductions.
- The topography of a road can influence local dispersion patterns as well as local prevailing wind directions which can have a large impact on the concentrations of pollutants recorded at monitoring sites.

Detailed analysis of the Low Emission Bus Zones

Putney High Street

Putney High Street was the first Low Emission Bus Zone to be completed in October 2017. The [Putney High Street \(Façade\)](#) air quality monitoring station is located part way along the Putney High Street bus corridor and is classified as a roadside site. There are two monitoring stations on Putney High Street. We have used the Putney High Street Façade monitoring station to calculate the benefits of the Low Emission Bus Zone as this is more representative of conditions that pedestrians will experience.

Reduction in emissions from buses

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on Putney High Street emit on average 87 per cent less NO_x than previously, with some routes having reduced emissions by 92 per cent.

As a result of cleaning up the buses on Putney High Street, these buses now emit 17 tonnes less NO_x per year than they did previously.

Annual average concentrations

There is a legal limit set for the annual average of NO₂ of 40 µg m⁻³.

At Putney High Street in 2016 annual average NO₂ was 98 µg m⁻³.

In 2019 (year to 15 August) the annual average has been 60 µg m⁻³. Whilst there is still work to be done in order to meet the legal limit this is a significant reduction of 39 per cent.

Hourly average concentrations

There is a legal limit set at 18 for the number of times the hourly average of NO₂ is allowed to exceed 200 µg m⁻³ per year.

At Putney High Street in 2016 (year to 15 August) there were 289 hours that exceeded the hourly limit meaning this site exceeded the legal limit for that year.

In 2019 to 15 August there has been only 1 hour of exceedance, this is a reduction of 99.7% per cent. Putney High Street is now on course to meet the hourly legal limit in 2019.

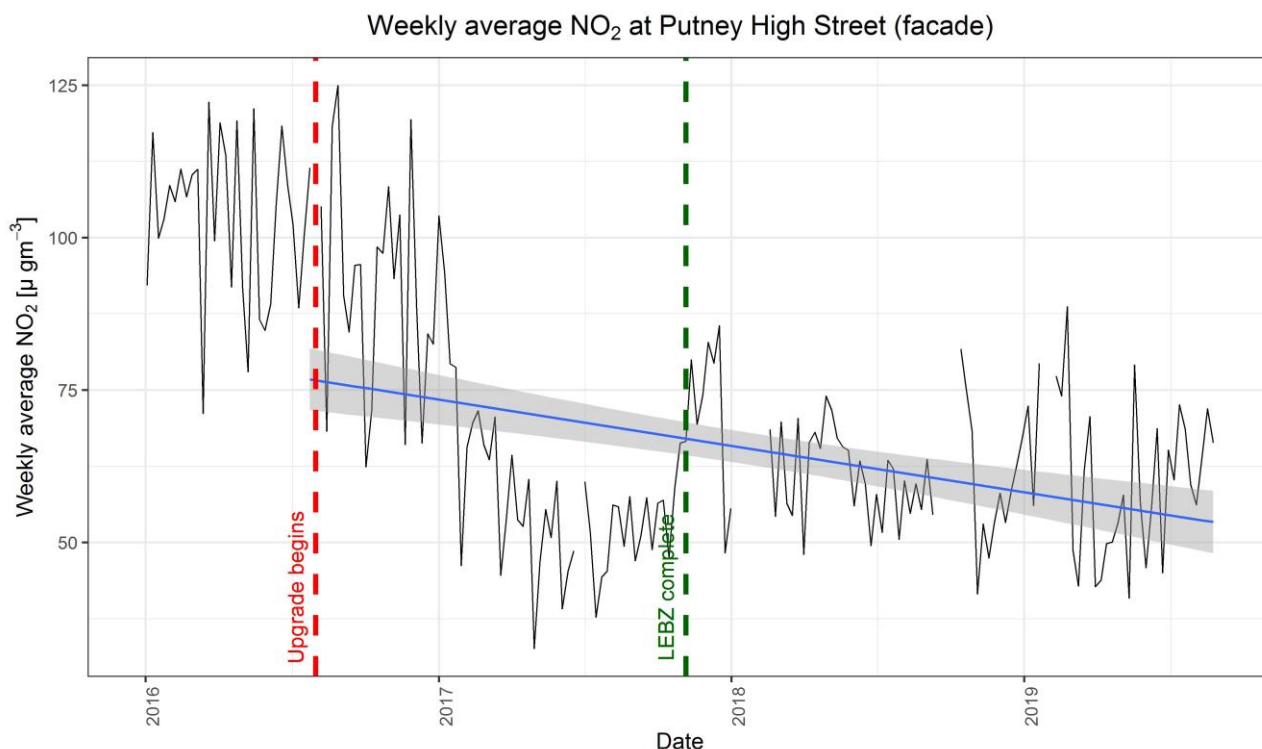


Figure 2: Weekly average concentrations of NO₂ at Putney High Street (façade)

In **Figure 2** the vertical red dashed line indicates the date when delivery of the Low Emission Bus Zone began. After this, non-Euro VI buses/non-compliant buses on this route were retrofitted or replaced with new buses. The green vertical dashed line indicates the date when the Low Emission Bus Zone was complete. Weekly averages have not been included for weeks with less than 75 per cent data capture and the most recent data is not yet ratified and may be subject to change.

Figure 2 shows there has been a decreasing trend in weekly average NO₂ concentrations since implementation of the Low Emission Bus Zone began in mid-2016.

Brixton to Streatham

Brixton Road was the second Low Emission Bus Zone completed in October 2017. The [Lambeth Brixton Road](#) air quality monitoring station is located part way along the Brixton to Streatham bus corridor and is classified as a kerbside site.

During a heavy rainstorm in August 2018 the Lambeth Brixton Road site was flooded, and all the equipment was damaged. The equipment has since been repaired. The London Borough of Lambeth, who are responsible for the monitoring site, ordered a new waterproof enclosure and replacement equipment. However, a number of delays with supplies and contractors resulted in the station being offline until 26 April 2019.

Reduction in emissions from buses

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on Brixton Road emit on average 89 per cent less NO_x than previously, with some routes having reduced emissions by 93 per cent.

As a result of cleaning up the buses on Brixton Road, these buses now emit 73 tonnes less NO_x per year than they did previously.

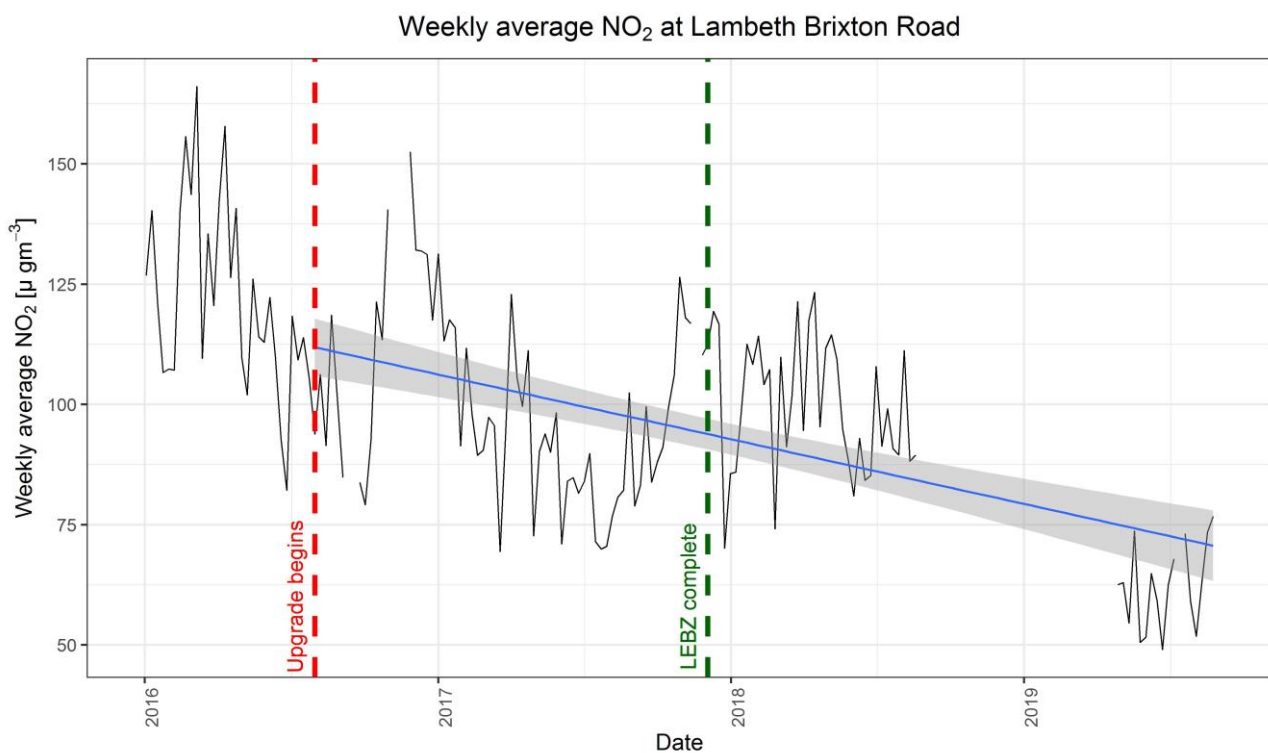


Figure 3: Weekly average concentrations of NO₂ at Lambeth Brixton Road

In **Figure 3** above the vertical red dashed line indicates the date when delivery of the Low Emission Bus Zone began. After this, non-Euro VI buses/non-compliant buses on this route were retrofitted or replaced with new buses. The green vertical dashed line indicates the date when the Low Emission Bus Zone was completed. Weekly averages have not been included for weeks with less than 75 per cent data capture and the most recent data is not yet ratified and may be subject to change.

Figure 3 shows there has been a decreasing trend in weekly average NO₂ concentrations since implementation of the Low Emission Bus Zone began in mid-2016.

Annual average concentrations

There is a legal limit set for the annual average of NO₂ of 40 µg m⁻³.

At Lambeth Brixton Road in 2016 annual average NO₂ was 118 µg m⁻³.

In 2019 (from 26 April to 15 August) the average was 60 µg m⁻³. Whilst there is still work to be done in order to meet the legal limit this is a significant reduction of 49 per cent.

Hourly average concentrations

There is a legal limit set at 18 for the number of times the hourly average of NO₂ is allowed to exceed 200 µg m⁻³ per year.

At Lambeth Brixton Road in 2016 (26 April – 15 August) there were 77 hours that exceeded the hourly limit, meaning this site exceeded the legal limit for that year.

In 2019 (26 April – 15 August) there has been 0 hours of exceedance, this is a reduction of 100.0% per cent. Lambeth Brixton Road is currently on course to meet the hourly legal limit in 2019.

Camberwell to New Cross

The Camberwell to New Cross Low Emission Bus Zone was completed in August 2018. The [Lewisham New Cross](#) air quality monitoring station is part way along the Camberwell to New Cross bus corridor and is classified as a roadside site.

Reduction in emissions from buses

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on the Camberwell to New Cross corridor emit on average 90 per cent less NO_x than previously, with some routes having reduced emissions by 93 percent.

As a result of cleaning up the buses between Camberwell and New Cross, these buses now emit 93 tonnes less NO_x per year than they did previously.

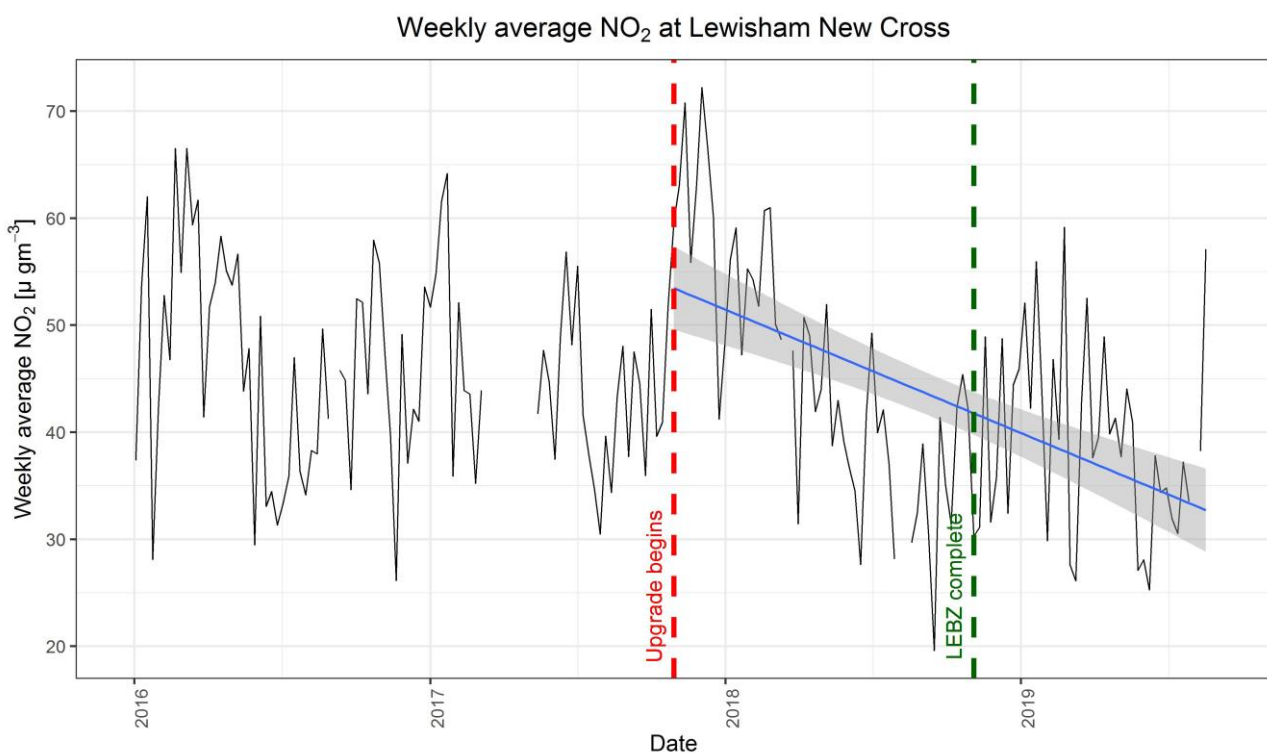


Figure 4: Weekly average concentrations of NO₂ at Lewisham New Cross

In **Figure 4** above the vertical red dashed line indicates the date when delivery of the Low Emission Bus Zone began. After this, non-Euro VI buses/non-compliant buses on this route were retrofitted or replaced with new buses. The green vertical dashed line indicates the date when the Low Emission Bus Zone was complete. Weekly averages have not been included for weeks with less than 75 per cent data capture and the most recent data is not yet ratified and may be subject to change.

Figure 4 shows there has been a decreasing trend in weekly average NO₂ concentrations since implementation of the Low Emission Bus Zone began in late 2017.

Annual average concentrations

There is a legal limit set for the annual average of NO₂ of 40 µg m⁻³.

At Lewisham New Cross in 2016 annual average NO₂ was 46 µg m⁻³.

In 2019 (year to 15 August) the annual average has been 39 µg m⁻³. This is a reduction of 15 per cent and this site is currently on course to meet the annual legal limit in 2019.

Hourly average concentrations

There is a legal limit set at 18 for the number of times the hourly average of NO₂ is allowed to exceed 200 µg m⁻³ per year.

At Lewisham New Cross in 2016 (year to 15 August) there were 0 hours that exceeded the hourly limit.

In 2019 (year to 15 August) there have been 0 hours of exceedance. This site is on course to meet the hourly legal limit in 2019.

Wandsworth to St John's Hill

The Wandsworth to St John’s Hill Low Emission Bus Zone was completed in July 2018. The [Wandsworth Lavender Hill](#) air quality monitoring station is located part way down the Wandsworth to St John's Hill bus corridor. It is classified as a roadside site. However, it is set quite far back from the kerb and on an adjacent road to the bus corridor.

Reduction in emissions from buses

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on the Wandsworth to St John’s Hill corridor emit on average 91 per cent less NO_x than previously, with some routes having reduced emissions by 93 percent.

As a result of cleaning up the buses from Wandsworth to St John’s Hill, these buses now emit 48 tonnes less NO_x per year than they did previously.

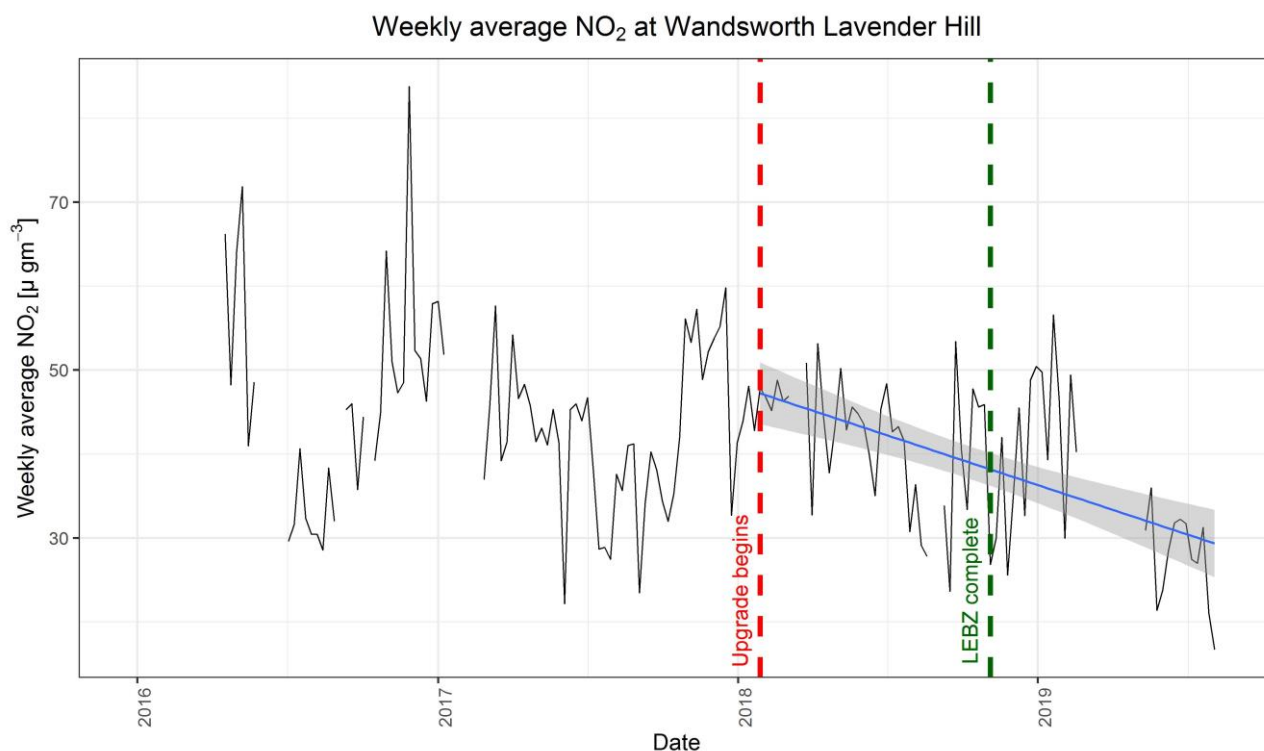


Figure 5: Weekly average concentrations of NO₂ at Wandsworth Lavender Hill

In **Figure 5** above the vertical red dashed line indicates the date when delivery of the Low Emission Bus Zone began. After this, non-Euro VI buses/non-compliant buses on this route were retrofitted or replaced with new buses. The green vertical dashed line indicates the date when the Low Emission Bus Zone was complete. Weekly averages have not been included for weeks with less than 75 per cent data capture and the most recent data is not yet ratified and may be subject to change.

Figure 5 shows there has been a decreasing trend in weekly average NO₂ concentrations since implementation of the Low Emission Bus Zone began in early 2018.

Annual average concentrations

There is a legal limit set for the annual average of NO₂ of 40 µg m⁻³.

At Wandsworth Lavender Hill in 2017 the annual average NO₂ was 43 µg m⁻³.

In 2019 (from 26 April to 15 August) the annual average was 35 µg m⁻³. This is a reduction of 19 per cent and this site is currently on course to meet the annual legal limit in 2019.

Hourly average concentrations

There is a legal limit set at 18 for the number of times the hourly average of NO₂ is allowed to exceed 200 µg m⁻³ per year.

At Wandsworth Lavender Hill in 2016 (year to 15 August) there were 23 hours that exceeded the hourly limit, exceeding the legal limit, meaning this site exceeded the legal limit for that year.

In 2019 (year to 15 August) there have been no exceedances of the hourly limit, a reduction of 100 per cent. This site is now on course to meet the hourly legal limit in 2019.

Haringey Green Lanes

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on the Haringey Green Lanes corridor emit on average 92 per cent less NO_x than previously, with some routes having reduced emissions by 93 percent.

As a result of cleaning up the buses in Haringey, these buses now emit 79 tonnes less NO_x per year than they did previously.

There is no monitoring station on the Haringey Low Emission Bus Zone so we are unable to report concentrations reductions.

A12 Eastern Avenue from Homerton High Street

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on A12 Eastern Avenue from Homerton High Street emit on average 91 per cent less NO_x than previously, with some routes having reduced emissions by 93 percent.

As a result of cleaning up the buses in Homerton, these buses now emit 54 tonnes less NO_x per year than they did previously.

We do not have a monitoring station at the roadside on the A12 in Homerton so we are unable to report concentrations reductions.

Edgware Road (Kilburn - Maida Vale)

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on A5 Edgware Road (Kilburn to Maida Vale) emit on average 90 per cent less NO_x than previously, with some routes having reduced emissions by 93 percent.

As a result of cleaning up the buses on Edgware Road, these buses now emit 39 tonnes less NO_x per year than they did previously.

There is no fixed monitoring station on the Haringey Low Emission Bus Zone so we are unable to report concentrations reductions.

Lewisham to Catford

The Lewisham to Catford Low Emission Bus Zone was completed in December 2018. The [Lewisham Catford](#) air quality monitoring station is located half way along the Lewisham to Catford corridor and is classified as an urban background site.

Reduction in emissions from buses

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on Lewisham to Catford corridor emit on average 90 per cent less NO_x than previously, with some routes having reduced emissions by 93 percent.

As a result of cleaning up the buses from Lewisham to Catford, these buses now emit 107 tonnes less NO_x per year than they did previously.

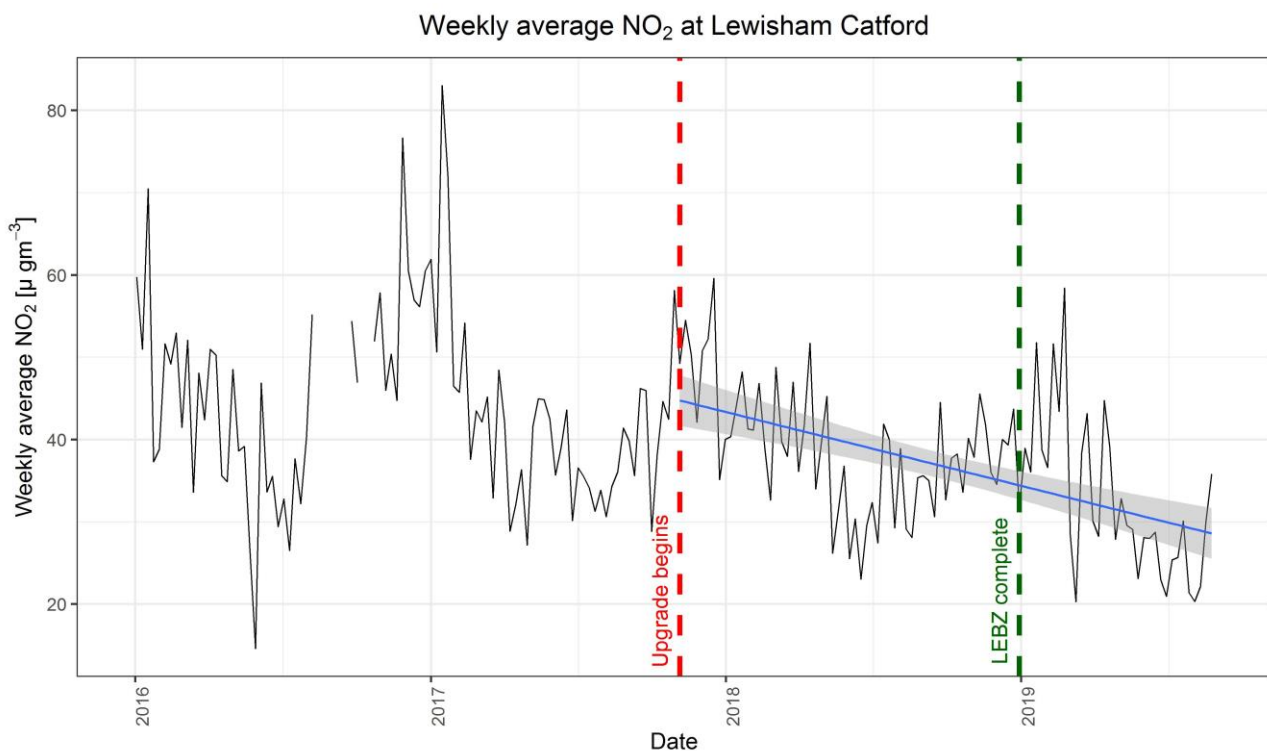


Figure 6: Weekly average concentrations of NO₂ at Lewisham Catford

In **Figure 6** above the vertical red dashed line indicates the date when delivery of the Low Emission Bus Zone began. After this, non-Euro VI buses/non-compliant buses on this route were retrofitted or replaced with new buses. The green vertical dashed line indicates the date when the Low Emission Bus Zone was complete. Weekly averages have not been included for weeks with less than 75 per cent data capture and the most recent data is not yet ratified and may be subject to change.

Figure 6 shows there has been a decreasing trend in weekly average NO₂ concentrations since implementation of the Low Emission Bus Zone began in November 2017.

Annual average concentrations

There is a legal limit set for the annual average of NO₂ of 40 µg m⁻³.

At Lewisham Catford in 2017 the annual average NO₂ was 43 µg m⁻³.

In 2019 (year to 15 August) the annual average was 33 µg m⁻³. This is a reduction of 23 per cent and this site is currently on course to meet the annual legal limit in 2019.

Hourly average concentrations

There is a legal limit set at 18 for the number of times the hourly average of NO₂ is allowed to exceed 200 µg m⁻³ per year.

At Lewisham Catford in 2016 (year to 15 August) there were 0 hours that exceeded the hourly limit.

In 2019 (year to 15 August) there have been 0 hours of exceedance. This site is on course to meet the hourly legal limit in 2019.

Edmonton to Seven Sisters

The Edmonton to Seven Sisters Low Emission Bus Zone was completed in April 2019. The [Haringey Town Hall](#) air quality monitoring station is located half way along the Edmonton to Seven Sisters bus corridor and is classified as a roadside site.

Reduction in emissions from buses

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on the Edmonton to Seven Sisters corridor emit on average 91 per cent less NO_x than previously, with some routes having reduced emissions by 93 percent.

As a result of cleaning up the buses from Edmonton to Seven Sisters, these buses now emit 96 tonnes less NO_x per year than they did previously.

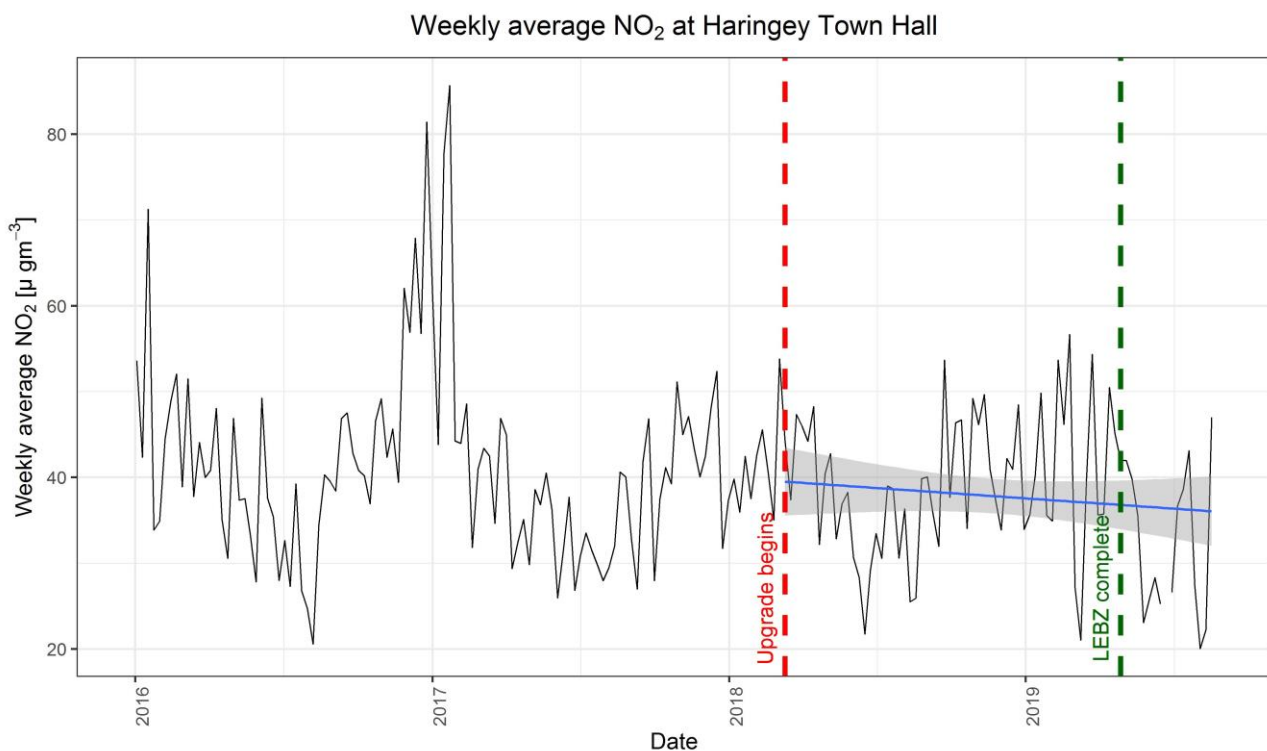


Figure 7: Weekly average concentrations of NO₂ at Haringey Town Hall

In **Figure 7** the vertical red dashed line indicates the date when delivery of the Low Emission Bus Zone began. After this, non-Euro VI buses/non-compliant buses on this route were retrofitted or replaced with new buses. The green vertical dashed line indicates the date when the Low Emission Bus Zone was complete. Weekly averages have not been included for weeks with less than 75 per cent data capture and the most recent data is not yet ratified and may be subject to change.

Figure 7 shows there has been a decreasing trend in weekly average NO₂ concentrations since implementation of the Low Emission Bus Zone began in March 2018.

Annual average concentrations

There is a legal limit set for the annual average of NO₂ of 40 µg m⁻³.

At Haringey Town Hall in 2016 the annual average NO₂ was 43 µg m⁻³.

In 2019 (year to 15 August) the annual average was 37 µg m⁻³. This is a reduction of 14 per cent and this site is currently on course to meet the annual legal limit in 2019. In addition, the Low Emission Bus Zone from Edmonton to Seven Sisters has only been in full implementation since April 2019. It is likely average NO₂ concentrations will be lower once the route has been established longer.

Hourly average concentrations

There is a legal limit set at 18 for the number of times the hourly average of NO₂ is allowed to exceed 200 µg m⁻³ per year.

At Haringey Town Hall in 2016 (year to 15 August) there were 0 hours that exceeded the hourly limit.

In 2019 to 15 August there have been 0 hours of exceedance. This site is on course to meet the hourly legal limit in 2019.

Stratford

The Stratford Low Emission Bus Zone was completed in May 2019. The [Newham Cam Road](#) air quality monitoring station is located half way along the Stratford bus corridor and is classified as a roadside site.

Reduction in emissions from buses

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on the Stratford bus corridor emit on average 90 per cent less NO_x than previously, with some routes having reduced emissions by 93 percent.

As a result of cleaning up the buses on the Stratford corridor, these buses now emit 78 tonnes less NO_x per year than they did previously.

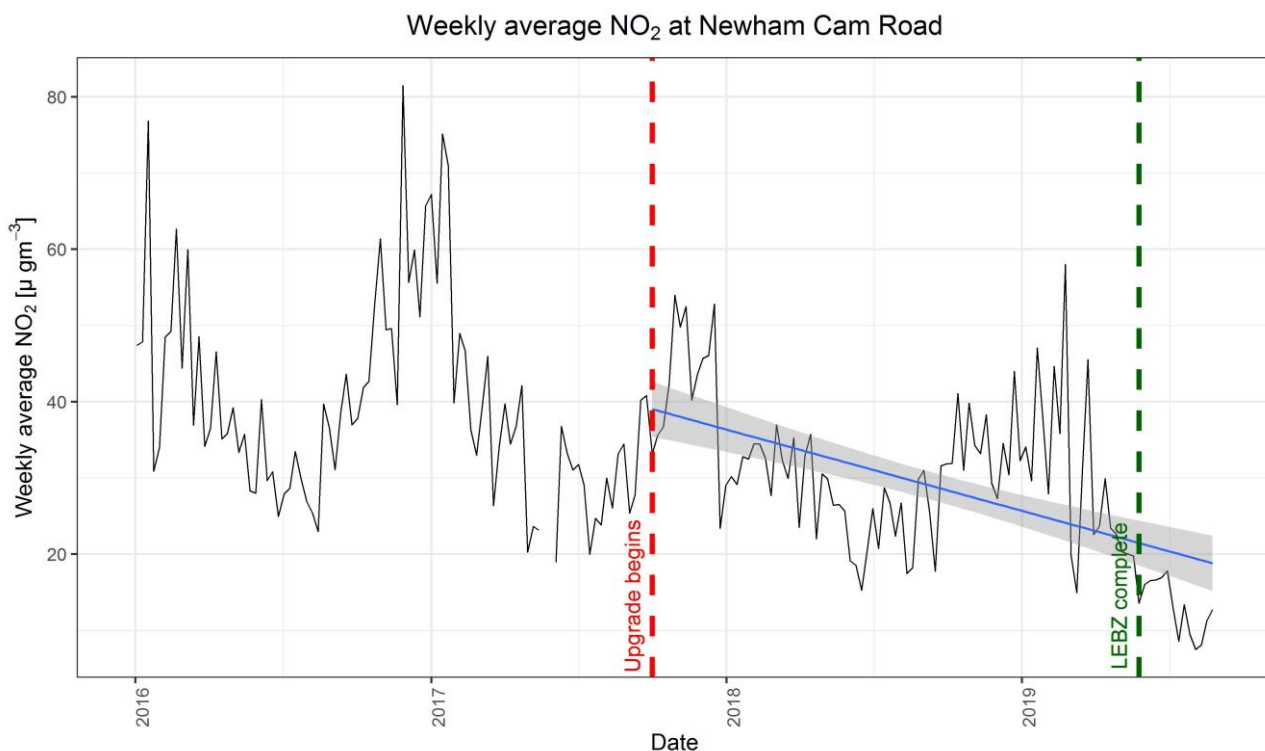


Figure 8: Weekly average concentrations of NO₂ at Newham Cam Road

In **Figure 8** the vertical red dashed line indicates the date when delivery of the Low Emission Bus Zone began. After this, non-Euro VI buses/non-compliant buses on this route were retrofitted or replaced with new buses. The green vertical dashed line indicates the date when the Low Emission Bus Zone was complete. Weekly averages have not been included for weeks with less than 75 per cent data capture and the most recent data is not yet ratified and may be subject to change.

Figure 8 shows there has been a decreasing trend in weekly average NO₂ concentrations since implementation of the Low Emission Bus Zone began in October 2017.

Annual average concentrations

There is a legal limit set for the annual average of NO₂ of 40 µg m⁻³.

At Newham Cam Road in 2016 the annual average NO₂ was 42 µg m⁻³.

In 2019 (year to 15 August) the annual average was 24 µg m⁻³. This is a reduction of 43 per cent and this site is currently on course to meet the annual legal limit in 2019. In addition, the Low Emission Bus Zone at Stratford has only been in full implementation since May 2019. It is likely average NO₂ concentrations will be lower once the route has been established longer.

Hourly average concentrations

There is a legal limit set at 18 for the number of times the hourly average of NO₂ is allowed to exceed 200 µg m⁻³ per year.

At Newham Cam Road in 2016 (year to 15 August) there were 0 hours that exceeded the hourly limit.

In 2019 (year to 15 August) there have been 0 hours of exceedance. This site is on course to meet the hourly legal limit in 2019.

Chiswick High Road to Kensington

The Chiswick High Road to High Street Kensington Low Emission Bus Zone was completed in June 2019. The [Hounslow Chiswick](#) air quality monitoring station is located on the Chiswick High Road to Kensington bus corridor and is classified as a roadside site.

Reduction in emissions from buses

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on the Chiswick High Road to High Street Kensington corridor emit on average 91 per cent less NO_x than previously, with some routes having reduced emissions by 100 per cent as some routes are now fully electric.

As a result of cleaning up the buses from Chiswick High Road to High Street Kensington, these buses now emit 71 tonnes less NO_x per year than they did previously.

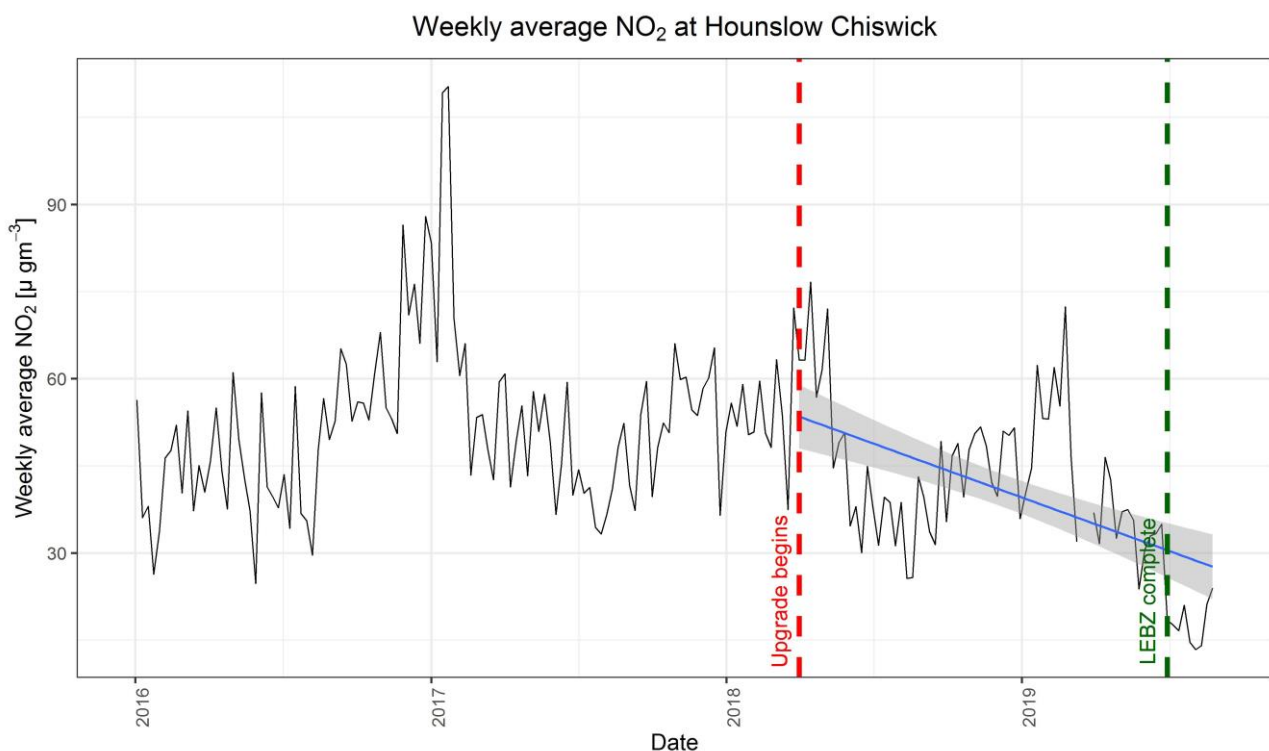


Figure 9: Weekly average concentrations of NO_2 at Hounslow Chiswick

In **Figure 9** the vertical red dashed line indicates the date when delivery of the Low Emission Bus Zone began. After this, non-Euro VI buses/non-compliant buses on this route were retrofitted or replaced with new buses. The green vertical dashed line indicates the date when the Low Emission Bus Zone was complete. Weekly averages have not

been included for weeks with less than 75 per cent data capture and the most recent data is not yet ratified and may be subject to change.

Figure 9 shows there has been a decreasing trend in weekly average NO₂ concentrations since implementation of the Low Emission Bus Zone began in April 2018.

Annual average concentrations

There is a legal limit set for the annual average of NO₂ of 40 µg m⁻³.

At Hounslow Chiswick in 2016 the annual average NO₂ was 50 µg m⁻³.

In 2019 (year to 15 August) the annual average was 38 µg m⁻³. This is a reduction of 24 per cent and this site is currently on course to meet the annual legal limit in 2019. In addition, the Low Emission Bus Zone from Chiswick High Road to High Street Kensington has only been in full implementation since June 2019. It is likely average NO₂ concentrations will be lower once the route has been established longer.

Hourly average concentrations

There is a legal limit set at 18 for the number of times the hourly average of NO₂ is allowed to exceed 200 µg m⁻³ per year.

At Hounslow Chiswick in 2016 (year to 15 August) there were 0 hours that exceeded the hourly limit.

In 2019 (year to 15 August) there have been 0 hours of exceedance. This site is on course to meet the hourly legal limit in 2019.

Uxbridge Road to Shepherds Bush

The Uxbridge Road to Shepherds Bush Low Emission Bus Zone was completed in August 2019. The [Hammersmith & Fulham Shepherd's Bush](#) air quality monitoring station is located on the Uxbridge Road to Shepherds Bush bus corridor and is classified as a roadside site.

Reduction in emissions from buses

Our modelling indicates that since becoming a Low Emission Bus Zone, the buses on Uxbridge Road to Shepherds Bush corridor emit on average 92 per cent less NO_x than previously, with some routes having reduced emissions by 100 per cent as some routes are now fully electric.

As a result of cleaning up the buses from Uxbridge Road to Shepherds Bush, these buses now emit 127 tonnes less NO_x per year than they did previously.

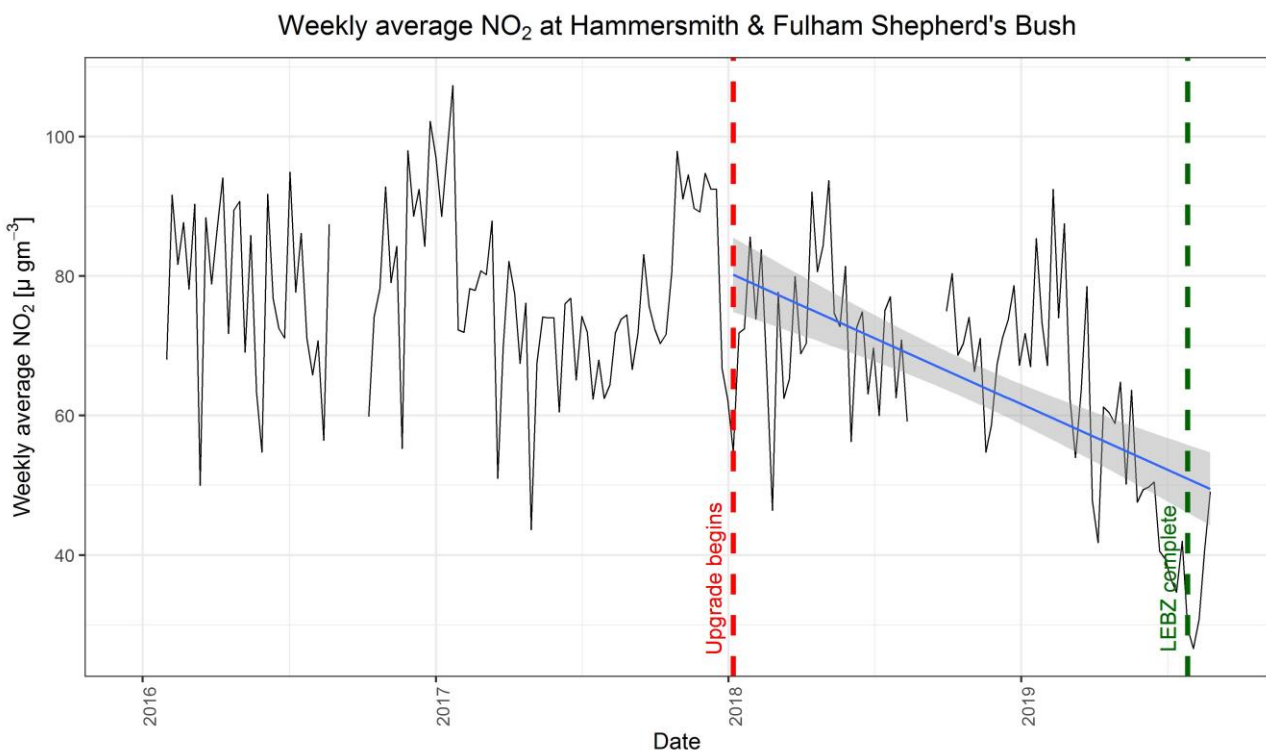


Figure 10: Weekly average concentrations of NO₂ at Hammersmith & Fulham Shepherd's Bush

In **Figure 10** the vertical red dashed line indicates the date when delivery of the Low Emission Bus Zone began. After this, non-Euro VI buses/non-compliant buses on this route were retrofitted or replaced with new buses. The green vertical dashed line indicates

the date when the Low Emission Bus Zone was complete. Weekly averages have not been included for weeks with less than 75 per cent data capture and the most recent data is not yet ratified and may be subject to change.

Figure 10 shows there has been a decreasing trend in weekly average NO₂ concentrations since implementation of the Low Emission Bus Zone began in January 2018.

Annual average concentrations

There is a legal limit set for the annual average of NO₂ of 40 µg m⁻³.

At Hammersmith & Fulham Shepherd's Bush in 2016 the annual average NO₂ was 79 µg m⁻³.

In 2019 (year to 15 August) the annual average has been 57 µg m⁻³. Whilst there is still work to be done in order to meet the legal limit this is a significant reduction of 28 per cent. In addition, the Low Emission Bus Zone from Uxbridge Road to Shepherds Bush has only been in full implementation since July 2019. It is likely average NO₂ concentrations will be lower once the route has been established longer.

Hourly average concentrations

There is a legal limit set at 18 for the number of times the hourly average of NO₂ is allowed to exceed 200 µg m⁻³ per year.

At Hammersmith & Fulham Shepherd's Bush in 2016 (year to 15 August) there were 25 hours that exceeded the hourly limit.

In 2019 to 15 August there have been 2 hours of exceedance. This site is now on course to meet the hourly legal limit in 2019.

Wider benefits

The benefits of the emissions reductions by the Low Emission Bus Zones will be seen on a wider scale than the zones themselves, as these cleaner buses will provide benefits beyond the Low Emission Bus Zone areas but across entire bus routes.

In **Figure 11** the orange lines show the full route of all buses that are part of a Low Emission Bus Zone. This demonstrates how cleaning up all routes passing through the Low Emission Bus Zones has a London wide benefit, as once passing through the Low Emission Bus Zones these routes go on to cover much wider areas.

The same is true for the bus routes that were upgraded to meet the emissions standards of the central London Ultra Low Emission Zone which was introduced in April 2019. These are indicated by the blue lines in **Figure 11**. All buses operating in central London have met the Euro VI standard since April 2019.

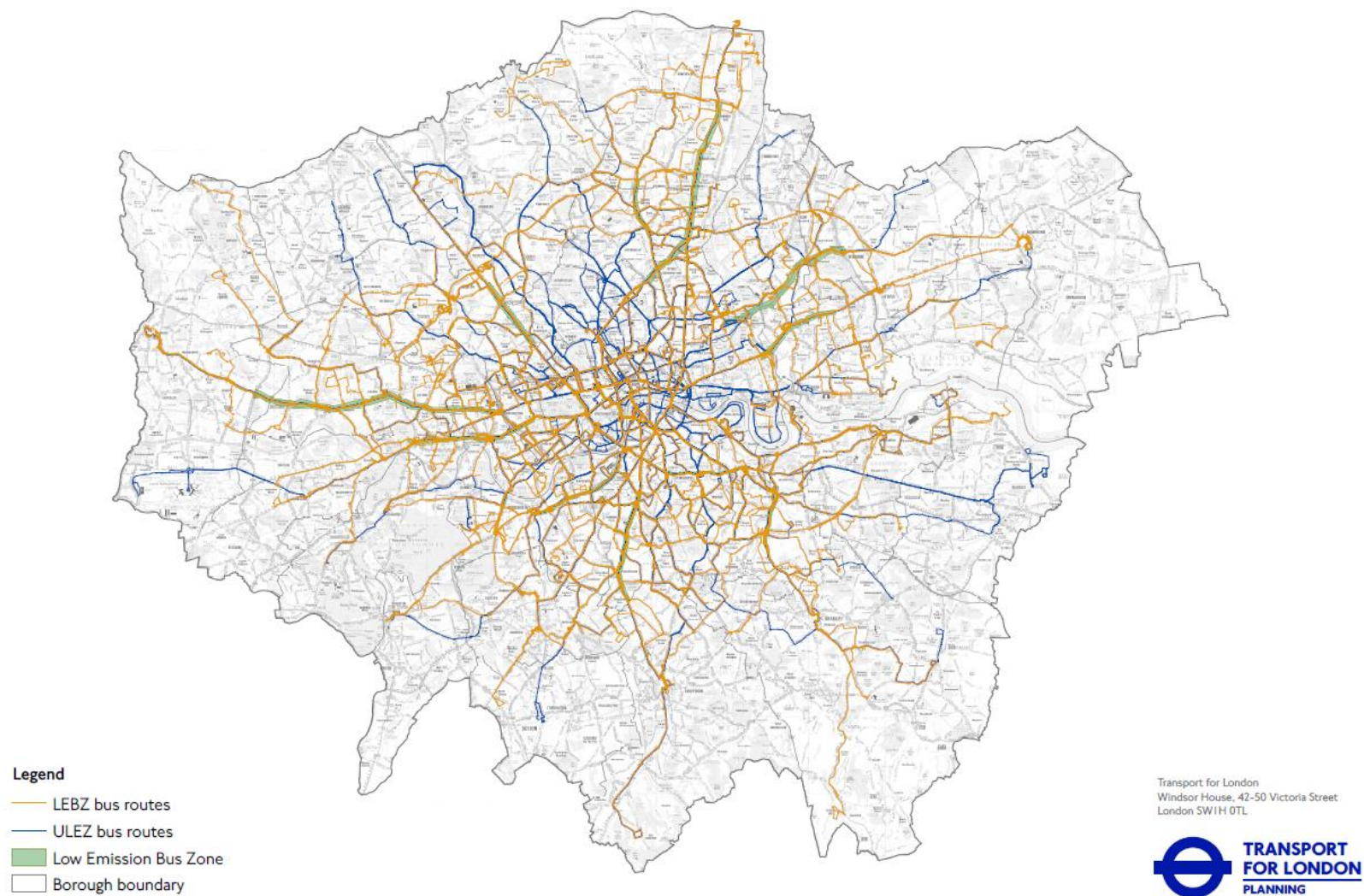


Figure 11: Map of the routes covered by cleaner buses passing through the Low Emission Bus Zones

Complementary measures

Low Emission Bus Zones have been rolled out as a targeted measure to significantly reduce the emissions from buses in specific areas with analysis showing emissions have reduced between 87 and 92 per cent.

However, buses are only one of the contributors to poor air quality in London. It is essential to continue to reduce emissions from all forms of road transport. This is being done through a number of measures including:

- Introducing the world's first Ultra Low Emission Zone (ULEZ) in April 2019
 - Expanding the Ultra Low Emission Zone in 2021 to the North and South Circulars for all vehicles and London wide for lorries, coaches and buses from 2020;
 - Transforming the whole of London's bus fleet by phasing out of pure diesel buses and purchasing only hybrid or zero-emission double decker buses from 2018, with the entire fleet becoming 'zero emission' by 2037 at the latest;
 - No longer licensing new diesel taxis from 2018 and supporting the trade to upgrade to much cleaner 'zero emission capable' vehicles;
 - Reducing traffic volumes by encouraging mode shift from travelling by car to walking, cycling and using public transport so that 80 per cent of all trips in London to be made on foot, by cycle or using public transport by 2041.
-

Conclusions

- All twelve Low Emission Bus Zones have now been delivered much sooner than the planned delivery date of 2020. In addition, since April 2019 all buses entering the central London ULEZ have to meet the Low Emission Bus Zone standards.
 - Modelling shows that Low Emission Bus Zones have reduced bus NO_x emissions by an average of 90 per cent across the routes operating in those areas.
 - Introduction of the twelve Low Emission Bus Zones has reduced NO_x emissions from those buses by 881 tonnes. This equates to a 29 per cent reduction in London wide bus fleet emissions.
 - Large reductions in annual and hourly concentrations have been recorded at the first two Low Emission Bus Zones announced towards the end of 2017, Putney High Street and Brixton Road.
 - At Putney High Street, annual mean NO₂ concentrations have reduced by 39 per cent and exceedances of the hourly mean limit have reduced by 99.7 per cent since 2016.
 - At Brixton Road annual mean NO₂ concentrations have reduced by 49 per cent and exceedances of the hourly mean limit have reduced by 100 per cent since 2016, though more data is needed as the monitoring station was offline from August 2018 to April 2019.
 - Monitoring data is available for seven of the other of the Low Emission Bus Zones. Although the zones have been in place a shorter time, reductions in annual and hourly average nitrogen dioxide were recorded at every site.
 - The average reduction in annual average NO₂ at the nine Low Emission Bus Zones where monitoring is available is 28 per cent compared to 2016.
 - The three other Low Emission Bus Zones do not have monitoring sites locating along the route. Our modelling shows these zones have all had reductions in NO_x emissions of over 90 per cent.
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