Sustainability and Green Space

Adam Webber

PROOF OF EVIDENCE

FOR PUBLIC INQUIRY COMMENCING ON 10th OCTOBER 2017

SITE

The scheme is located on the Torrington Place / Tavistock Place Corridor, between the junctions with Tottenham Court Road and Judd Street

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SUBJECT OF PUBLIC INQUIRY

The Camden (Torrington Place to Tavistock Place) (Prescribed Routes, Waiting and Loading Restrictions and Loading Places) Traffic Order [2017]

PLANNING INSPECTORATE REFERENCE:

DPI/X5210/17/8

CAMDEN REFERENCE:

SC/2017/04

Introduction

i. I, Adam Webber, have prepared this proof of evidence for presentation at the Public Inquiry into the Tavistock Place / Torrington Place traffic scheme. I hold a BA degree in Geography from the University of Oxford and a Master's degree in Environmental Politics from King's College London. I am Senior Sustainability Officer responsible for Air Quality at the London Borough of Camden where I have worked since September 2011.

ii. This proof concentrates on the air quality aspects of the Trial. This includes the context of air pollution in the scheme's area and the monitoring work undertaken to help evaluate the impact of the Trial.

iii. This statement is true to the best of my knowledge and belief. I can confirm that the views expressed are my true and professional opinion.

iv. **Structure of this proof**

This evidence is divided into five sections:

a. Section 1 (Existing pollution levels and sources of pollution in Camden) provides background information on air quality within the borough.

b. Section 2 (Direction of travel) outlines the policies proposed and implemented by Camden and other stakeholders including the Mayor of London to improve air quality in London, and the likely impacts of these policy interventions.

c. Section 3 (Existing monitoring data) discusses air quality monitoring undertaken in the scheme area not specifically for the evaluation of the scheme.

d. Section 4 (Scheme monitoring) discusses the air quality monitoring undertaken in the scheme area to assist with the evaluation of the impacts of the Trial.

e. Section 5 (Conclusions) summarises the analysis contained in this proof of evidence.

1. Existing pollution levels and sources of pollution in Camden

1.1 Camden Council has a responsibility under the Environment Act 1995 to take steps to reduce air pollution. The relevant standards and objectives are set out in Appendix 1, Table A. As in much of central London, the EU Objectives for Nitrogen Dioxide (NO_2) are exceeded within Camden. Although currently meeting EU Objective levels for particulate matters (PM), Camden is also working to reduce PM levels as far as possible as there is no safe level for PM.

1.2 As a result of failing to meet these Objectives within Camden, the whole of the Borough has been designated an Air Quality Management Area (AQMA) since 2000. This requires the Council to take action to reduce air pollution levels, and to monitor pollution levels across the Borough. The Council's Clean Air Action Plan 2016-18[1] has over 65 actions aimed at reducing pollution levels. The Council also has a monitoring network capturing AQ data from across the borough, which consists of both automatic reference method monitors and diffusion tubes.

1.3 The health impacts of air pollution are discussed in Jason Strelitz's Public Health and wellbeing evidence.

1.4 Emissions from road transport account for just under 50% of Camden's NO_x (oxides of nitrogen, including NO_2) and PM_{10}. Figures 1 and 2 below show an overall breakdown of pollution sources within the borough for NO_x and PM_{10}, including a further breakdown of road transport emissions into constituent sources.

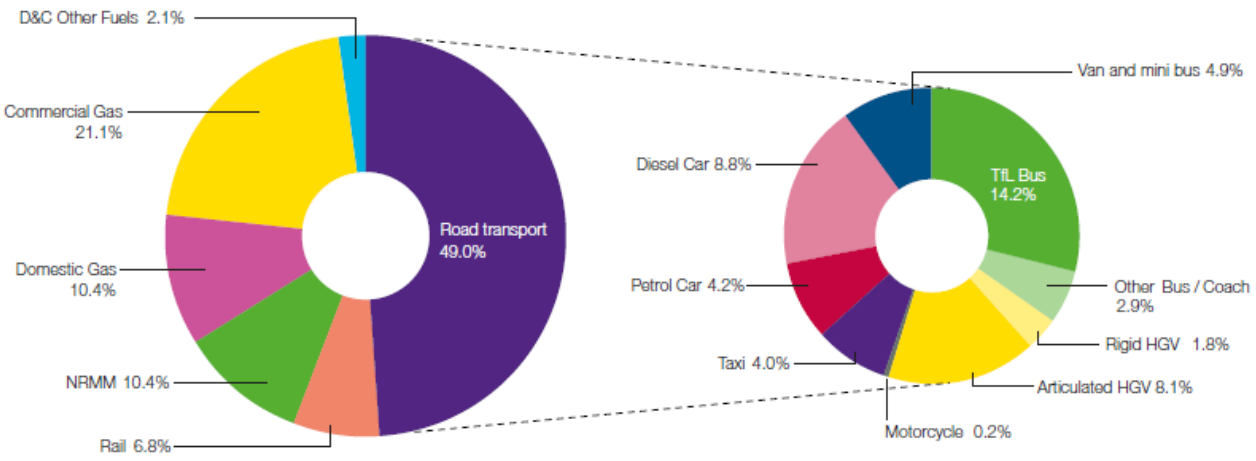

Figure 1 Sources of NO_x emissions in Camden (Source: LAEI 2016)

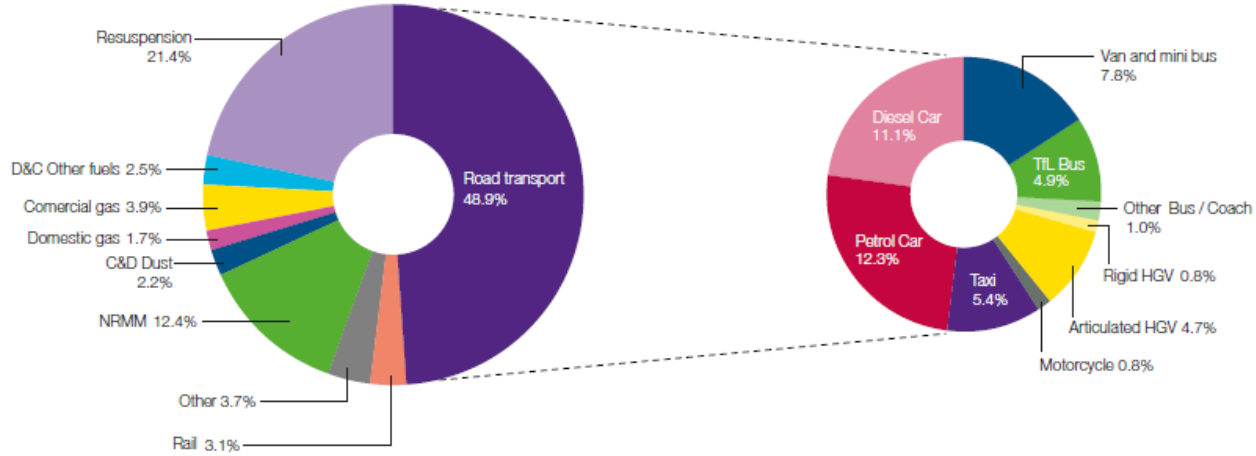

Figure 2 Sources of PM_{10} in Camden (Source: LAEI 2016)

1.5 Note that in Figure 2 above 'NRMM' represents emissions from Non Road Mobile Machinery, 'D&C other fuels' reflect domestic and commercial other fuels, and 'C&D dust' stands for emissions from construction and demolition sites.

1.6 The breakout of emissions from road transport are against data for vehicle kilometres in Table 1 below, which allows an identification of which types of transport are more or less proportionately polluting.

	% of Camden's Vehicle km	% of Camden's transport NO_x	% of Camden's transport PM_{10}
Motorcycles	4.20%	0.40%	1.60%
Taxi	7.90%	8.10%	11.10%
Petrol Car	43.10%	8.60%	25.20%
Diesel Car	25.60%	17.90%	22.80%
LGVs	11.20%	10.00%	16.00%
HGVs	3.90%	20.20%	11.30%
Bus and Coach	4.10%	34.80%	12.10%
Electric Vehicle	<0.1%	<0.1%	<0.1%
Total	100.00%	100.00%	100.00%

Table 1 Breakdown of pollution sources from road transport (Source: LAEI 2016)

1.7 The most disproportionate polluters in Camden are HGVs and buses and coaches. HGVs represent 4% of Camden's vehicle kms but 20% NO_x and 11% PM_{10} transport emissions, while buses and coaches are 4% of vehicle kms while emitting 35% of Camden's transport NO_x and 12% of PM_{10}. Diesel cars are disproportionately polluting compared to petrol cars. In addition, black cab taxis (the majority of which at present are diesels) are around five times as polluting in terms of NO_x as petrol vehicles (while taxis and petrol vehicles are responsible for roughly the same proportion of Camden's NO_x emissions, petrol vehicles make up over five times as many vehicle km); for PM_{10} emissions taxis are currently two and half times as polluting.

1.8 It should be noted that the above table does not take into account the number of passengers using each mode of transport; for example the pollution per passenger per km would be much lower for buses.

1.9 The corridor does not form part of any TfL bus route and therefore the scheme does not require the re-routing of any bus routes.

1.10 There is a variety of modelled data for major pollutants. The London Atmospheric Emissions Inventory (LAEI), produced by the GLA and published on the London Datastore[2], reflects the most up to date modelling of general air quality across London. Published in 2016, the figures are the latest such available data and reflect 2013 pollution levels. Figures 3 and 4 show NO_2 and PM_{10} levels for the whole of Camden as modelled by the LAEI (with the general area of the Trial bound in black).

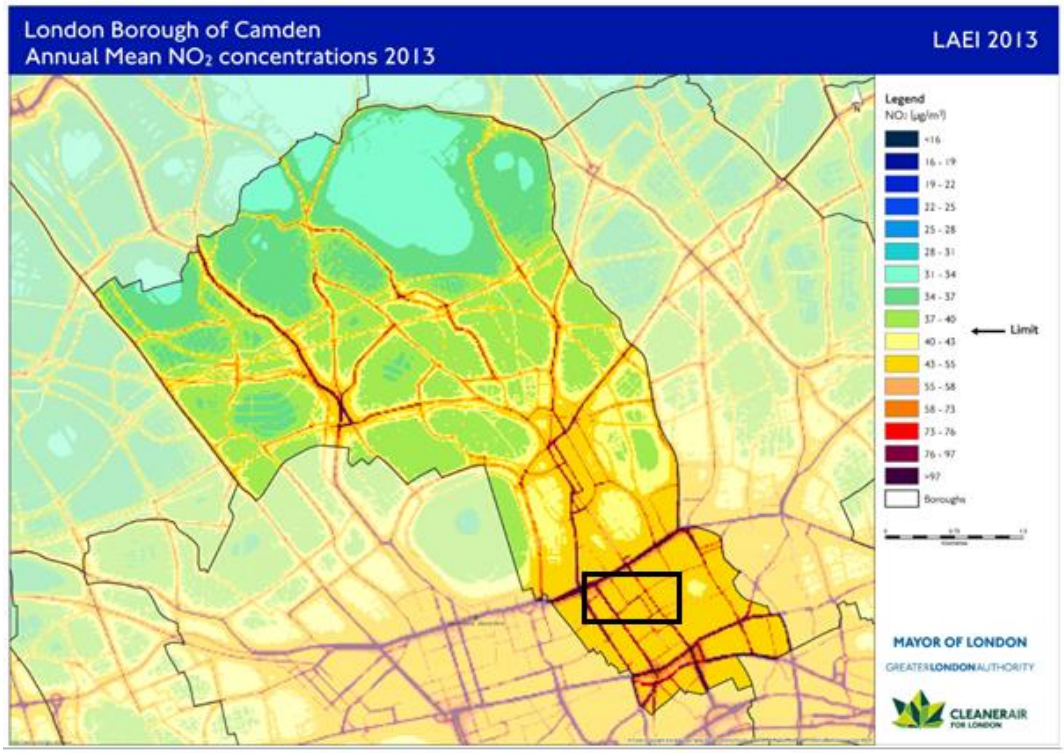

Figure 3 Modelled annual mean NO_2 concentrations for 2013 (Source: LAEI 2016)

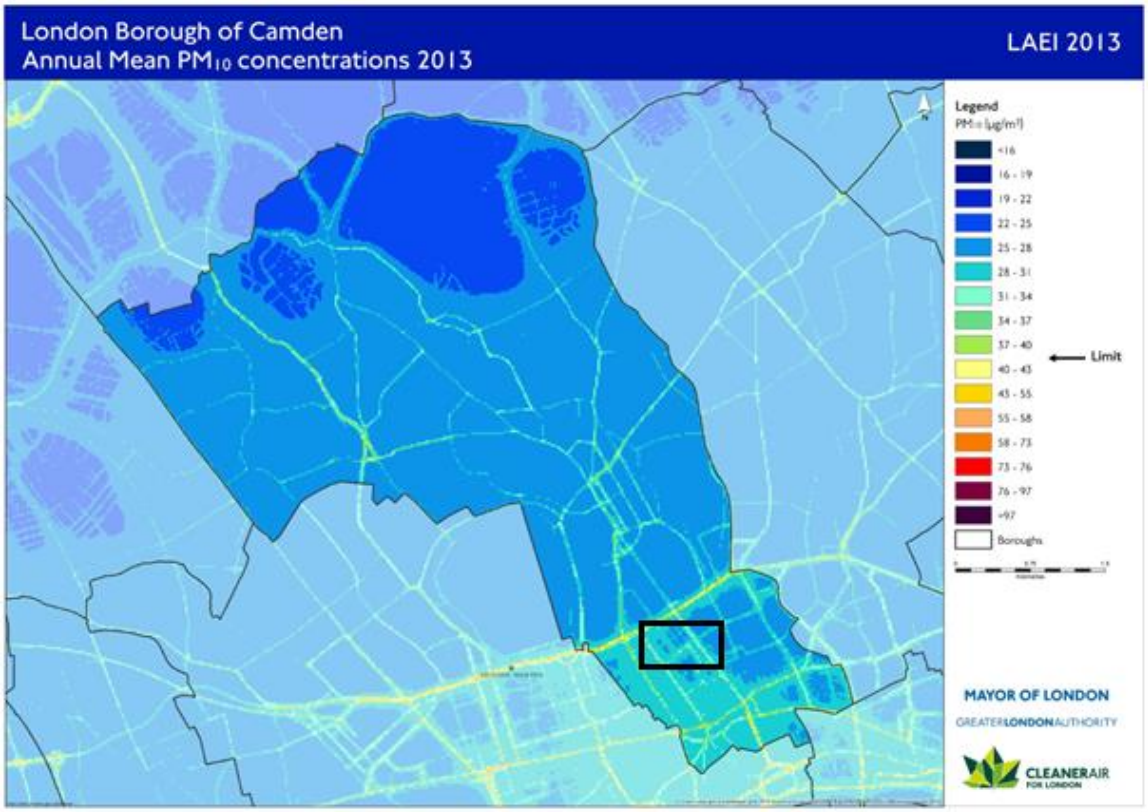

Figure 4 Modelled annual mean PM_{10} concentrations for 2013 (Source: LAEI 2016)

1.11 The above Figures show the strong correlation between air pollution levels and major roads across Camden; for example Euston Road (just to the north of the Trial area) is clearly visible cutting across the borough in both NO_2 and PM_{10} maps. These maps also reflect the general gradient of improving air quality from the south to the north of the borough. While quieter residential streets in the north of the borough are likely to not exceed EU Objective levels for NO_2, similar streets from approximately Camden Town southwards are much more likely to experience air quality levels exceeding EU Objective levels.

1.12 These models suggest that in 2013 the whole area of the Corridor was likely to be in exceedance of annual Objectives for NO_2; this is also reflected in background maps produced by Defra. Camden's more up to date monitoring data, which provides real time information and monthly data up to 2017, suggests that pollution levels in the area are decreasing to around the annual Objective level. The results are set out in section 4.

1.13 This section has outlined the significance of road transport as a source of emissions in Camden, in particular the disproportionate pollution caused by larger vehicles (HGVs and buses), diesel vehicles and taxis. This section has also demonstrated that air quality levels are worst in the south of the borough. Any schemes which aim to encourage modal shift and a reduction in road transport use, such as the Torrington Place Trial, are therefore consistent with Camden's overarching goal as an Air Quality Management Area (AQMA). As set out in Local Air Quality Management Support produced by Defra, AQMAs and their attendant actions plans "identifying the nature of the problem whilst detailing measures that are or will be actively implemented to improve air quality and quantifying their impact over time"[3].

2. Direction of travel: policies aimed at improving London's air quality

2.1 Projections of future air quality levels in London show a picture of reducing pollution levels.

2.2 This is for a number of high level reasons:

- Technological energy efficiency improvements for domestic and commercial heating (both in new developments and existing housing stock)
- Technological advancements in road vehicles and general replacement of older vehicles (a general rule is the older the road vehicle the more polluting it is)
- Modal shift (including interventions such as the Trial which aim to encourage a long term shift away from road vehicles towards walking and cycling)
- Policy interventions

2.3 These long term modelled trends can be seen in the results of Camden's monitoring network.

2.4 Figures 5 and 6 below show how the LAEI projects Camden's emissions sources to change over time. These projections include all elements leading to reductions in pollution outlined in 2.2.

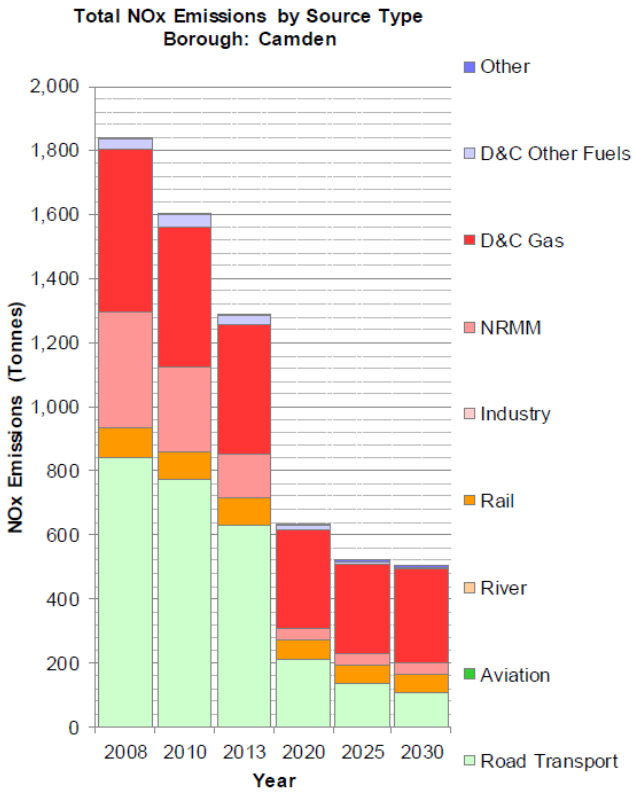

Figure 5 Projections of NO_2 emissions by source type (Source: LAEI 2016 'Borough factsheets')

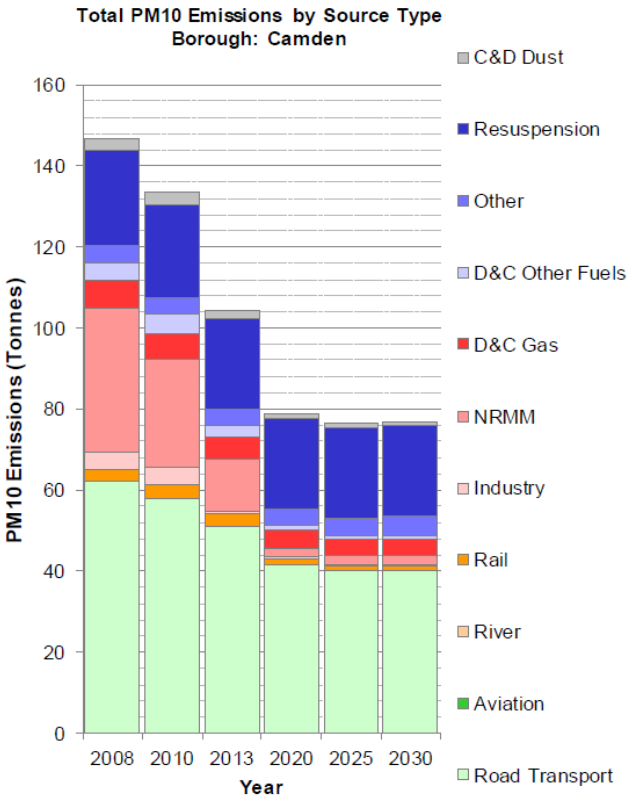

Figure 6 Projections of PM_{10} emissions by source type (Source: LAEI 2016 'Borough factsheets')

2.5 The above models include reductions in pollution that result from modal shift away from road transport. Modal shift has been shown to be more likely where infrastructure to support walking and cycling is put in place. Therefore the impact of interventions such as the Trial are modelled into these projections.

Central Government Policy supporting improvements in air quality

2.6 In the summer of 2017 central Government released a new 'UK plan for tackling roadside nitrogen dioxide concentrations'[4]. This plan sets out a number of key actions and objectives by Government to bring the UK into compliance with EU Objectives for air quality.

2.7 Some of the key actions to improve air quality to be undertaken by Government include:

- More stringent laboratory testing requirements for statutory type approval of new light duty vehicles and new real driving emissions requirements for light passenger and commercial vehicles
- Additional funding to support the update and associated infrastructure of low emission vehicles
- Exploring the appropriate tax treatment for diesel vehicles (including making potential changes to Vehicle Excise Duty)

2.8 The Defra Plan notes that:

> *"Addressing road transport emissions therefore presents the most significant opportunity to tackle this specific exceedance problem… The solution involves effective and appropriately targeted actions to… reduce emissions of NOx from the current road vehicle fleet in problem locations now, including through promoting public transport, cycling and walking".*[5]

2.9 A key mechanism identified by Government as having a large positive impact on emissions are road charging schemes or 'Clean Air Zones'. In London, the Ultra Low Emission Zone (ULEZ) is an example of road charging scheme that has already been planned and consulted on, and will be introduced in 2019 by the Mayor of London.

London policy supporting improvements in air quality

2.10 The Emissions Surcharge (or T Charge as it is commonly known), is a daily charge on the oldest vehicles entering the Congestion Charging Zone; the whole of the Trial area is therefore affected by this policy. From 23 October 2017, motor vehicles older than Euro 4/IV for both petrol and diesel will be subject to a daily surcharge in addition to existing Congestion Charge Zone payments. Transport for London modelling suggests that the Emissions Surcharge will reduce NO_x emissions within the Congestion Charging Zone

area by 2% and PM_{10} emissions by 1%. The Surcharge will be superseded in 2019 by the Ultra Low Emission Zone.

2.11 The future policy intervention that is expected to have the largest impact on road transport emissions in London is the Ultra Low Emission Zone (ULEZ) proposed by the Mayor of London. The ULEZ is a charging regime, scheduled to be introduced in April 2019, which will levy a daily charge onto vehicles of a certain age when they enter inner London (using the existing Congestion Charge Zone boundaries). The impact of a ULEZ scheme to be introduced in 2020 was modelled by TfL to reduce NO_x emissions within the CCZ by an average of 4.6 µg/m^3 in 2020 and a further 2.3 µg/m^3 in 2025[6]. This would result in the number of sensitive receptors (including residential properties, care homes, health facilities and schools) exposed to NO_2 levels over the annual mean Objective reducing by 52%. The current Mayor of London has since brought the ULEZ start date forward to April 2019. TfL's modelling suggests because of implementing the ULEZ in central London sooner, road transport emissions in the area are expected to reduce by an additional 20% in 2019[7]. This is in addition to a reduction in emissions already forecast in the baseline for 2019 as a result of people pre-complying with the original ULEZ starting in 2020.

2.12 The introduction from 2018 of Zero Emissions Capable (ZEC) petrol hybrid black cab taxis will result in emissions from these vehicles decreasing. While this is positive, Camden believes policies such as a reduced age limit on black cab taxis would accelerate a move away from older and more polluting vehicles. This is important given the current disproportionate amount of pollution generated in Camden by black cab taxis, comparative to their proportion of Camden's vehicle kilometres.

2.13 Full details of the Mayor of London's policies to improve London's air quality can be found in the draft consultation version of the London Environment Strategy[8].

2.14 Air quality levels are predicted to continue to decrease in London. As well as technological advances, modal shift, encouraged by a number of policies and interventions by both boroughs and the GLA / TfL, is a key driver in this projected reduction. Future policies implemented by the GLA such as the ULEZ will have a greater impact on overall pollution levels in Camden than local interventions such as the Torrington Place Trial.

3. Existing monitoring data for the Trial area

3.1 Camden's statutory monitoring network is made up of four automatic reference method monitors, which were sited in consultation with Defra and the GLA and form part of the national Automatic Urban and Rural Network (AURN). We also monitor air quality through diffusion tubes at an additional 14 sites across the borough. These sites were chosen to be representative of air quality across Camden. They therefore represent a spread of locations geographically, a combination of busier roads and quieter streets, and also a variety of locations relative to roads. Additional diffusion tubes and mobile real-time monitors are also used to evaluate area specific projects, as are modelled baseline levels produced by the GLA.

3.2 As a small note regarding the types of data captured by these different instruments:

- Reference method monitors: these capture data from pollutants relevant to this Proof (nitrogen dioxide or NO_2 and Particulate matter with particle diameter less than or equal to 10 microns, known as PM_{10}) in 15-minute increments. These figures are then verified by King's College London who run the London Air Quality Network and used to calculate annual mean figures.
- Diffusion tubes: these monitors provide a single monthly figure for nitrogen dioxide (NO_2). These monitors are collected and sent to an independent laboratory for analysis. Camden's laboratory contract is with Gradko International.

- AQmesh units: these units, which captured the monitoring data specifically used to evaluate the scheme (in Section 5), capture a variety of pollutants dependent on the model of monitor used. For this scheme, all AQmesh units captured nitrogen dioxide (NO_2) in 15-minute increments, which is then used to calculate annual mean figures.

3.3 As part of the preparatory work for the West End Project (WEP), a year-long NO_2 monitoring project was undertaken across 16 locations in 2015. This was to provide an overview of baseline conditions in the WEP area, and it is planned that this monitoring will be repeated once WEP work has been completed. The monitoring project was undertaken using diffusion tubes, which provide a monthly reading for NO_2.

3.4 Figure 7 shows the locations of this monitoring. The northern most six of the monitoring sites are most relevant to the Trial.

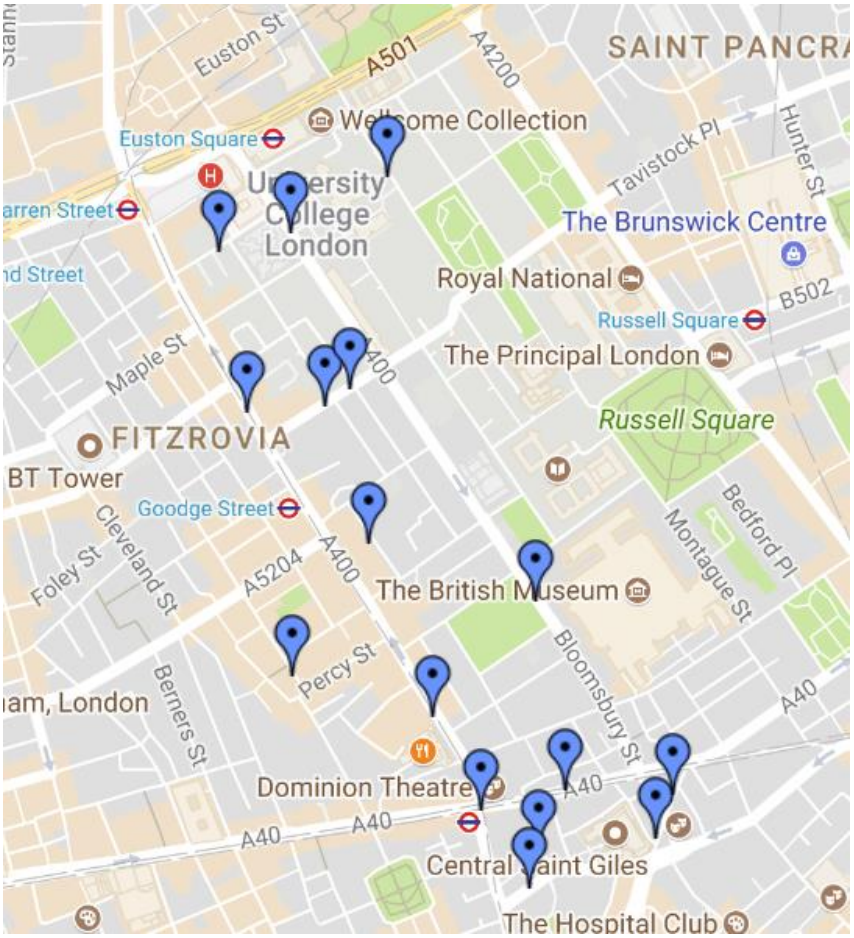

Figure 7 WEP baseline monitoring locations (source: LB Camden)

3.5 The results from the six sites most relevant to the trial are shown below in Table 2.

Monitoring location	2015 Annual NO_2 (µg/m^3)
Gordon Street	59.3
Gower St North	54.0
Grafton Way	49.4
Tottenham Court Road / Torrington Place	49.4
Torrington Place / Huntley Street	40.0
Torrington Place / Chenies Mews	41.3

Table 2 Results from West End Project baseline monitoring survey (source: LB Camden)

3.6 Part of Camden's statutory monitoring network covers the Trial area. Figure 8 below shows the locations of Camden's long term monitoring that takes place in this area, consisting of:

- Tavistock Square Gardens (diffusion tube)
- St George's Gardens[9] (diffusion tube)
- Camden Bloomsbury (automatic urban background monitor)
- Euston Road (automatic urban kerbside monitor)

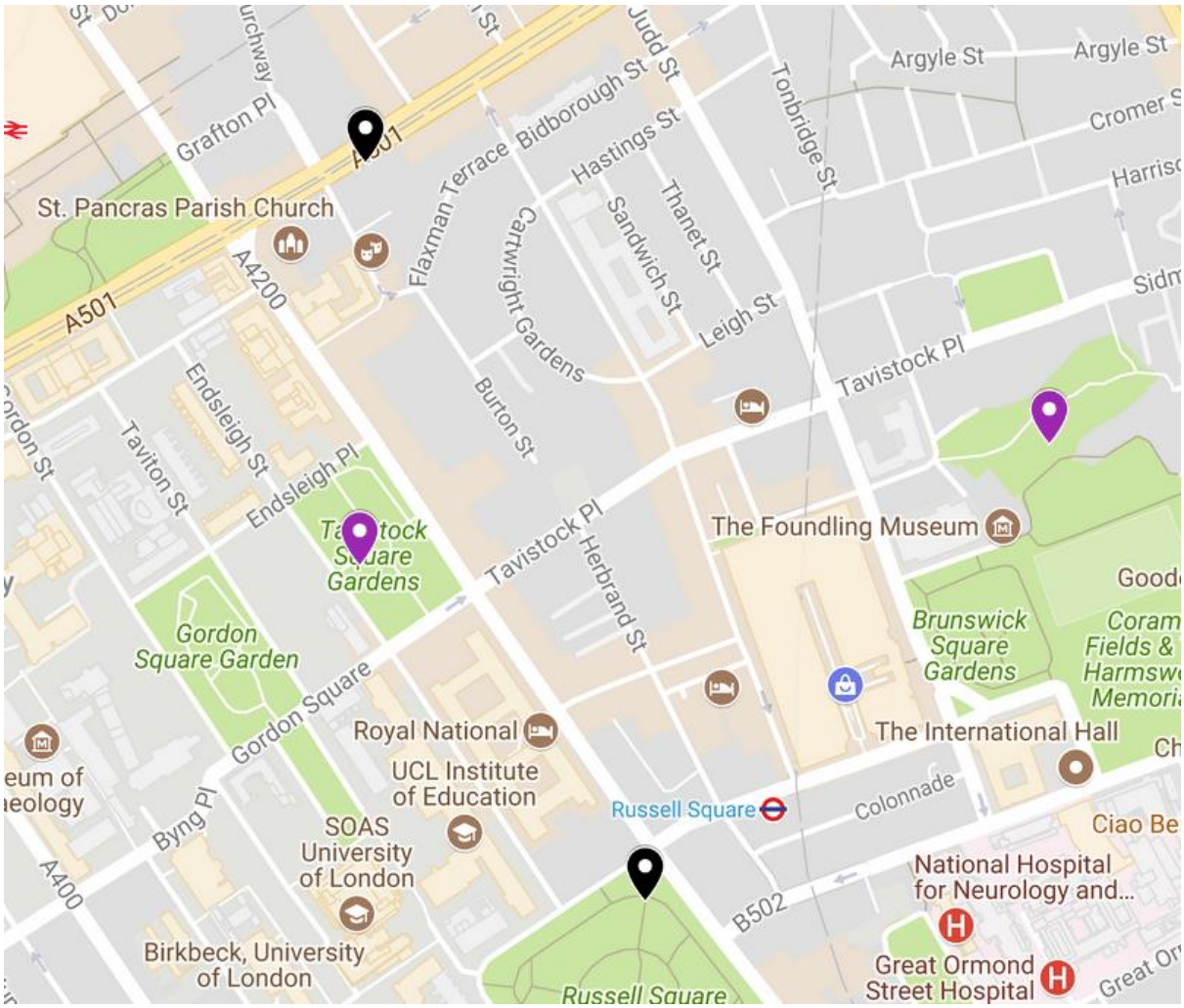

Figure 8 Relevant statutory monitoring locations in the Trial area (source LB Camden)

Purple markers: statutory diffusion tube monitoring locations

Black markers: statutory automatic monitoring stations

3.7 The annual results for these four locations, extracted from Camden's statutory reporting documents to Defra are shown below. Figures in red reflect exceedances of the annual mean Objective of 40µg/m^3 (note the Euston Road site has only been in place since 2011).

Site ID	Nitrogen Dioxide (NO_2) Annual Mean Concentration µg/m^3						
	2010	2011	2012	2013	2014	2015	2016
CD9: Euston Road	-	122	106	106	98	90	88
LB: London Bloomsbury	55	50	55	44	45	48	42
CA10: Tavistock Gardens	52	47.56	40.12	49.37	46.50	44.57	39.68
CA6: St George's Gardens	34	45.61	39.29	40.32	36.44	35.80	31.31

Table 3 NO_2 annual results from monitoring close to Trial area (source LB Camden)

3.8 The results outlined in Table 3 above show a long-term trend of decreasing pollution levels in the Trial area. From 2010 to 2016, NO_2 levels at the Bloomsbury background site have reduced by 23.6%, while reductions in the two diffusion tube sites have reduced by 23.7% (Tavistock Gardens) and 7.9% (St George's Gardens). Between 2011 and 2016 the Euston Road site saw a reduction of 27.8%. For the last year unaffected by the Trial (2014) to 2016, the percentage reductions (2010-2014) are 6.7% (London Bloomsbury), 14.7% (Tavistock Gardens) and 14.1% (St George's Gardens). For the Euston Road site, the equivalent reduction 2011-2014 is 19.7%.

3.9 The reduction in Camden's overall average NO_2 levels (per diffusion tube data) for all sites monitored across the borough between 2010 and 2016 is 4.5% (Appendix 1, Table D). Compared with the figures set out in 3.8, the reductions in levels in the Trial area are therefore much higher than the reductions that have been seen overall across the borough; the Trial may have helped contribute towards this.

3.10 These results show that the impacts of the Trial should be taken with a wider view of a trend towards decreasing pollution levels in the area. The data above, which reflect locations near but not on the Trial route, suggest that local air quality levels have not been adversely impacted by the Trial. In particular, results from the London Bloomsbury site, which is located on the north to south Woburn Place / Russell Square Road, do not reflect an increase in pollution levels that would occur should a large quantity of pollution from traffic be generated on this route.

3.11 This section has outlined the existing monitoring regime in place around the Trial area. In terms of geographical and temporal coverage of air quality, the Trial area is the most highly monitored area of Camden. Analysis of the long term trends given by Camden's statutory monitoring network suggest that the Trial may have contributed to an overall trend of reducing pollution levels.

4. Specific Trial monitoring

4.1 For the initial monitoring, two real time pollution monitors called AQmesh units were installed along the trial route to give before and after readings of NO_2. The units provide data in 15 minute increments.

4.2 Following the introduction of the trial, two additional units were installed on roads around the trial area (Judd Street and Endsleigh Gardens). These additional units were installed in February 2017. Figure 9 below shows the general locations of the four AQmesh units in place specifically to help evaluate the impacts of the Trial, while Figures 10 and 11 show the precise locations of the additional units on Judd Street and Endsleigh Gardens.

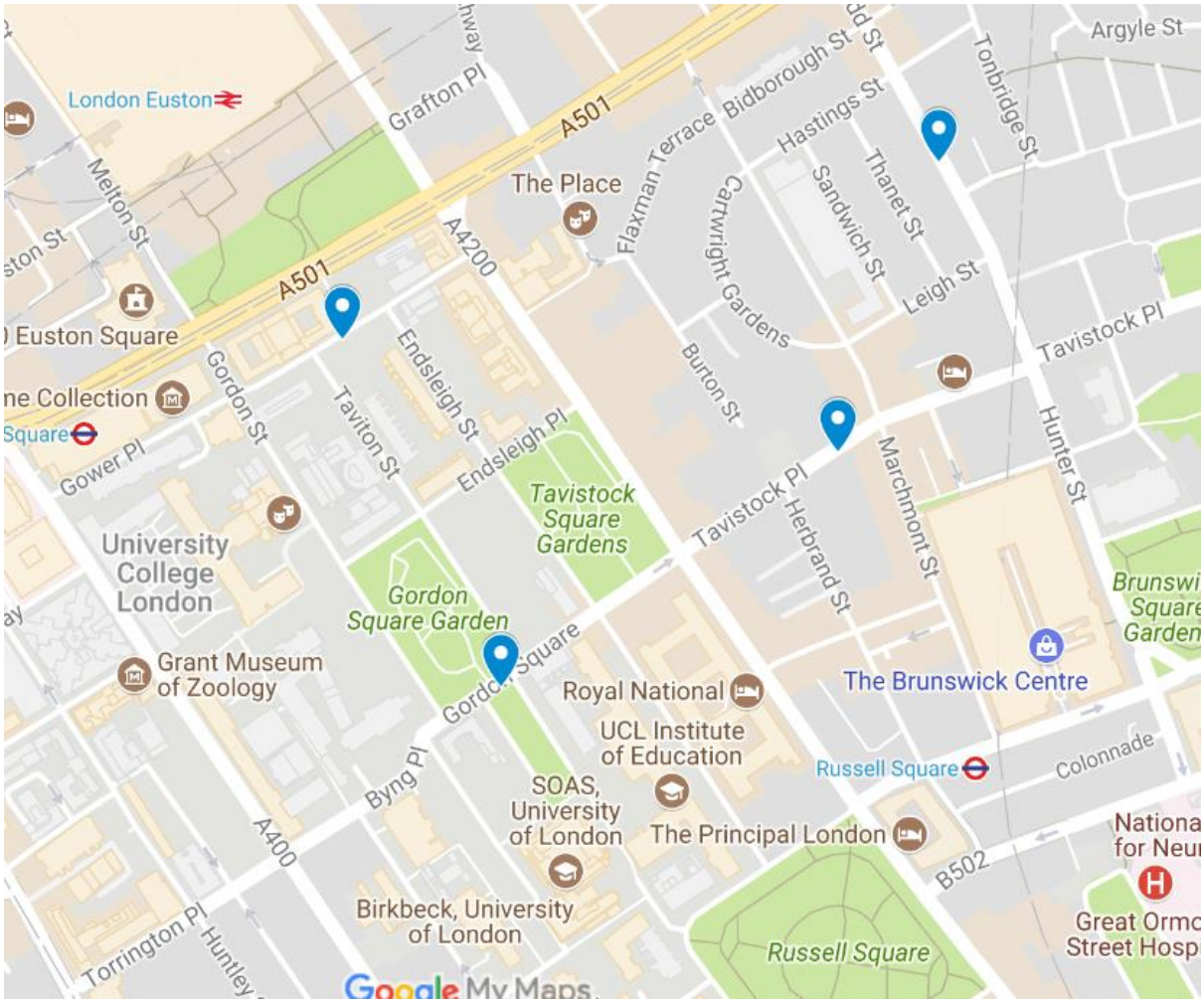

Figure 9 Location of current AQmesh units (source: LB Camden)

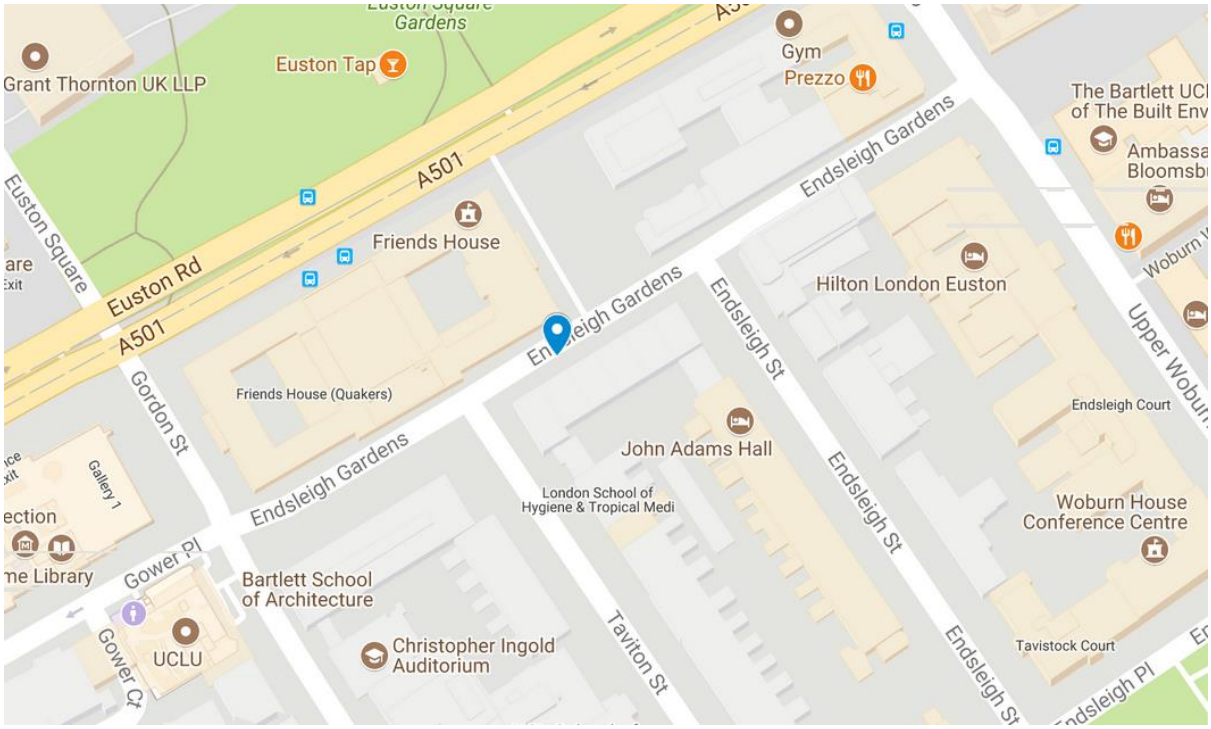

Figure 10 Location of Endsleigh Gardens Monitor (source: LB Camden)

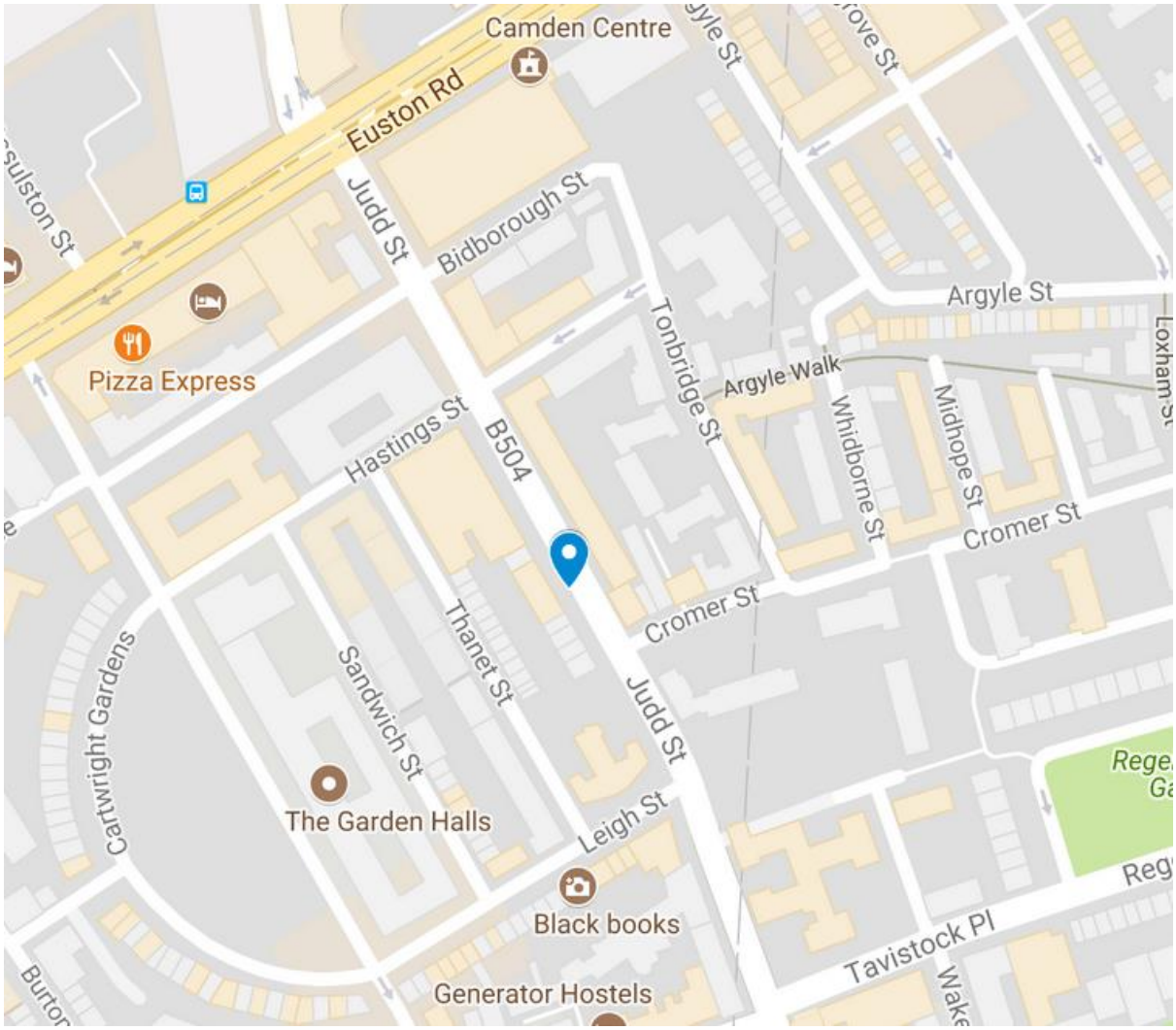

Figure 11 Location of Judd Street monitor (source LB Camden)

4.3 The installation of real time air quality monitoring units around the Trial area is the first time that these types of unit have been used by Camden Council, apart from a preliminary use of the same monitors to help evaluate the introduction of a borough-wide 20mph speed limit. This is because real time monitoring of pollution, especially NO_2, has historically been difficult to achieve without highly expensive equipment not fit for purpose for evaluating schemes.

4.4 The two AQmesh units were installed on Tavistock Place (location: 51.52545, -0.12604) and Gordon Square (location: 51.5237, -0.13005) on 1 July 2015. They collected continuous data until changes to the road layout were made in November 2015, and then collected data since that date. The ‘before trial’

dates for data are 1 July 2015 to 8 November 2015, and 'post trial implementation' data from 13 November 2015 to 3 August 2017. Data was collected for NO_2 at 15-minute intervals.

Monitor	Pre trial (µg/m^3)	During trial (µg/m^3)	Difference (µg/m^3)	Percentage difference
Gordon Square	51.38	46.77	4.61	-8.97%
Tavistock Place	33.11	26.01	7.1	-21.44%

Table 4 NO_2 levels in monitoring locations along the trial route (Source LB Camden)

4.5 As table 4 above shows, both monitors along the trial route itself show reductions in air pollution levels since the introduction of the trial. This is consistent with the reduced traffic levels monitored along the trial route since implementation, which is discussed in Simi Shah's proof. As noted in 3.9, both these reductions are higher than the overall reduction in Camden's air quality levels between 2014 and 2016.

4.6 The results of the two additional monitors (on Judd Street and Endsleigh Gardens) are shown below alongside the annual mean objective for NO_2. This data was taken for the time period 10th February 2017 to 03 August 2017.

Monitor Location	NO_2 – µg/m^3
Judd Street	41.81
Endsleigh Gardens	81.89
Annual mean objective	*40*

Table 5 NO_2 levels in additional monitoring locations (time period: 21.00 10/02/17 – 00.00 03/08/17) (Source LB Camden)

4.7 This data can be compared to the modelled data within the LAEI. The data outlined in Table 5 above suggests that air quality levels on Judd Street have

not been adversely impacted by traffic being dispersed as a result of the trial, as NO_2 levels are actually below what would be expected on the street from LAEI data. However the Endsleigh Gardens monitor suggests that pollution levels are higher on this street than are expected by modelled data (see Figure 3).

4.8 Without monitoring data being available for before the scheme along Endsleigh Gardens, it is difficult to accurately quantify the impacts of the scheme along this route. However, it does appear that there have been some increases in pollution along Endsleigh Gardens, which could be as a result of traffic displacement from the scheme. However, the improved walking and cycling infrastructure along the scheme's route should ensure that the number of walkers and cyclists exposed to higher pollution levels on Endsleigh Gardens is reduced as the scheme's route is more attractive to them.

4.9 There are a number of factors that may have influenced the higher than expected readings on Endsleigh Gardens. Traffic displacement from the scheme is one. The location of the monitor itself, which is directly overhanging traffic and is open to Euston Road less than 50m to the north, may also have inflated the readings. As Table 3 shows, levels on Euston Road itself are still higher than those on Endsleigh Gardens.

4.10 Gordon Square North, which runs parallel to Endsleigh Gardens, has been closed since September 2014. The closure of this route may be another factor in increasing traffic levels (and pollution levels) along Endsleigh Gardens. Simi Shah's Proof of Evidence deals with this closure in more detail.

4.11 Changes in traffic count numbers for Endsleigh Gardens will not have had a beneficial impact on pollution levels along this road. However the extent to which the Trial has directly inflated pollution levels is unknown. The contribution of vehicular traffic reduction or increases to air quality is dependent on a number of factors, including fuel type, engine size, and driving style.

4.12 The proportion of taxis using Endsleigh Gardens is likely to be higher than the Camden average, partly due to taxis wishing to turn right onto Gordon Street in order to access the taxi rank at Euston station. This means that the expected reduction in taxi emissions due to the introduction of zero emission capable taxis from 2018 is likely to have a disproportionately positive impact on emissions on Endsleigh Gardens. This is in addition to the likely reductions in pollution resulting from policies that affect the road such as the Emissions Surcharge and Ultra Low Emission Zone (see 2.10 to 2.12 for more details on these policies).

4.13 Pollution levels drop off from their source. While levels on Endsleigh Gardens are high, this monitor is located directly by polluting traffic. Using Defra's 'NO_2 fall off from distance from roads calculator'[10], applying the Defra 2013 background reading of 50.26µg/m^3, a distance from the kerbside of 0.1m, and the measured NO_2 levels of 82µg/m^3 from Endsleigh Gardens produces a drop off graph shown below in Figure 12. Pedestrians 1.5m from the kerbside are likely to be exposed to NO_2 levels of around 70µg/m^3, while property facades 4m from the kerbside will be exposed to NO_2 levels of 65.9µg/m^3. This shows that pedestrians and residents of Endsleigh Gardens are likely exposed to lower levels of pollution than those captured by the kerbside monitor.

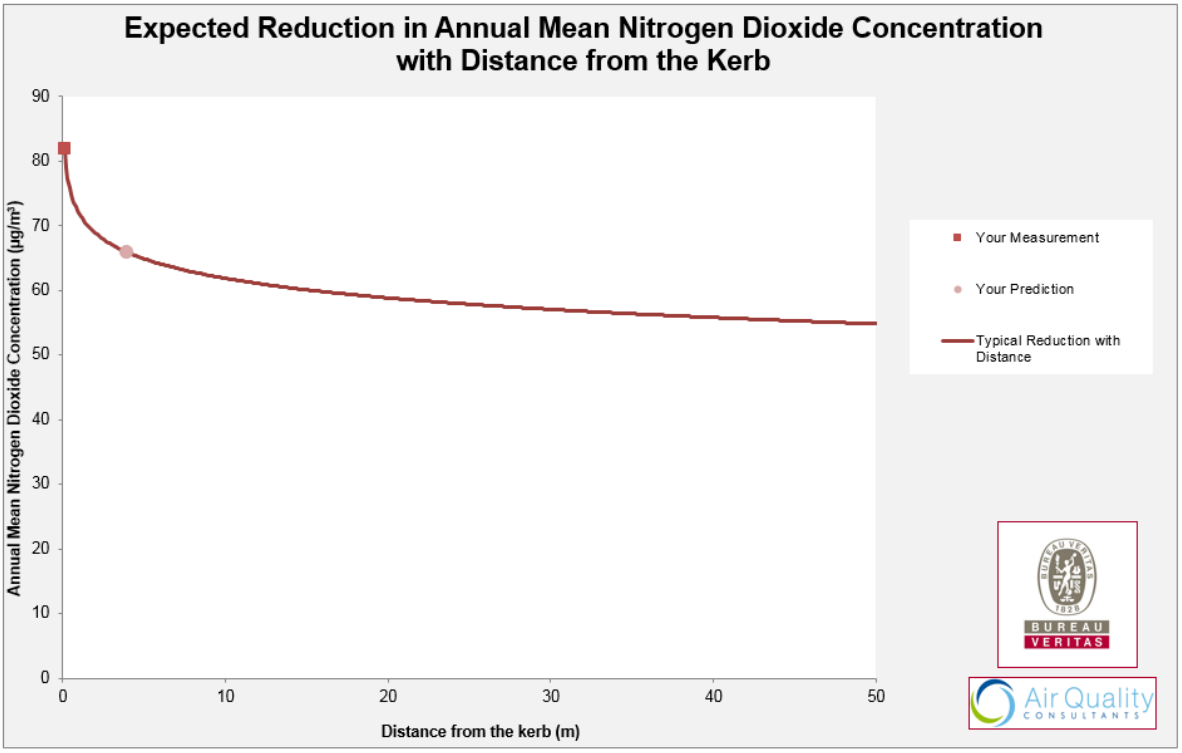

Figure 12 Expected reduction in annual mean NO_2 concentrations with distance from the kerb at Endsleigh Gardens (Source: Defra model and LB Camden). Note that 'your prediction' point marked on the graph show expected levels at building facades 4m from the kerbside.

4.14 The monitoring undertaken specifically for the scheme, combined with relevant statutory monitoring taking place in the area, shows how well covered by air quality monitoring this part of Camden is. Figure 13 shows the eight monitoring locations that have been analysed in this Section and Section 5.

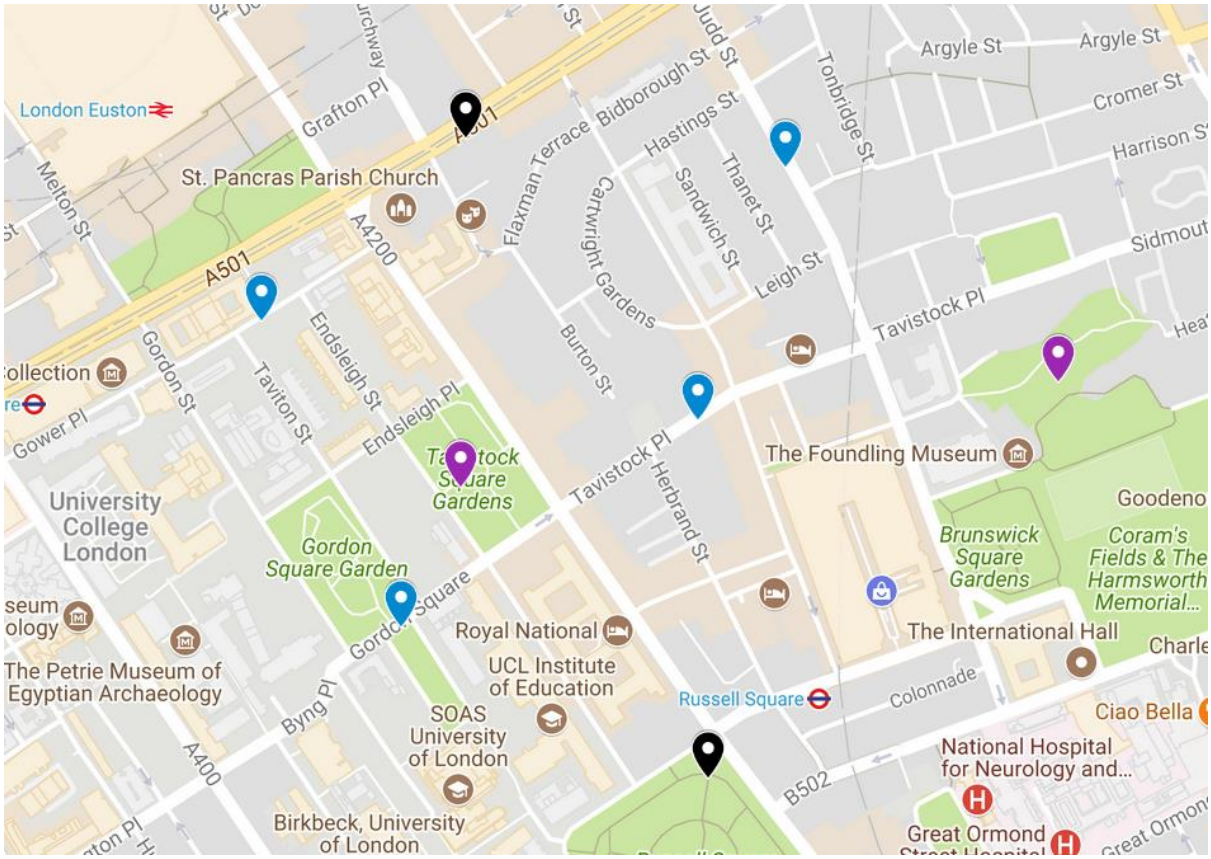

Figure 13 All monitoring locations in the scheme area (source: LB Camden)

Blue markers: AQmesh mobile monitoring locations

Purple markers: statutory diffusion tube monitoring locations

Black markers: statutory automatic monitoring stations

4.15 The data collected specifically to help evaluate the scheme have shown a quantifiable reduction in pollution along the Trial route; some of this can be attributed to the reductions in traffic along the Corridor as a result of the Trial. Additional modelling on roads that may be affected by the Trial show more mixed results, with both lower and higher than expected data from Judd Street and Endsleigh Gardens respectively. The Judd Street data, combined with the London Bloomsbury monitoring results in particular, suggest that north – south routes have not been adversely affected by any potential displacement of traffic onto these routes.

5. Conclusions

5.1 This proof has outlined that the general direction of travel in London is towards that of improved air quality. It has also shown that pollution levels in

the scheme's area have been reducing more than the Camden average, and that the area of the scheme is the most monitored area of the borough for air quality. Monitoring undertaken along the trial route has shown reductions in nitrogen dioxide since the introduction of the scheme. The picture along other roads in the area is more complex, with both higher and lower than expected pollution levels being monitored.

5.2 The Trial, with its goals of encouraging modal shift towards increased walking and cycling, is consistent with Camden Council's statutory responsibilities as an Air Quality Management Area, which are to reduce pollution as far as possible in order to meet air quality Objectives. The direction of travel in London is of gradually improving air quality, resulting from policies and strategies from central Government, the GLA, and London Boroughs such as Camden.

5.3 While large scale policy interventions such as the ULEZ will have larger impacts on overall pollution levels across central and inner London, localised schemes that encourage modal shift will continue to play a role in modelling that suggests a continued downward trend in pollution levels.

5.4 The air quality effects of the Trial will not be confined to the Trial area. Providing high quality infrastructure and public realm improvements to encourage walking and cycling will result in long term modal shift away from polluting road vehicles across the borough. This is because those walking and cycling will not only use these methods of transport along the Corridor route itself, but their journeys will also include areas outside of the Trial area. Modal shift encouraged by the provision of infrastructure like the Trial will also result in fewer motor vehicle journeys along routes which do not include the Corridor.

5.5 With regards ongoing monitoring, the Trial area has the greatest coverage of monitoring in Camden. This reflects not just the number of locations but also the long term nature of some of the monitoring and the variety of monitoring (i.e. a combination of diffusion tubes, automatic monitors and real-time

monitors). The only other comparable area in Camden is the Euston Station area being monitored in relation to High Speed 2.

5.6 Camden's monitoring shows that air pollution levels along the Trial route themselves have reduced since the implementation of the scheme. Additional monitoring undertaken since the implementation of the scheme presents a more mixed picture: monitored levels along some surrounding streets (Judd Street) suggest there has not been an adverse impact from traffic displacement, while monitoring along Endsleigh Gardens does show higher than expected levels of pollution. Simi Shah's evidence outlines options Camden officers are exploring to reduce traffic levels on Endsleigh Gardens. Nearby statutory monitoring suggests that air quality levels in the surrounding area, such as along Woburn Place / Russell Square, have also not been adversely affected by the Trial. Air pollution levels in the scheme's area have reduced by more than the Camden average since 2010, some of which may be attributed to this scheme.

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[1] CD3/4 - Camden Clean Air Action Plan 2016-18
[2] London Atmospheric Emissions Inventory 2013 (Published 2016); https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory-2013
[3] CD1/23 Local Air Quality Management Policy Guidance (PG16) – Defra (Published April 2016); https://consult.defra.gov.uk/.../laqm.../LAQM%20Policy%20Guidance%202016.pdf

[4] CD1/4 - Air Quality Plan for nitrogen dioxide (NO2) in UK (Department for Environment, Food & Rural Affairs, Department for Transport, July 2017)
[5] *Ibid.* paragraph 49, page 17
[6] CD2/13 Ultra Low Emission Zone Integrated Impact Assessment – Jacob's for TfL October 2014
[7] CD2/14 Proposed Changes to the ULEZ (start date and emissions standards) Consultation and Information Document – TfL April 2017
[8] CD2/2 - Mayor's Environment Strategy (Draft for Public Consultation – August 2017)
[9] Also known at Wakefield Gardens
[10] Nitrogen Dioxide fall off from distance – Defra guidance https://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html

Appendix

Appendix 1: Extracts from Camden's Air Quality Annual Status Report for 2016

Table A. Summary of National Air Quality Standards and Objectives

Pollutant	Objective (UK)	Averaging Period	Date[1]
Nitrogen dioxide - NO_2	200 μg m^{-3} not to be exceeded more than 18 times a year	1-hour mean	31 Dec 2005
	40 μg m^{-3}	Annual mean	31 Dec 2005
Particles - PM_{10}	50 μg m^{-3} not to be exceeded more than 35 times a year	24-hour mean	31 Dec 2004
	40 μg m^{-3}	Annual mean	31 Dec 2004
Particles - $PM_{2.5}$	25 μg m^{-3}	Annual mean	2020
	Target of 15% reduction in concentration at urban background locations	3 year mean	Between 2010 and 2020
Sulphur Dioxide (SO_2)	266 μg m^{-3} not to be exceeded more than 35 times a year	15 minute mean	31 Dec 2005
	350 μg m^{-3} not to be exceeded more than 24 times a year	1 hour mean	31 Dec 2004
	125 μg m^{-3} mot to be exceeded more than 3 times a year	24 hour mean	31 Dec 2004

Note: [1]by which to be achieved by and maintained thereafter

Table B. Details of Automatic Monitoring Sites for 2016

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Does this location represent worst-case exposure?
LB: London Bloomsbury	Urban background	X 530120	Y 182034	NO_2, PM_{10}, $PM_{2.5}$, SO_2, CO, O_3	Y	FDMS, API Nox, TEOM	Y (40m)	27m	Y
CD1: Swiss Cottage	Roadside	X 526633	Y 184392	NO_2, PM_{10}, $PM_{2.5}$,	Y	FDMS, AC31 Nox	Y (7m)	1.5m	Y
CD3: Shaftesbury Avenue	Kerbside	X 530060	Y 181290	NO_2, PM_{10},	Y	TEOM, API Nox	Y (1m)	<1m	Y
CD9: Euston Road	Kerbside	X 529878	Y 182648	NO_2, PM_{10}, $PM_{2.5}$	Y	API Nox, FDMS	Y (1m)	0.5m	Y

Table C. Details of Non-Automatic Monitoring Sites for 2016

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Does this location represent worst-case exposure?
CA4	Euston Road	Roadside	X 530110	Y 182795	NO_2	Y	N	Y (1m)	5m	Y
CA6	Wakefield Gardens	Urban background	X 530430	Y 182430	NO_2	Y	N	Y (18m)	30m	Y
CA7	Frognal Way	Urban background	X 526213	Y 185519	NO_2	Y	N	Y (6m)	30m	Y
CA10	Tavistock Gardens	Urban background	X 529880	Y 182334	NO_2	Y	N	Y (35m)	25m	Y
CA11	Tottenham Court Road	Kerbside	X 529568	Y 181728	NO_2	Y	N	Y (4m)	<1m	Y
CA15	Swiss Cottage	Kerbside	X 526633	Y 184392	NO_2	Y	Y	Y (7m)	<1m	Y
CA16	Kentish Town Road	Roadside	X 529013	Y 185102	NO_2	Y	N	Y (1m)	1m	Y
CA17	47 Fitzjohn's Road	Roadside	X 526547	Y 185125	NO_2	Y	N	Y (5m)	5m	Y
CA20	Brill Place	Roadside	X 529914	Y 183147	NO_2	Y	N	Y (9m)	<5m	Y

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Does this location represent worst-case exposure?
CA21	Bloomsbury Street	Roadside	X 529962	Y 181620	NO_2	Y	N	Y (4m)	<1m	Y
CA23	Camden Road	Roadside	X 529173	Y 184129	NO_2	Y	N	Y (5m)	<1m	Y
CA24	Chetwynd Road	Roadside	X 528722	Y 185950	NO_2	Y	N	Y (2m)	1m	Y
CA25	Emmanuel Primary	Roadside	X 525325	Y 185255	NO_2	Y	N	Y (3m)	1m	Y
WITT	Wittanhurst Lane	Roadside	X 528213	Y 187203	NO_2	Y	N	Y (3m)	1.5m	Y

Table D. Annual Mean NO_2 Ratified and Bias-adjusted Monitoring Results (μg m^{-3})

Site ID	Nitrogen Dioxide (NO2) Annual Mean Concentration μg/m^3						
	2010* [c]	**2011*** [c]	**2012*** [c]	**2013*** [c]	**2014** [c]	**2015**	**2016**
LB: London Bloomsbury	55	50	**55**	**44**	**45**	**48**	**42**
CD1: Swiss Cottage	82	71	**70**	**63**	**66**	**61**	**66**
CD3: Shaftesbury Avenue	89	76	**71**	**74**	**69***	**83**	**84**

CD9: Euston Road	-	122*	**106**	**106**	**98**	**90**	**88**

Site ID	Location	Annual mean concentration (adjusted for bias) µg/m³						
		2010* (Bias Adjustment Factor = XX)	**2011*** (Bias Adjustment Factor = 0.95)	**2012*** (Bias Adjustment Factor = 0.95)	**2013*** (Bias Adjustment Factor = 1.00)	**2014** (Bias Adjustment Factor = 0.97)	**2015** (Bias Adjustment Factor = 0.98)	**2016** (Bias Adjustment Factor = 0.96)
CA4	Euston Road	**82**	**93.12**	**82.05**	**107.75**	**89.74**	**86.76**	**82.71**
CA6	Wakefield Gardens	34	**45.61**	39.29	**40.32**	36.44	35.80	31.31
CA7	Frognal Way	29	31.46	28.89	31.95	28.55	27.78	27.91
CA10	Tavistock Gardens / St George's Gardens	**52**	**47.56**	**40.12**	**49.37**	**46.50**	**44.57**	39.68
CA11	Tottenham Court Road	**92**	**91.67**	**83.30**	**88.09**	**86.75**	**85.61**	**83.57**
CA15	Swiss Cottage	**71**	**73.17**	**72.66**	**83.08**	**74.34**	**69.28**	**73.86**
CA16	Kentish Town Road	**74**	**57.19**	**58.97**	**65.32**	**57.83**	**63.55**	**58.72**
CA17	47 Fitzjohn's Road	**73**	**58.39**	**61.20**	**65.24**	**60.30**	**55.80**	**56.38**
CA20	Brill Place	**54**	**50.79**	**50.00**	**49.37**	**52.34**	**48.94**	**47.53**
CA21	Bloomsbury Street	**41**	**76.73**	**71.66**	**76.08**	**80.82**	**71.43**	**72.20**
CA23	Camden Road	**84**	**72.21**	**67.40**	**77.85**	**72.21**	**63.33**	**61.74**
CA24	Chetwynd Road	**68**	**44.12**	**43.67**	**47.75**	**44.76**	**46.52**	**41.96**
CA25	Emmanuel Primary	-	**41.5**	**45.94**	**57.91**	**48.36**	**47.70**	**52.18**
WITT	Wittanhurst Lane	-	-	-	**53.10**	**48.26**	**45.03**	**43.11**

Notes: Exceedance of the NO_2 annual mean AQO of 40 µgm^{-3} are shown in **bold**.
NO_2 annual means in excess of 60 µg m^{-3}, indicating a potential exceedance of the NO^2 hourly mean AQS objective are shown in bold and underlined.
[a] data capture for the monitoring period, in cases where monitoring was only carried out for part of the year
[b] data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)
[c] Means should be "annualised" in accordance with LLAQM Technical Guidance, if valid data capture is less than 75%

Table E. NO_2 Automatic Monitor Results: Comparison with 1-hour Mean Objective

Site ID	Site Type	Within AQMA?	Number of Exceedences of Hourly Mean (200 μg/m³)						
			2010* [c]	2011* [c]	2012* [c]	2013* [c]	2014 [c]	2015	2016
LB	Urban background	Y	1	0	1	0	0	0	0
CD1	Kerbside	Y	**128**	**79**	**43**	**28**	13	11	**37**
CD3	Roadside	Y	21	15	12	6	1 (140.4)[c]	Data capture issues	Data capture issues
CD9	Roadside	Y	-	**726**	**295**	**296**	**170**	**54**	**39**

Notes: Exceedance of the NO_2 short term AQO of 200 μgm^{-3} over the permitted 18 days per year are shown in **bold**.

[a] data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] Means should be "annualised" in accordance with LLAQM Technical Guidance, if valid data capture is less than 75%

Table F. Annual Mean PM_{10} Automatic Monitoring Results ($\mu g\ m^{-3}$)

Site ID	PM10 Annual Mean Concentration μg/m³						
	2010* [c]	2011* [c]	2012* [c]	2013* [c]	2014 [c]	2015	2016
LB: London Bloomsbury	18	22	19	18	20	22	20
CD1: Swiss Cottage	26	27	23	21	22	20	21
CD3: Shaftesbury Avenue	29	32	29	29	25	22	18
CD9: Euston Road	-	-	-	-	29	18	24

Notes: Exceedance of the PM_{10} annual mean AQO of 40 μgm^{-3} are shown in **bold**.

[a] data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] Means should be "annualised" in accordance with LLAQM Technical Guidance, if valid data capture is less than 75%

Table G. PM_{10} Automatic Monitor Results: Comparison with 24-Hour Mean Objective

Site ID	PM10 Number of Exceedences of 24-Hour Mean (50 ug/m³)						
	2010* [c]	2011* [c]	2012* [c]	2013* [c]	2014 [c]	2015	2016
LB: London Bloomsbury	2	17	10	4	11	6	9
CD1: Swiss Cottage	26	31	21	8	12	8	7
CD3: Shaftesbury Avenue	29	27	18	17	16	4	TBC
CD9: Euston Road	-	-	-	-	5	5	10

Notes: Exceedance of the PM_{10} short term AQO of 50 µg m^{-3} over the permitted 35 days per year or where the 90.4th percentile exceeds 50 µg m^{-3} are shown in **bold**. Where the period of valid data is less than 90% of a full year, the 90.4th percentile is shown in brackets after the number of exceedances.

[a] data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] Means should be "annualised" in accordance with LLAQM Technical Guidance, if valid data capture is less than 75%

Table H. SO_2 Automatic Monitor Results for 2015: Comparison with Objectives

Site ID	Site Type	Within AQMA?	Number of Exceedences (percentile in bracket µg/m³)[c]		
			15-minute Objective (266 µg/m³)	1-hour Objective (350 µg/m³)	24-hour Objective (125 µg/m³)
LB	Urban Background	Y	0	0	0

Exceedances of the SO_2 AQOs are shown in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed / year)

[a] data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] Means should be "annualised" as in Box 3.2 of TG(09) (http://laqm.defra.gov.uk/technical-guidance/index.html?d=page=38), if valid data capture is less than 75%

Appendix 2: AADT traffic count data for Euston Road

Figure A. Location of relevant Count Point ID

Count point ID: CP 17169

0.25 miles (0.4 km) of A501 (Euston Road)

Start junction: A400 (Gower Street)

End Junction: A4200 (Upper Woburn Place)

Table A. Extracted AADT figures for CP 17169

AADF Year	CP	Count Method	Pedal Cycles	Motorcycles	Cars & Taxis	Buses & Coaches	LGVs	All HGVs	All Motor Vehicles
2000	17169	Estimated	1067	3189	48259	1870	8041	3130	**64489**
2001	17169	Estimated	1215	3550	47149	1862	8218	3151	**63930**
2002	17169	Counted	2636	6445	38638	1528	6460	3238	**56309**
2003	17169	Estimated	3077	6716	37324	1848	6900	2942	**55730**
2004	17169	Estimated	3258	7058	33555	2010	7216	3344	**53183**
2005	17169	Counted	916	3312	35959	1901	7315	2222	**50709**
2006	17169	Estimated	1190	3604	37345	2076	7755	2133	**52913**
2007	17169	Estimated	1177	3690	36897	2043	7933	1963	**52526**
2008	17169	Counted	1697	3238	39510	2337	7452	2186	**54723**
2009	17169	Counted	1753	3308	41413	2291	7229	2262	**56503**
2010	17169	Counted	2637	3787	46791	2258	8756	2219	**63811**
2011	17169	Estimated	2593	3723	46136	2288	8607	2192	**62946**
2012	17169	Counted	1231	1938	29576	2312	5117	2119	**41063**
2013	17169	Estimated	1173	1784	29380	2443	5158	2240	**41004**
2014	17169	Estimated	1262	1830	29815	2377	5256	2013	**41291**
2015	17169	Counted	2235	2997	38967	2304	8152	1937	**54358**
2016	17169	Estimated	2607	3512	39234	2545	7439	1660	**54390**

Source: Department for Transport Traffic Counts; https://www.dft.gov.uk/traffic-counts/cp.php?la=Camden#17169