AIR QUALITY ASSESSMENT

AT: 332 West End Lane, London

CLIENT: Cubic Building Surveying Limited

DATE: 03/09/19

STROMA PROJECT REF: 132614

Please find below the link to the online feedback form:

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1 INTRODUCTION

1.1 Scope

Stroma Built Environment Ltd has been commissioned to undertake an air quality exposure assessment based on the potential impacts of existing and future traffic levels on a proposed development at 332 West End Lane in the London Borough of Camden. The pollutants modelled as part of this assessment are nitrogen oxides (NOx) and particulate matter (PM_{10}).

The impacts of vehicle emissions have been assessed using the techniques detailed within Volume 11, Section 3 of the Design Manual for Roads and Bridges (DMRB)[1] and the Local Air Quality Management Technical Guidance (LAQM.TG16)[2]. The impact of road traffic emissions will be assessed using the ADMS-Roads air dispersion model. This model has been devised by Cambridge Environmental Research Consultants (CERC) and is described as a "*comprehensive tool for investigating air pollution problems due to small networks of roads*".

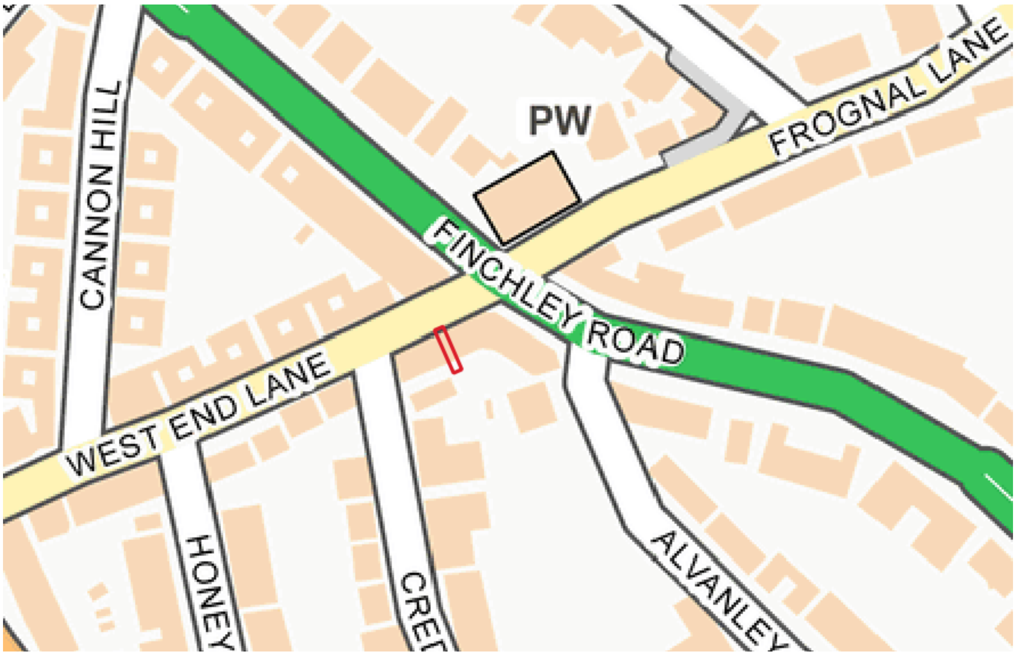
It should be noted that the short-term impacts of NO_2 and PM_{10} emissions have not been modelled as dispersion models are inevitably poor at predicting short-term peaks in pollutant concentrations, which are highly variable from year to year, and from site to site. Notwithstanding this, general assumptions have been made about short term concentrations based on the modelled annual mean concentrations.

1.2 Site Description

The proposed development site is located at 332 West End Lane in the London Borough of Camden. The proposed development is a change of use on the first and second floors from a restaurant to residential use, and a loft conversion.

A location plan can be found in figure 1.

Figure 1 – Site Location Plan



1 Design Manual for Roads and Bridges, Vol 11, Section 3, Part 1 – HA207/07, Highways Agency, May 2007
2 Part IV of the Environment Act 1995, Local Air Quality Management Technical Guidance (TG16), Defra, February 2018

2 POLLUTANTS & LEGISLATION

2.1 Pollutant Overview

In most urban areas of the UK, traffic generated pollutants have become the most common pollutants. These are nitrogen dioxide (NO_2), fine particulates (PM_{10}), carbon monoxide (CO), 1,3-butadiene and benzene, as well as carbon dioxide (CO_2). This air quality assessment focuses on NO_2 and PM_{10}, as these pollutants are least likely to meet their Air Quality Strategy objectives near roads. Table 1 provides an overview of NO_2 and PM_{10}.

Table 1 – Overview of NO_2 and PM_{10}

Pollutant	Properties	Anthropogenic Sources	Natural Sources	Potential Effects
Particles (PM_{10})	Tiny particulates of solid or liquid nature suspended in the air	Road transport; Power generation plants; Production processes e.g. windblown dust	Soil erosion; Volcanoes; Forest fires; Sea salt crystals	Asthma; Lung cancer; Cardiovascular problems
Nitrogen Dioxide (NO_2)	Reddish-brown coloured gas with a distinct odour	Road transport; Power generation plants; Fossil fuels – extraction & distribution; Petroleum refining	No natural sources, although nitric oxide (NO) can form in soils	Pulmonary edema; Various environmental impacts e.g. acid rain

2.2 Air Quality Strategy

The UK Government and the devolved administrations published the latest Air Quality Strategy for England, Scotland, Wales and Northern Ireland on 17 July 2007[3]. The Strategy provides an over-arching strategic framework for air quality management in the UK.

With regards to this assessment, the Air Quality Strategy contains national air quality standards and objectives established by the Government to protect human health. The objectives for nitrogen dioxide and particulates (PM_{10} and $PM_{2.5}$) have been set, along with seven other pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, PAHs, sulphur dioxide and ozone). Those which are limit values required by EU Daughter Directives on Air Quality have been transposed into UK law through the Air Quality Standards Regulations 2010 which came into force on 11th June 2010. Table 2 provides the UK Air Quality Objectives for NO_2 and PM_{10}.

[3] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland, July 2007

Table 2 – UK Air Quality Objectives for Nitrogen Dioxide and Particulate Matter

Pollutant	Objective	Concentration measured as
Nitrogen Dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times a year	1 hour mean
	40µg/m^3	Annual mean
Particles (PM_{10})	50µg/m^3 not to be exceeded more than 35 times a year	24 hour mean
	40µg/m^3	Annual mean
Particles ($PM_{2.5}$)	25µg/m^3 (except Scotland)	Annual Mean

Objectives for $PM_{2.5}$ were also introduced by the UK Government and the Devolved Administrations in 2010. However, these are not included in Regulations as the Air Quality Strategy has adopted an "exposure reduction" approach for $PM_{2.5}$ in order to seek a more efficient way of achieving further reductions in the health effects of air pollution by providing a driver to improve air quality everywhere in the UK rather than just in a small number of localised hotspot areas.

As defined in Table 4, background $PM_{2.5}$ concentrations are well below the limit value of 25 µg/m^3. As such, no further consideration has been given to $PM_{2.5}$ within this assessment.

2.3 London Local Air Quality Management (LLAQM)

At the core of LAQM delivery are three pollutant objectives; these are: nitrogen dioxide (NO_2), particulate matter (PM_{10}) and sulphur dioxide (SO_2). All current Air Quality Management Areas (AQMAs) across the UK are declared for one or more of these pollutants, with NO_2 accounting for the majority. It is a statutory requirement for local authorities to regularly review and assess air quality in their area and take action to improve air quality when objectives set out in regulation cannot be met.

2.3.1 Camden Council

Camden Council has declared an Air Quality Management Areas (AQMAs) for exceedances of both the annual mean objective for nitrogen dioxide and the 24-Hour mean objective for particulate matter PM_{10}. The AQMA has been declared for the entire borough and as such the proposed development lies within the AQMA.

There are currently 187 Air Quality Focus areas which have been declared across the 33 London Boroughs. The proposed development does not lie within a focus area, however, the A41 Finchley Road within close proximity to the proposed development does lie within a focus area.

3 PLANNING POLICY & GUIDANCE

3.1 National Planning Policy & Guidance

3.1.1 National Planning Policy Framework

On a national level, air quality can be a material consideration in planning decisions. The National Planning Policy Framework (NPPF)[4] for England, revised and released on 19th February 2019, is considered a key part of the Governments reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. The NPPF replaces the Planning Policy Statement 23 (PPS23) Planning and Pollution Control[5].

Paragraph 170 within the NPPF states that "planning policies and decisions should contribute to and enhance the natural and local environment" and that developments "should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans"

It goes on to state in paragraph 181 that "planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan".

3.1.2 Land-Use Planning & Development Control

In January 2017, Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) produced guidance to ensure that air quality is adequately considered in the land-use planning and development control processes[6].

The guidance document is particularly applicable to assessing the effect of changes in exposure of members of the public resulting from residential and mixed-use developments, especially those within urban areas where air quality is poorer. It is also relevant to other forms of development where a proposal could affect local air quality and for which no other guidance exists.

[4] National Planning Policy Framework, Secretary of State for Ministry of Housing, Communities and Local Government, February 2019

[5] Planning Policy Statement 23: Planning and Pollution Control, Office of the Deputy Prime Minister (ODPM), November 2004

[6] Land-Use Planning & Development Control: Planning for Air Quality. Guidance from Environmental Protection UK and the Institute of Air Quality Management for the consideration of air quality within the land-use planning and development control processes. EPUK & IAQM. January 2017

3.2 Regional Planning Policy

3.2.1 The Mayor's Air Quality Strategy

In October 2010, the Mayor's Air Quality Strategy[7] was released. The strategy sets out a framework for delivering improvements to London's air quality and includes measures aimed at reducing emissions from transport, homes, offices and new developments, as well as raising awareness of air quality issues and its impact on health.

3.2.2 The London Plan

In March 2016, the updated London Plan was published by the Greater London Authority[8]. The London Plan provides an overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20–25 years. The Plan brings together the geographic and locational aspects of the Mayor's other strategies, including a range of environmental issues such as climate change (adaptation and mitigation), air quality, noise and waste.

Policy 7.14 relates specifically to improving air quality and states the following:

"*The Mayor recognises the importance of tackling air pollution and improving air quality to London's development and the health and well-being of its people. He will work with strategic partners to ensure that the spatial, climate change, transport and design policies of this plan support implementation of his Air Quality and Transport strategies to achieve reductions in pollutant emissions and minimize public exposure to pollution*".

It goes on to state the following with regards to planning decisions:

"Development proposals should:

a minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within Air Quality Management Areas (AQMAs) and where development is likely to be used by large numbers of those particularly vulnerable to poor air quality, such as children or older people) such as by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans (see Policy 6.3)

b promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils' 'The control of dust and emissions from construction and demolition'

c be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs)).

d ensure that where provision needs to be made to reduce emissions from a development, this is usually made on-site. Where it can be demonstrated that on-site provision is impractical or inappropriate, and that it is possible to put in place measures having clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches

e where the development requires a detailed air quality assessment and biomass boilers are included, the assessment should forecast pollutant concentrations. Permission

[7] Clearing the Air: The Mayor's Air Quality Strategy. October 2010
[8] The London Plan. The Spatial Development Strategy for London. Consolidated with Alterations. March 2016

should only be granted if no adverse air quality impacts from the biomass boiler are identified".

3.2.3 Supplementary Planning Guidance (SPG)

Sustainable Design and Construction SPG

The Greater London Authority (GLA) released the "Sustainable Design and Construction" SPG in July 2014[9]. The SPG aims to support developers, local planning authorities and neighbourhoods to achieve sustainable development. It provides guidance on to how to achieve the London Plan objectives effectively, supporting the Mayor's aims for growth, including the delivery of housing and infrastructure.

In relation to air quality the SPG provides guidance on the following key areas:

- assessment requirements;
- construction and demolition;
- design and occupation;
- air quality neutral policy for buildings and transport; and
- emissions standards for combustion plant

[9] Sustainable Design and Construction SPG. Greater London Authority, July 2014

4 ASSESSMENT METHODOLOGY

4.1 Operational Phase

4.1.1 Modelled Scenarios

A modelled baseline year of 2017 has been used as this corresponds with the latest year of monitoring undertaken by the Council. The future year has also been chosen (2021) representing the first full year with the proposed development in place. Two scenarios have been adopted as part of the assessment. These are as follows:

- **Scenario 1** – existing levels of air quality / model verification (2017); and
- **Scenario 2** – future impact of traffic emissions on the proposed development i.e. introduction of new exposure (2021).

Predicted concentrations will be compared to the Air Quality Strategy objectives. Background pollutant concentrations and vehicle emission rates for all modelled years are based on the latest data issued by Defra. These background concentrations and emission factors are discussed further in the following sections.

4.1.2 ADMS-Roads

Modelling the impact of traffic emissions on the proposed development will be undertaken using the latest version of the ADMS-Roads model[10]. ADMS-Roads is significantly more advanced than that of most other air dispersion models in that it incorporates the latest understanding of the boundary layer structure, and goes beyond the simplistic Pasquill-Gifford stability categories method with explicit calculation of important parameters. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions.

4.1.3 Emission Factors

Defra and the Devolved Administrations have provided an updated Emission Factors Toolkit (Version 9.0) which incorporates updated NOx emissions factors and vehicle fleet information[11]. These emission factors have been integrated into the latest ADMS-Roads modelling software. However, in order to undertake a worst-case assessment emission factors for 2017 have been used for all modelled years.

4.1.4 Traffic Data

Baseline flows along the local roads are available from the London Atmospheric Emissions Inventory (LAEI). Baseline (2013) data from the LAEI has been projected to 2017 and 2021. Projection of traffic data has been undertaken using growth factors specific to the local authority, obtained from TEMPro. The projected flow rates are provided in Table 3. It is assumed that the percentage HDV and speed will remain unchanged in future years. Where a link approaches a junction a speed of 20 kph has been modelled in order to represent queuing traffic at a junction. This is the approach recommended by the London Local Air Quality Management Technical Guidance (LLAQM.TG16) for modelling queuing traffic at junctions by way of reducing the modelled vehicle speeds.

Roads within 200m of the verification sites have been modelled for the purposes of model verification.

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[10] Model Version: 4.1.1.0. Interface Version 4.1.1 (18/01/2018)
[11] https://laqm.defra.gov.uk/documents/EFT2019_v9.0.xlsb

Table 3 – Annual Average Daily Traffic Flows, Percentage HDV and Speeds for Modelled Roads

Link Name	AADT 2017	AADT 2021	HDV (%)	Speed (kph)
West End Lane	4,560	4,773	3.9	20
A41 Finchley Road	43,187	45,204	6.4	23
B510 Fortune Green Road	11,011	11,525	5.9	29
Mill Lane	13,748	14,390	6.6	28

4.2 Background Concentrations

Background NOx, NO_2 and PM_{10} concentrations have been obtained from Defra[12]. These 1 km x 1 km grid resolution maps are derived from a base year of 2017 (for NOx, NO_2, PM_{10} and $PM_{2.5}$ only), which are then projected to future years up to 2030. Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ derived from Defra are provided in Table 4.

Table 4 – Background NOx, NO_2, PM_{10} and $PM_{2.5}$ Concentrations

Location	Pollutant	X	Y	2017
Proposed Development	NO_2	525500	185500	28.3
	NOx			46.2
	PM_{10}			17.9
	$PM_{2.5}$			12.2

In order to undertake a worst-case assessment, 2017 background concentrations have been assumed for all modelled scenarios.

4.3 Surface Roughness

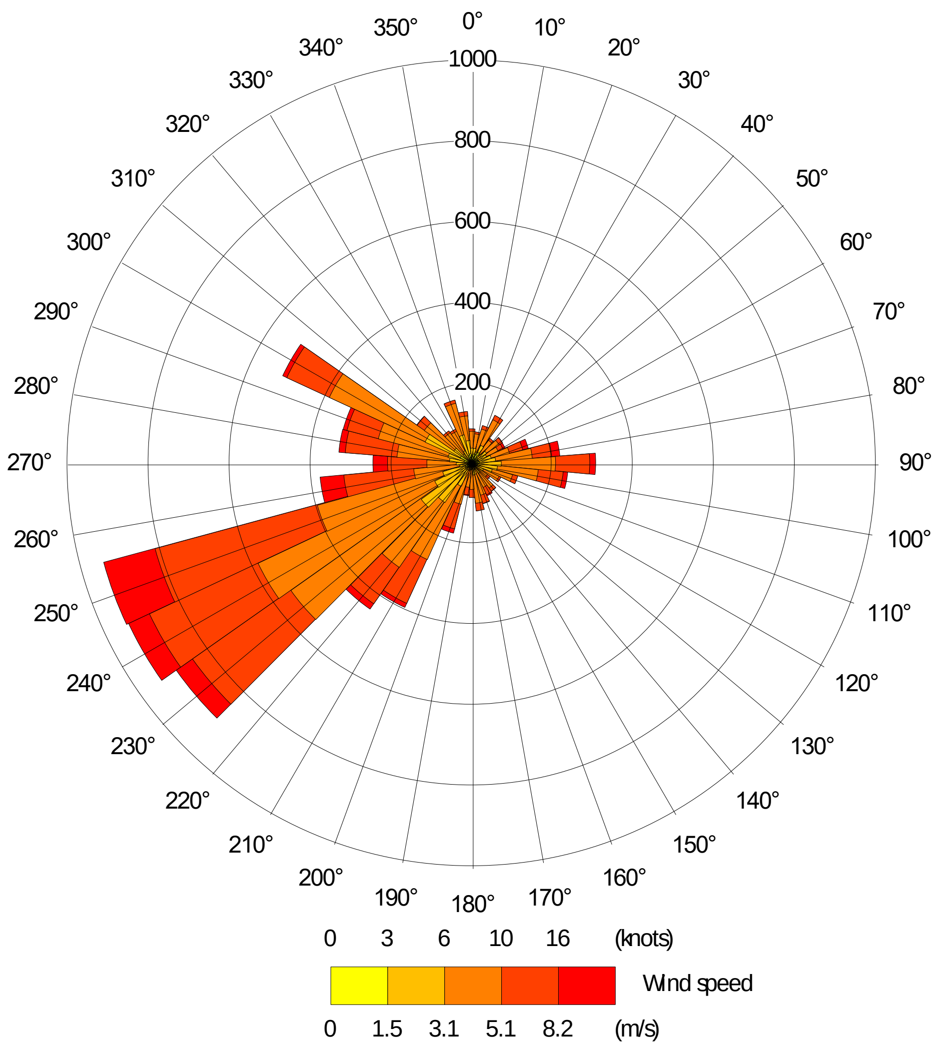
A surface roughness of 1.5 metre has been used in the model. This value is provided by ADMS-Roads as a typical roughness length for large urban areas. This value has been used across the modelled domain.

4.4 Meteorological Data

Hourly sequential meteorological data from the London City Airport meteorological station has been used. Wind speed and direction data from the London City Airport meteorological station has been plotted as a wind rose in Figure 2.

12 https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017

Figure 2 – Wind Speed and Direction Data, London City Airport (2017)



4.5 Model Output

4.5.1 NOx/NO_2 Relationship

Following recent evidence that shows the proportion of primary NO_2 in vehicle exhaust has increased[13]. As such, a new NOx to NO_2 calculator has been devised[14]. This new calculator has been used to determine NO_2 concentrations for this assessment, based on predicted NOx concentrations using ADMS-Roads. Converted NO_2 concentrations are initially compared to local monitoring data in order to verify the model output. If the model performance is considered unacceptable then the NOx concentrations are adjusted before conversion to NO_2.

[13] Trends in Primary Nitrogen Dioxide in the UK, Air Quality Expert Group, 2007

[14] http://laqm.defra.gov.uk/documents/no2tonox9_ja-forweb_june2016.xls

4.5.2 Predicted Short Term Concentrations

As discussed in the introduction, it has not been possible to model the short-term impacts of NO_2 and PM_{10}. Research undertaken in 2003[15] has indicated that the hourly NO_2 objective is unlikely to be exceeded at a roadside location where the annual mean NO_2 concentration is less than 60 µg/m^3.

For PM_{10}, a relationship between the annual mean and the number of 24-hour mean exceedances has been devised and is as follows:

- No. 24-hour mean exceedances = -18.5 + 0.00145 x annual mean^3 + (206/annual mean)

This relationship has been applied to the modelled annual mean concentrations in order to estimate the number of 24-hourly exceedances.

4.5.3 Model Verification

The monitoring sites listed in Table 5 have been used for the purposes of model verification. These are the closest monitoring sites to the proposed development.

Table 5 – Modelled Verification Locations

Site ID	Location	X	Y	Height (m)
CA16	Kentish Town Road	529010	185102	2.0
CA23	Camden Road	529171	184130	2.0
CA24	Chetwynd Road	528722	185950	2.0

4.5.4 Receptor Locations

In order to assess the potential impact of the proposed development, a number of receptors have been identified on each floor, which represent openable windows. The location of these model points, together with their height above ground level is provided in Table 6 and represented in Figures 3, 4 and 5.

Table 6 – Modelled Receptor Locations

First floor receptors			
Air Quality Assessment ID	**X**	**Y**	**Height (m)**
1F_R1	525646	185317	1.5
1F_R2	525644	185316	1.5
1F_R3	525652	185303	1.5
Second floor receptors			
2F_R1	525646	185316	4.5
2F_R2	525645	185316	4.5
2F_R3	525649	185306	4.5
2F_R4	525650	185305	4.5
2F_R5	525652	185303	4.5

[15] Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003

Third floor receptors			
3F_R1	525646	185316	7.5
3F_R2	525645	185316	7.5
3F_R3	525649	185306	7.5
3F_R4	525650	185304	7.5
3F_R5	525652	185303	7.5

Figure 3 – First floor modelled receptor locations

Figure 4 – Second floor modelled receptor locations

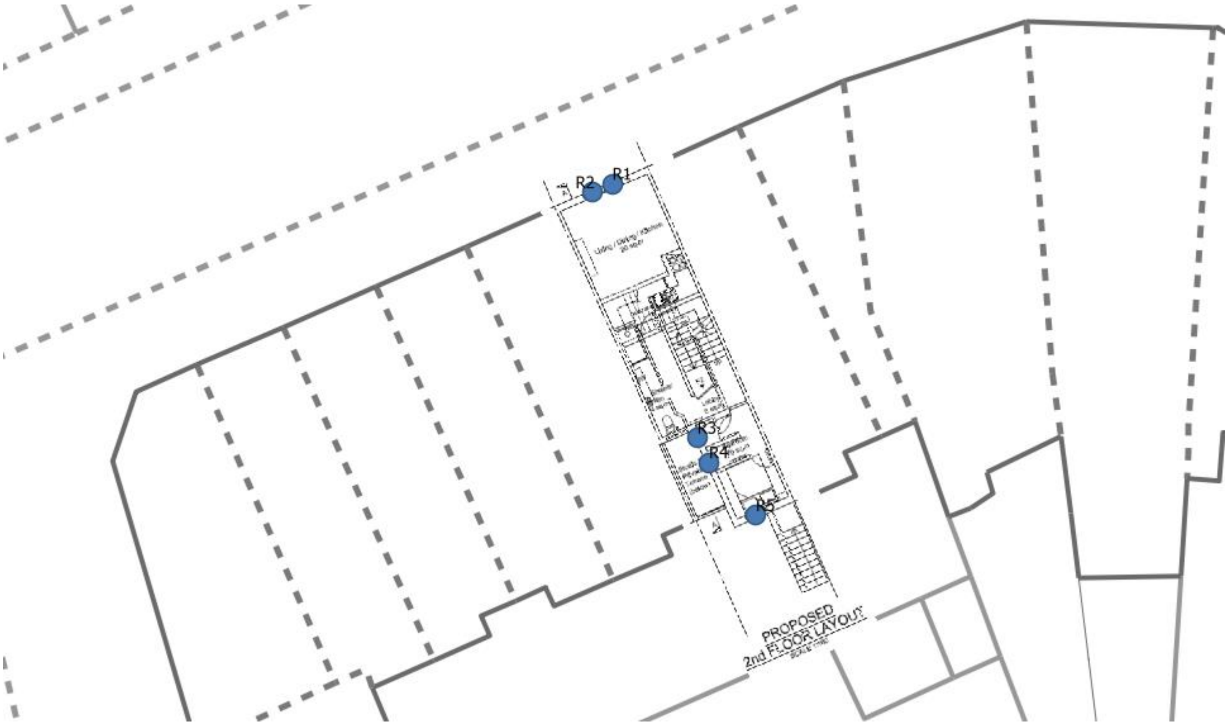
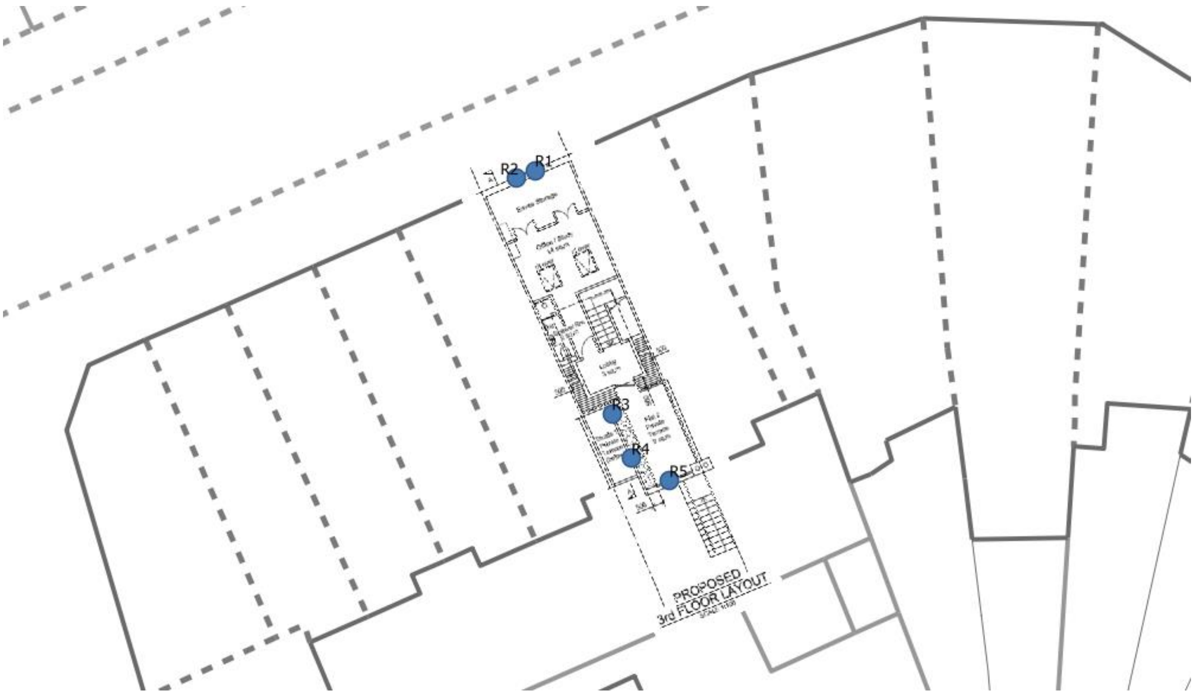


Figure 5 – Third floor modelled receptor locations



4.6 Significance Criteria

4.6.1 Operational Phase

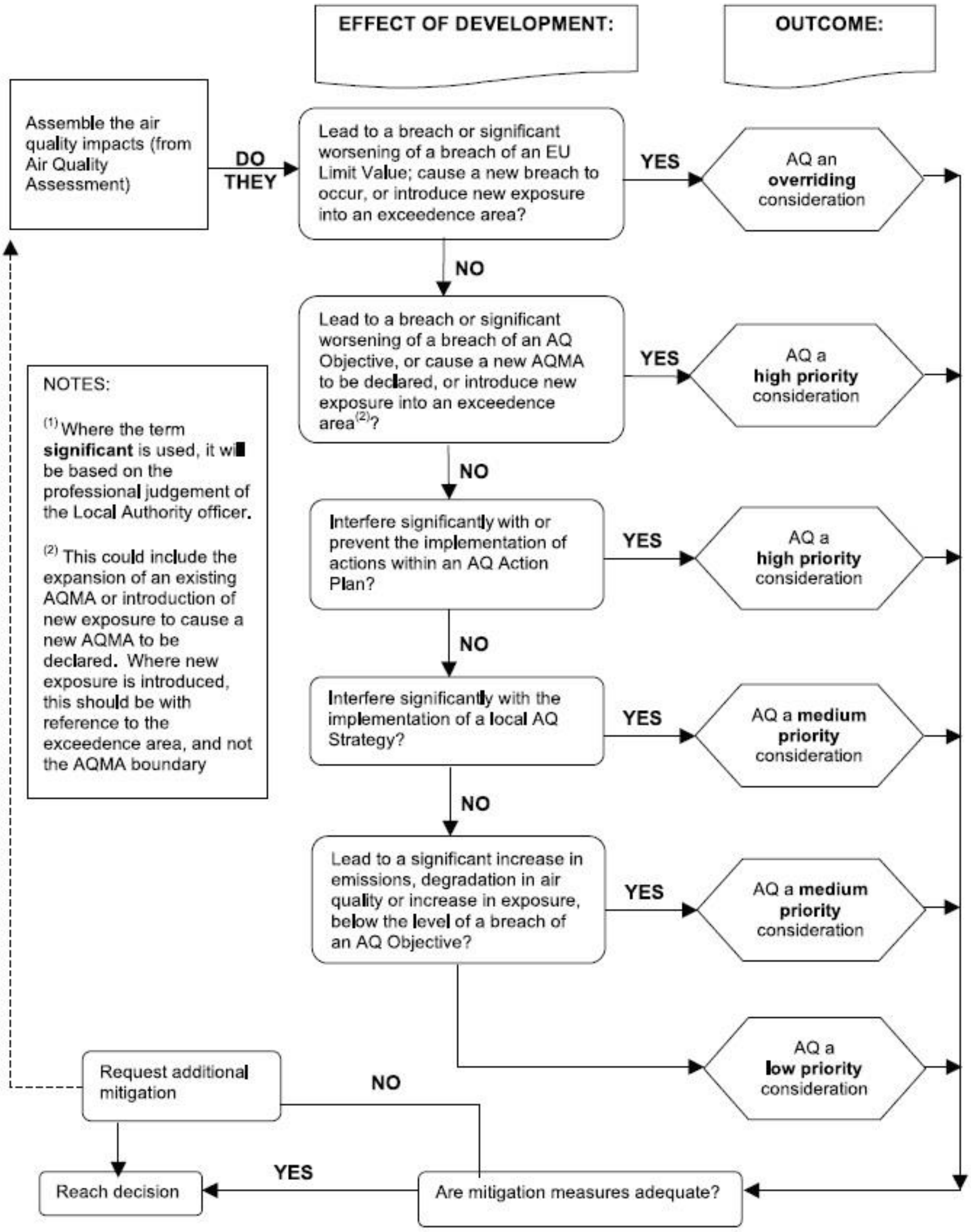
The significance of emissions will be determined by comparing the predicted results to the Air Pollution Exposure Criteria (APEC) detailed in the Air Quality and Planning Guidance written by the London Air Pollution Planning and the Local Environment (APPLE) working group[16]. The Air Pollution Exposure Criteria is considered appropriate to describe the significance of the impacts predicted, together with an indication as to the level of mitigation required in order for the development to be approved. The APEC table is provided below.

Table 7 – Air Pollution Exposure Criteria (APEC)

APEC Category	NO_2	PM_{10}	Recommendations
A	>5% below national annual mean objective	>5% below national annual mean objective >1-day less than national 24-hour objective	No air quality grounds for refusal; however mitigation of any emissions should be considered.
B	Between 5% below or above national annual mean objective	Between 5% above or below national annual mean objective Between 1-day above or below national 24-hour objective	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered
C	>5% above national annual mean objective	>5% above national annual mean objective >1-day more than national 24-hour objective	Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated

[16] Air Quality and Planning Guidance, written by the London Air Pollution Planning and the Local Environment (APPLE) working group, January 2007

Figure 6 – Assessing the Significance of Air Quality Impacts of a Development Proposal



5 AIR QUALITY ASSESSMENT

5.1 Impact of Vehicle Emissions

5.1.1 Model Verification

Using the guidance provided within the London Local Air Quality Management Technical Guidance TG(16), the modelled output has been verified against the monitoring data obtained from the site listed in Table 8. The following tables provide a summary of the model verification process for NOx/NO_2 and PM_{10} concentrations.

Table 8 – Comparison of Modelled and Monitored NO_2 and PM_{10} Concentrations (µg/m^3)

Verification Location	Modelled Concentration	Monitored Concentration	Difference [(modelled - monitored)/ monitored] x100
CA16	40.7	74.9	-45.7%
CA23	47.4	75.4	-37.1%
CA24	37.1	55.0	-32.6%

As described in the Technical Guidance (LLAQM.TG16), in order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within ±25% (ideally ±10%) of the monitored concentrations. In order to improve the confidence in modelled concentrations across the modelled domain the model output has been adjusted. This is described further in the next section.

5.1.2 Model Adjustment

In order to undertake model adjustment, it is first necessary to derive the monitored and modelled road contributions of NOx (excluding background). The modelled road contribution NOx is taken directly from the ADMS-Roads output before it has been converted to NO_2 using the NOx to NO_2 calculator described in Section 4.5.1. The NOx to NO_2 calculator can also be used to derive monitored road contributions of NOx from NO_2 diffusion tube results. A summary of these calculations is provided in Table 9.

Table 9 – Monitored NOx and NO_2 concentrations

Verification Location	Monitored Total NO_2	Defra Background NO_2	Monitored road contribution NO_2 (total – background)	Monitored road contribution NOx (total – background)	Modelled road contribution NOx (excludes background)	Ratio of monitored road contribution NOx / modelled road contribution NOx
CA16	74.9	29.5	45.4	128.8	25.3	5.08
CA23	75.4	33.5	41.9	119.2	33.1	3.61
CA24	55.0	29.9	25.1	62.9	16.0	3.94

Once the monitored and modelled road contributions of NOx (excluding background) have been derived the contributions of NOx are compared and a ratio derived. In this case it is 4.125 and is used to adjust the modelled road contribution of NOx. This is shown in Table 10.

Figure 7 – Linear Regression of Modelled and Monitored NOs

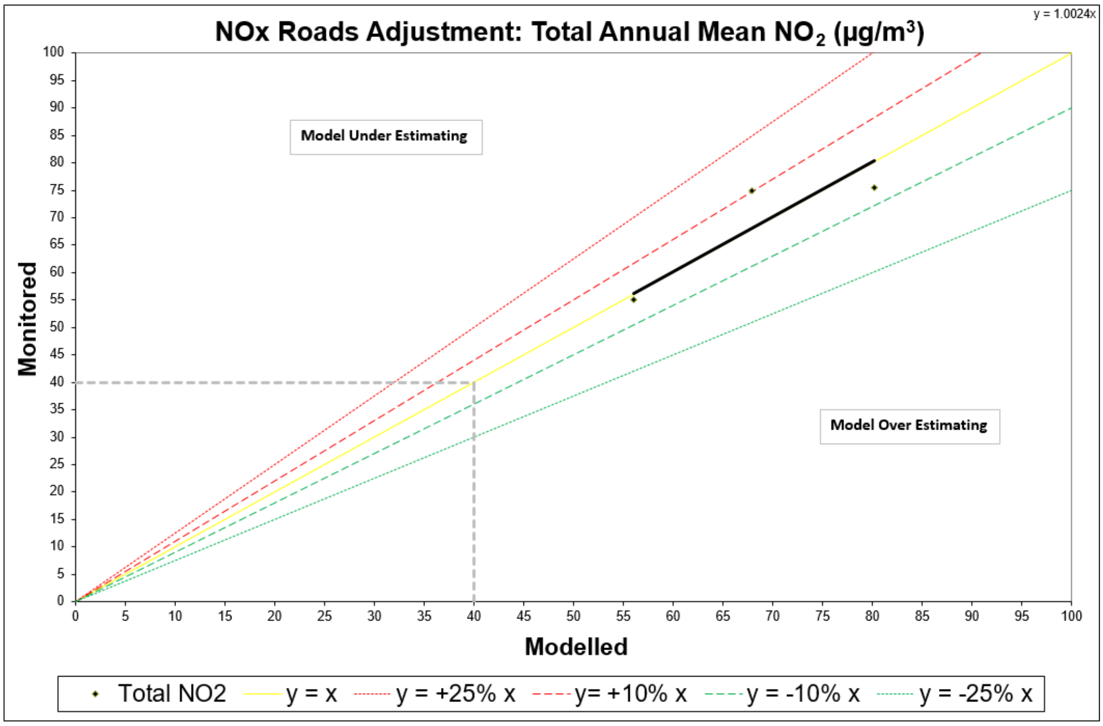


Table 10 – Adjustment of Modelled NOx Contributions

Verification Location	Adjustment factor for modelled road contribution	Adjusted modelled road contribution NOx	Modelled total NO_2 (based on empirical NOx/NO_2 relationship)	Monitored total NO_2	% Difference [(modelled – monitored) / monitored] x 100
CA16	4.125	104.5	67.9	74.9	-9.4%
CA23	4.125	136.4	80.3	75.4	6.4%
CA24	4.125	65.8	56.0	55.0	1.8%

Following adjustment of the modelled NOx concentrations by a factor of 4.125 the total NO_2 concentration at the model verification location has been calculated using the method described in Section 4.5.1. The revised NO_2 concentration, shown in Table 10, indicates a more acceptable model performance when compared against the monitored NO_2 concentrations. As such, an adjustment factor of 4.125 has been applied to all modelled NOx concentrations across the model domain before conversion to NO_2.

5.1.3 Nitrogen Dioxide

Predicted annual mean concentrations for NO_2 at the proposed development in 2017 and 2021 are provided in Table 11. As mentioned in Section 4.5.1, NO_2 concentrations have been calculated from the predicted NOx concentrations using the latest NOx-NO_2 conversion spreadsheet available from the Air Quality Archive.

Table 11 – Comparison of Predicted Annual Mean NO_2 Concentrations (µg/m^3)

Receptor ID	2017	2021
1F_R1	43.1	44.9
1F_R2	42.7	44.5
1F_R3	38.7	40.1
2F_R1	40.4	42.0
2F_R2	40.3	41.8
2F_R3	38.0	39.3
2F_R4	37.9	39.1
2F_R5	37.6	38.8
3F_R1	37.1	38.2
3F_R2	37.0	38.1
3F_R3	36.1	37.1
3F_R4	35.9	36.9
3F_R5	35.9	36.8

The ADMS predictions for annual mean NO_2 concentrations in 2017 and 2021 indicate that the annual mean objective (40 µg/m^3) would not be achieved at the modelled receptor locations.

Nitrogen dioxide also has an hourly objective of 200 µg/m^3 not to be exceeded more than 18 times in one year. However, the hourly mean concentration has not been calculated directly by ADMS Roads. This is as a result of an evaluation of continuous monitoring data from across the UK that revealed that the relationship between the annual mean and hourly mean NO_2 concentrations was very weak. Nonetheless, research undertaken in 2003[17] has indicated that the hourly NO_2 objective is unlikely to be exceeded at a roadside location where the annual mean NO_2 concentration is less than 60 µg/m^3. Given that predicted NO_2 concentration in 2017 and 2021 are well below 60 µg/m^3 at the modelled receptor the likelihood of the short-term objective for NO_2 being exceeded is considered low.

[17] Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003

5.1.4 Particulate Matter

Predicted annual mean concentrations for PM_{10} in 2017 and 2021 are provided in Table 12.

Table 12 – Predicted PM_{10} Concentrations, Annual Mean (µg/m^3)

Receptor ID	2017	2021
1F_R1	20.2	20.3
1F_R2	20.1	20.2
1F_R3	19.5	19.5
2F_R1	19.7	19.8
2F_R2	19.7	19.8
2F_R3	19.3	19.4
2F_R4	19.3	19.4
2F_R5	19.3	19.3
3F_R1	19.2	19.2
3F_R2	19.2	19.2
3F_R3	19.0	19.1
3F_R4	19.0	19.1
3F_R5	19.0	19.1

The ADMS predictions for annual mean PM_{10} concentrations in 2017 and 2021 indicate that the annual mean objective (40 µg/m^3) would be achieved at all the modelled receptor locations. In addition, the maximum number of days when PM_{10} concentrations are more than 50 µg/m^3 is 4, less than the 35 exceedances allowed in the regulations.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Impact of Vehicle Emissions

All predicted PM_{10} concentrations at the modelled receptor locations fall within APEC Category A, which states that there are “No air quality grounds for refusal; however mitigation of any emissions should be considered”.

The majority of the predicted concentrations of NO_2 in the base and opening model years are above the relevant objective and fall within APEC Category B and C meaning mitigation measures may need to be adopted in order to protect the future inhabitants from poor air quality. These are outlined below.

Based on the outcome of this assessment mitigation measures would be required in order to mitigate the impact of poor air quality on the future occupants of the proposed development.

The Institute of Air Quality Management (IAQM) issued a position statement in relation to the mitigation of development air quality impacts. Based on this statement, the IAQM recommends that the following basic hierarchy be used for mitigating the operational air quality impacts associated with the particular development:

1. Preference should be given to **preventing or avoiding** exposure/impacts to the pollutant in the first place by eliminating or isolating potential sources or by replacing sources or activities with alternatives;
2. **Reduction and minimisation** of exposure/impacts should next be considered, once all options for prevention/avoidance have been implemented so far as is reasonably practicable (both technically and economically). To achieve this reduction/ minimisation, preference should be given first to:
   a) mitigation measures that act on the source; before
   b) mitigation measures that act on the pathway; which in turn should take preference over
   c) mitigation measures at or close to the point of receptor exposure all subject to the efficacy, cost and practicability of the available solutions. In each case, measures that are designed or engineered to operate passively are preferred to active measures that require continual intervention, management or a change in people's behaviours.
3. **Off-setting** a new development's air quality impact by proportionately contributing to air quality improvements elsewhere (including those identified in air quality action plans and low emission strategies) should only be considered once the solutions for preventing/avoiding, and then for reducing/minimising, impacts have been exhausted.

Based on this hierarchy, Option 2 could be applied to the proposed development. Using Option 2, some form of mitigation would need to be implemented on all floors so that the future occupants are not reliant solely on opening windows in order to provide ventilation. This would require an additional form of ventilation; whereby clean air is drawn in naturally or mechanically and maintained thereafter.

A mechanical ventilation system that draws air in from the roof may not be considered acceptable by the Council due to predicted exceedances. Alternatively, air could be drawn in and filtered[18]. Such filtration systems would “scrub” the incoming air stream of NO_2, reducing the concentrations of NO_2 to well below the air quality objective within the building. Such systems are becoming more common, particularly at city centre locations where traffic emissions make it difficult to find locations where clean air can be drawn into the property. A filtered ventilation system would also allow the inlets to be placed anywhere regardless of the predicted NO_2 concentrations, although they should ideally be placed as far away from emission sources as possible in order to reduce the burden on the filters. If such a filtration system is installed the Council will require details relating to the mechanical ventilation and air filtration systems, as well as the ongoing maintenance and cleaning of these systems.

[18] Such devices include the AAC Swiftpack® with Nitrosorb® media for NO_2 and NOx removal, or the City Breathe: Indoor Air Quality Filtration System