Air Quality CONSULTANTS

Air Quality Proof of Evidence of Prof. Duncan Laxen

On behalf of Imperial Hotels

Torrington Place to Tavistock Place Traffic Order DPI/X5210/17/8

September 2017

Experts in air quality management & assessment

Document Control

Client	Imperial London Hotels Limited	**Principal Contact**	John Russell (of SCP Traffic and Transport Consultants)

Job Number	J2976A

Proof Prepared By:	Prof. Duncan Laxen

Document Status and Review Schedule

Report No.	Date	Status	Reviewed by
J2976A/1/F1	22 September 2017	Final Report	Dr Austin Cogan

Air Quality Consultants Ltd
23 Coldharbour Road, Bristol BS6 7JT Tel: 0117 974 1086
12 Airedale Road, London SW12 8SF Tel: 0208 673 4313
aqc@aqconsultants.co.uk

Registered Office: 12 St Oswalds Road, Bristol, BS6 7HT
Companies House Registration No: 2814570

1 Introduction

1.1 My name is Duncan Laxen. I hold Bachelor of Science and Master of Science degrees in Environmental Sciences and a Doctor of Philosophy degree in air pollution chemistry, all obtained at Lancaster University in 1971, 1975 and 1978 respectively. I am a Visiting Professor in Air Quality Management and Assessment at the University of the West of England, Bristol. I have over 40 years' experience in environmental sciences, most of them in the field of air pollution. I am Managing Director of Air Quality Consultants Ltd ("AQC").

1.2 I have been a member of various Government expert groups, including the Department of the Environment, Food and Rural Affairs' ("Defra") *Air Quality Expert Group* and of the Department of Health's *Committee on the Medical Effects of Air Pollution*. I was involved with the Department for Transport's *Project for the Sustainable Development of Heathrow Airport*, chairing its Monitoring Panel and being a member of its Modelling Panel. I was a member of the Steering Group established by the European Commission to oversee the Clean Air for Europe initiative. In support of this I was a member of the Commission's Working Groups on particles and on implementation. I was also a member of the Air Quality Committee of Environmental Protection UK ("EPUK"). In 2004 I was an invited expert reviewer for the World Health Organisation's response to questions from the European Commission on the Health Aspects of Air Pollution. I am a Fellow of the Institute of Air Quality Management ("IAQM"), the professional body for air quality practitioners. I have published over 70 scientific and technical papers and have made numerous presentations to conferences.

1.3 I have been closely involved with the development of air quality management and assessment in the UK. This includes a close involvement with the preparation of technical guidance to support the local air quality management responsibilities of local authorities, on behalf of Defra, and guidance on air quality assessments for the planning regime, on behalf of the IAQM and EPUK. These guidance documents are widely used by air quality practitioners in the UK.

1.4 I have worked on air quality projects in London for the last 30 years, so have an excellent understanding of air quality issues in the capital. I have given expert evidence on air quality at numerous Public Inquiries and DCO Hearings over the last 25 years, including recently providing expert air quality support to Transport for London in relation to the Silvertown Tunnel DCO application.

1.5 In July 2017 I was commissioned by Imperial London Hotels Limited (ILHL) to review the air quality evidence produced by the London Borough of Camden (LBC) in connection with The Camden (Torrington Place to Tavistock Place) (Prescribed Routes, Waiting and Loading Restrictions and Loading Places) Traffic Order [2017] (the 'Order'). I have provided continuing support since that time, including preparation of this proof of evidence.

2 Scope of Evidence

2.1 In my proof of evidence, I will:

- discuss the air quality in the study area and why it is an important consideration;
- discuss the relevance of an air quality assessment and why it is important;
- discuss the significance of the air quality monitoring relied upon by LBC;
- discuss the claims made by LBC and why the conclusions drawn are not proven; and
- discuss air quality in the context of a modification of the proposed order.

(The relevant references to the documents are set out when they are referred to in my proof of evidence.)

2.2 The evidence I have prepared and provided to this Appeal is true and the opinions I express are my true and professional judgements based on the evidence I have reviewed and my professional experience.

3 Relevance of Air Quality in the Study Area

3.1 The study area is within an Air Quality Management Area (AQMA) declared by LBC. It is the statuary duty of the local authority to declare an AQMA where exceedances of the national air quality objectives are measured. For Camden, an AQMA was declared for the whole borough in 2002, due to measured exceedances of the annual mean nitrogen dioxide (NO_2) objective and the daily mean PM_{10} (particles smaller than 10 µm in diameter) objective.

3.2 For the purposes of this evidence, I will be focusing on NO_2 concentrations in microgrammes per cubic metre (µg/m^3). The annual mean NO_2 objective is 40 µg/m^3. This objective applies at locations where members of the public are regularly exposed, such as residential properties, student accommodation, and schools. There is also a short-term national air quality objective for NO_2 of 200 µg/m^3 as a 1-hour mean, which should not be exceeded more than 18 times a year. This short-term objective applies where members of the public might spend one hour or longer, such as residential properties, gardens, local parks, pavements of busy shopping streets and outdoor eating locations. The London Local Air Quality Management Technical Guidance 2016 (LLAQM.TG(16)) states that exceedances of the short-term objective are only likely to occur when annual mean concentrations are above 60 µg/m^3, and this value can thus be used to represent when short-term exceedances are likely to occur.

3.3 Existing air quality conditions within the Borough are very poor, with annual mean NO_2 concentrations well above 60 µg/m^3 at many locations within the study area. The annual mean

and short-term NO_2 objectives are both already exceeded, which is of relevance to public health within the study area.

3.4 LBC has a statutory duty to work in pursuit of improving air quality within the AQMA.

3.5 LBC has already acknowledged that *"the Scheme is located within an area of central London which suffers from poor air quality"*, as stated in the LBC Statement of Case (SoC), and should therefore be taking appropriate action to ensure that the proposed Order does not cause any significant adverse air quality impacts.

4 Importance of an Air Quality Assessment

4.1 No air quality assessment of the proposed Order has been provided by LBC. An air quality assessment is normally carried out for a scheme of this kind, to determine the likely impacts that changes in road traffic will have on local air quality, and to ensure that no significant adverse air quality impacts will occur. This is especially true for schemes within an AQMA, where it is very important to not worsen existing conditions. I would have expected to see an assessment that covered not only the air quality along the corridor but also across the whole study area. Since much of the road traffic has been re-routed with the introduction of the Trial, the emissions from the road traffic will have changed the air quality conditions throughout the study area. Where road traffic has increased in the study area, it is expected that air quality conditions will have worsened. I would add that AQC prepared just such a detailed air quality assessment for the Baker Street Two Way Project in the City of Westminster, which is not dissimilar in terms of the area affected.

4.2 In the absence of an air quality assessment then there is no evidence that the Trial will give rise to overall adverse or beneficial air quality effects or have no significant effect at all. Nevertheless, despite the absence of an air quality assessment prior to implementation of the Trial, LBC has made a number of statements in its SoC that the Trial has led to an overall improvement in air quality in the area. For instance in paragraph 7.12 on page 14 of the SoC it says: *"The main impact on local air quality is a reduction in vehicle emissions"*, with further claims in paragraphs 7.13 and 7.14 that *"the total amount of traffic in the area is likely to have reduced"* and the *"likely overall decrease in the amount of traffic in the area"*. Without a proper air quality assessment, based on sound traffic data, it is not possible to make such claims, and such an assessment has not been carried out. Part of this assessment would need to use information on the change in traffic (in terms of vehicle-kilometres) across the whole area, but this has not been provided. The issue of traffic data, or lack of such data, to inform such an assessment, is dealt with in the evidence of John Russell on behalf of ILHL.

4.3 LBC's claim that air quality has improved as a result of the introduction of the Trial is based on a narrow assessment of the changes in the scheme Corridor, where it is known that traffic flows have reduced, with no proper consideration of the effects across the wider area where traffic flows

have changed by way of traffic displacement. This narrow assessment is based entirely on monitoring, which I examine in the next section of my proof of evidence.

5 Significance of Monitoring

5.1 LBC's claim that air quality has improved due to the Trial is based entirely on monitoring that LBC carried out for four months prior to and then around seven months during the Trial at two monitoring sites, located at Tavistock Place and Gordon Square. LBC has also made reference to data from Defra's Russell Square long-term monitoring site. The results are set out in the LBC document 'Consultation: Torrington Place / Tavistock Place route' in section 5 on page 6, with the accompanying statement that the results *"indicate significant improvements in air quality following implementation of the Trial, of between 9% and 20%"*. I reproduce this section of the LBC document in Appendix 1 to my proof of evidence.

5.2 The monitors located by LBC at Tavistock Place and Gordon Square were both low-cost air quality sensors called AQ Mesh monitors which are, in my professional opinion, insufficiently reliable for the purpose. The World Meteorological Organization (WMO) has recently provided a technical advice note advising on the applications for which such sensors are suitable (see Appendix 2 to my proof of evidence). In Recommendation 4 WMO state that such sensors *"provide a useful qualitative measurement of the temporal variability of general air pollution levels ... over period of days to months"* (emphasis in original), however, *"There is no evidence for sensor approaches being currently suitable for discerning long-term trends in atmospheric composition"* and *"There is rather limited evidence for the sensors being appropriate ... for determining compliance with legal or regulatory standards"*. It is normal practice in the UK for air quality to be measured using automatic monitors and diffusion tubes, whose reliability is well documented.

5.3 Measurements should also be presented as annual mean concentrations, to align with the national annual mean objective for nitrogen dioxide, and more importantly, in order to take account of any seasonal effects (it is known that concentrations are higher in winter than the summer). LBC has just presented the results for the two monitoring periods without considering such seasonal influences. Where measurements have been made over a period of less than a year, the results should be adjusted to provide an annual mean concentration. This adjustment is commonly known as annualisation. No annualisation has been applied to the measured concentrations, and it is therefore inappropriate to compare the two periods either against each other or with the national objective.

5.4 LBC has carried out other local monitoring, using automatic monitors and diffusion tubes, over many years, with a number of sites relevant to the study area. Table 1 in Appendix 3 to my proof of evidence presents the annual mean NO_2 concentrations measured at these monitoring sites for the years 2010 to 2016. The locations of the monitors are shown in Figure 1 in Appendix 4 to my

proof of evidence. The monitoring results are also presented in Figure 2 in Appendix 4 to my proof of evidence.

5.5 To emphasise the concerns about the monitors used by LBC, I would note that the minimum measured background concentration in 2016 at any of the monitoring sites was 31 µg/m^3. This is around 5 µg/m^3 higher than the concentration measured at the Tavistock Place AQ Mesh monitor. Since this AQ Mesh monitor is located at a roadside location, it should be measuring background levels plus a road traffic contribution, i.e. it should be measuring significantly more than background levels. The fact that the Tavistock Place monitor is recording a concentration below what would be expected from the more reliable results presented in Table 1 in Appendix 3 to my proof of evidence reinforces my opinion that the AQ Mesh monitors are not reliable.

5.6 There is evidence, as set out in Figure 2 in Appendix 4 to my proof of evidence, of downward trends in nitrogen dioxide concentrations over the past seven years, with variation from year to year. This follows the expected decline due to general improvements in vehicle emissions as well as reductions in commercial and industrial emissions. This improvement is seen across the UK and is not specific to Camden. The Russell Square and Euston Road automatic monitors will provide the most reliable data. They both show a downward trend that I would expect to be largely unrelated to the effects of the Trial. It is therefore inappropriate to claim that the reduction at Russell Square is due to the Trial; it is more likely to be the result of the downward trend seen across the area.

5.7 The Tavistock Place and Gordon Square AQ Mesh monitors are also both located along the corridor where traffic has significantly reduced with the Trial, due to westbound traffic being re-routed. So despite the unreliability of the monitors, it is to be expected that there would be improvements of air quality along this corridor due to a reduction in vehicles, so finding some reduction is not surprising. The concern, though, is that monitoring just at these two locations is not representative of the study area as a whole. LBC has not carried out any air quality monitoring along the roads that have seen a significant increase in traffic. It is, accordingly, misleading of LBC to say that air quality has improved as a result of the Trial. LBC has monitored traffic changes and I make comments on the findings in the next section of my proof of evidence.

5.8 LBC stated on Page 2 of the information leaflet published in October 2015 that *"detailed monitoring will be undertaken"*. I do not consider the monitoring carried out by LBC to have been detailed. In my view, a detailed programme of monitoring would have included diffusion tubes located adjacent to all roads in the study area likely to be affected by the Trial. This would have provided a representative study of how air quality changed across the entire local area. The assessment should also have taken into account residential exposure alongside all these roads.

5.9 A proper study of changes due to the Trial would have employed control sites well away from the Corridor to provide evidence of changes in concentrations due to meteorology and general emissions unaffected by the Trial. Comparing one year with another is not straightforward, as

meteorological conditions, such as wind direction and speed changes from year to year resulting in fluctuations in concentrations between years. Vehicle technology is also continuously improving leading to reductions in pollutant emissions from vehicles. It is therefore to be expected that concentrations in 2016 would be slightly lower than those in 2015, as I have already shown.

5.10 Overall, I do not believe that LBC can say whether there has been an improvement in air quality in the study area as a whole, as a result of the Trial, based on the monitoring it has carried out.

6 Conclusions of Trial

6.1 LBC has made a number of assertions in its Statement of Case that I do not believe to be justified. For instance, LBC claims that there has been a reduction in vehicle emissions as a result of the Trial. As I mentioned in paragraph 5.9 above, vehicle emissions will have reduced due to improvements in vehicle technologies and uptake of newer vehicles. It is, however, unknown whether vehicle emissions have reduced as a direct result of the Trial. This can only be ascertained via a detailed air quality assessment, which has not been carried out.

6.2 LBC claims the Trial layout has significantly improved air quality along the corridor. While improvements are likely to have occurred along the corridor, the monitoring equipment used is not sufficiently reliable to say how much this improvement has been. The problems are compounded by the lack of consideration of control sites that would allow for the influence of meteorology and vehicle emissions on the differences in concentrations, independent of the Trial.

6.3 LBC recognises that displaced motorised traffic may be adding to pollution levels, but the extent to which this is the case has not been established and the importance of this has not been addressed. Without an air quality assessment or detailed (and reliable) monitoring, the increase in pollution levels elsewhere attributable to the Trial is unknown. Without knowing what this increase is, it is impossible to say whether the Trial has led to an overall improvement in air quality or not.

6.4 LBC has monitored changes in traffic flow. I have assembled the information on changes in Annual Average Daily Traffic (AADT) flows and present this in Figure 3 in my Appendix 4. This shows that there are roads with substantial flow changes, taken to be an increase or decrease in flow of more than 1,000 AADT, throughout the study area. The count points are shown in this figure divided into the change in flow either for north or east bound traffic or for south or west bound traffic on each link.

6.5 LBC claims that any increase in pollution on other roads (other than the Trial corridor) is more than offset by the improvement in air quality that pedestrians and cyclist experience along the Corridor. However, members of the public travelling through the Corridor will be exposed to high levels of pollution whether they use the Corridor or not, and this will only be for short durations. The health benefits of exercise will help to offset any pollution they are exposed to. I would consider people

living in residential houses or student accommodation to be by far the most sensitive to air quality in the study area, compared with the transient population of cyclists and pedestrians, as they will be exposed for long durations. Any increase in traffic on the local roads outside of the Corridor will result in worse air quality conditions for these most sensitive people. LBC's claim in relation to cyclists and pedestrians would need much more information to be justified and ignores the likely changes in air quality for people living in the area.

6.6 LBC claims the Trial can be considered to meet Camden's objectives in its Clean Air Action Plan (CAAP). Below are the objectives within the CAAP that I believe are relevant:

- *"Raise awareness about air quality in Camden and promote lifestyle changes which can help reduce levels of air pollution and minimise exposure to air pollution"*

  While the Trial may promote cycling, I do not consider it to raise awareness about air quality in Camden. The air quality information provided to the public by LBC paints a picture that the Order will cause significant improvements in air quality. In reality though, impacts of the Trial on air quality in the study area are unknown. To make this claim, LBC needed to have undertaken a detailed air quality assessment and carried out detailed and reliable monitoring to prove the Trial would raise appropriate awareness of air quality in Camden. This has not been done.

- *"Improve the health and well-being of the local population, including those that work and visit Camden"*

  As I have made clear, the changes in air quality across the study area caused by the Trial are unknown. Therefore the changes in health and well-being are also unknown. There is no evidence produced by LBC of an overall improvement.

6.7 The CAAP also includes specific actions to improve air quality. Below are the actions within the CAAP that I believe are relevant:

- Action 16 of the CAAP requires developers to undertake an air quality assessment where a new development could have a negative impact on air quality. The proposed Order is in essence a new development, but an assessment of its air quality effects has not been undertaken.

- Action 23 of the CAAP is to continue to undertake measures to increase walking and cycling in Camden. While the Trial promotes walking and cycling within the corridor, the indications are that the increase in traffic elsewhere in the study area will discourage walking and cycling on these roads.

- Action 42 and Action 46 of the CAAP state that LBC will disseminate results, best practice and up-to-date information about air quality. LBC has not provided an air quality assessment or sufficiently detailed monitoring for the Trial, to demonstrate its overall effect on local air quality.

LBC has not provided sufficient information about air quality or carried out best practices for the assessment of air quality effects.

6.8 LBC claims in the concluding paragraph of its SoC (paragraph 9.6) that *"More efficient use of the limited carriageway space will not only deliver environmental and personal health benefits but will also mean less traffic on the road."*. Since there is no evidence for an improvement in air quality across the study area, there is no evidence of an improvement in public health across the study area.

6.9 LBC claims that the Trial represents the best overall option. Since there are no air quality assessments for any of the options, and unreliable and insufficiently detailed monitoring has been carried out for the Trial, there is no clear evidence that the Trial is the best option in terms of air quality.

7 Possible Modification to the Proposed Scheme

7.1 ILHL contends that the scheme, if to be adopted, should be modified, so as to reverse the vehicular traffic flow to be westbound through the Corridor. LBC acknowledges in its Statement of Case that if the direction was reversed then this could still achieve its aim of *"reducing motor traffic along the corridor"*.

7.2 I am not in a position to say whether the eastbound Trial has improved air quality throughout the study area, and likewise, I cannot say anything about how a westbound scheme would affect air quality. How air quality conditions will be affected can only be determined via an air quality assessment based on modelling, and my understanding is that the traffic data for such an exercise has yet to be provided, if available, by LBC.

8 Summary and Conclusion

8.1 In summary I have shown that:

- the claims by LBC that there have been air quality improvements brought about by the Trial are not proven, as an air quality assessment has not been undertaken;
- the monitoring results relied upon by LBC as evidence of an improvement in air quality are not adequate for the purpose for a number of reasons:
  - the monitors used are not reliable;
  - the before and after monitoring results cannot be compared, as they have not been annualised or related to control sites;

- the monitoring does not cover those roads that have experienced an increase in traffic; and

- as a result of the limitations of the monitoring carried out, there is no evidence of an improvement in air quality, health or well-being attributable to the Trial.

8.2 On the basis of the evidence I have set out, I conclude that there is no basis to claim that the Trial has led to an overall improvement in air quality in the study area or in the borough. Accordingly it has not been shown, that the Order, if confirmed, would deliver the air quality benefits claimed by LBC in its Statement of Case and elsewhere in the evidence before the inquiry. Section 1 (1) (g) of the Road Traffic Regulation Act 1984 says that a Road Traffic Regulation Order may be made *"for any of the purposes specified in paragraphs (a) to (c) of section 87(1) of the Environment Act 1995."* These purposes concern the implementation of the National Air Quality Strategy and or the implementation of the air quality obligations of the UK under EC and international treaties and or the assessment or management of the quality of air. In the absence of a proper air quality assessment of the Trial it cannot be said, in my professional opinion, that the Order, if confirmed, would serve any of these purposes.