



Air Quality Assessment:

17 Lorne Street, Reading

Asees Estates Ltd

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1. INTRODUCTION

1.1. Overview

Hawkins Environmental Limited has been instructed by Asees Estates Limited to undertake an air quality assessment for the proposed redevelopment of 17 Lorne Street, situated in Reading, Berkshire.

During the planning process, it has been identified that the site may require an air quality assessment to determine whether the site is suitable for residential use and to determine whether the proposed development would have an adverse impact on the surrounding environment. Consequently, this assessment has been completed in order to determine whether the proposed development achieves compliance with the National Air Quality Objectives, as well as national, regional and local planning policy.

This assessment has been undertaken in accordance with the Department of Environment, Food and Rural Affairs' (Defra) current *Technical Guidance on Local Air Quality Management (LAQM) (TG16)* and the Institute for Air Quality Management and Environmental Protection UK's *Land-Use Planning & Development Control: Planning for Air Quality* (January 2017).

The assessment addresses the effects of air pollutant emissions from traffic using the adjacent roads and emissions associated with the development of the site. In addition, a risk-based assessment of the likely impact of construction on the air quality of the local environment has been conducted in accordance with the Institute of Air Quality Management's 2014 edition of the *Guidance on the assessment of dust from demolition and construction*.

This report assesses the overall levels of nitrogen dioxide (NO₂) and particulates (PM₁₀ and PM_{2.5}) in the vicinity of the site. A glossary of terms is detailed in **Appendix 1**. The constraints which existing air quality may have on the proposed development have been considered and forms part of this assessment. However, the impacts of the development on the air quality of surrounding properties have also been considered.

1.2. Site Description

The proposed development site is on Lorne Street, a residential street situated off of Oxford Road, a busy road through the centre of Reading that joins the A33/A329 main road that runs through the town. The site is currently a five-bedroom residential property across 3 floors and a basement. The proposed development will see the conversion of the existing property into a 7 bedroom House of Multiple Occupation (HMO), with the existing living and dining rooms converted to new bedrooms, the installation of bathrooms in each room and the possible removal of a chimney. A location plan of the proposed site can be seen in **Figure 1.1**.

Figure 1.1: Site Location Plan



2. LEGISLATION, PLANNING POLICY & GUIDANCE

2.1. National Legislation

Part IV of the Environment Act (1995), requires the UK government to produce a national Air Quality Strategy which contains standards, objectives and measures for improving ambient air quality. The National Air Quality Strategy sets out National Air Quality Objectives (NAQOs) that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale.

The Clean Air for Europe (CAFE) programme revisited the management of Air Quality within the EU and replaced the EU Framework Directive 96/62/EC, its associated Daughter Directives 1999/30/EC, 2000/69/EC, 2002/3/EC, and the Council Decision 97/101/EC, with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC.

Directive 2008/50/EC is currently transcribed into UK legislation by the Air Quality Standards Regulations 2010, which came into force on 11th June 2010. These limit values are binding on the UK and have been set with the aim of avoiding, preventing or reducing harmful effects on human health and on the environment as a whole. These limit values are the basis of the NAQOs.

For the purposes of this air quality assessment of the Proposed Development, the National Air Quality Objectives (NAQOs) and their Limit Values will form the basis of the assessment. The NAQOs are based on an assessment of the effects of each pollutant on public health. Therefore, they are a good indicator in assessing whether, under normal circumstances, the air quality in the vicinity of a development is likely to be detrimental to human health. In determining whether air pollutant levels may constrain development, the results of studies are compared against the acceptability criteria. The Air Quality Standards are displayed in **Table 2.1**.

Table 2.1: Air Quality Standards

Pollutant	Average Period	NAQO Limit Value
Sulphur Dioxide	One Hour	350 µg/m ³ Not to be exceeded more than 24 times per calendar year
	One Day	150 µg/m ³ Not to be exceeded more than 3 times per calendar year
Nitrogen Dioxide	One Hour	200 µg/m ³ Not to be exceeded more than 18 times per calendar year
	Calendar Year	40 µg/m ³
Benzene	Calendar Year	5 µg/m ³
Lead	Calendar Year	0.5 µg/m ³

Pollutant	Average Period	NAQO Limit Value
PM ₁₀	One Day	50 µg/m ³ Not to be exceeded more than 35 times per calendar year
	Calendar Year	40 µg/m ³
PM _{2.5}	Calendar Year	25 µg/m ³
Carbon Monoxide	Maximum daily running 8-hour mean	10 mg/m ³

2.2. National Planning Policy Framework (2018)

The National Planning Policy Framework (NPPF) was first published on the 27th March 2012 and revised on the 24th July 2018 and outlines the Government's environmental, economic and social policies for England. The NPPF sets out a presumption in favour of sustainable development which should be delivered with three main dimensions: economic; social and environmental (Paragraphs 7, 8 10 and 11). The NPPF aims to enable local people and their councils to produce their own distinctive local and neighbourhood plans, which should be interpreted and applied in order to meet the needs and priorities of their communities.

The NPPF states that the planning system *"Planning policies and decisions should contribute to and enhance the natural and local environment by... e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development 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"* (Paragraph 120).

Section 180 of the NPPF talks specifically about noise stating that *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life; b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason..."*.

The NPPF also states 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" (Paragraph 181).

2.3. Planning Practice Guidance (2015)

The Planning Practice Guidance (PPG) was launched on 6th March 2014 and provides additional guidance and interpretation to the Government's strategic policies, outlined within the NPPF, in a web-based resource. This is updated regularly.

Matters of relevance to the air quality assessment include:

- The provision of *"guiding principles on how planning can take account of the impact of new development on air quality"*. The PPG provides signposts as to how to address air quality in planning applications and highlights the importance of local plans.
- The statement that *"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values" and "It is important that the potential impact of new development on air quality is taken into account ... where the national assessment indicates that relevant limits have been exceeded or are near the limit"* (Reference ID: 32-001-20140306). The PPG goes on to say that *"Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife)"* (Reference ID: 32-005-20140306).
- The identification of the content of an air quality assessment, stating clearly that *"Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality"* and that *"Mitigation options where necessary, will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact"* (Reference ID: 32-007-20140306).

2.4. Land-Use Planning & Development Control: Planning for Air Quality (2017)

Land-Use Planning & Development Control: Planning for Air Quality, jointly published by the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) in May 2015 and updated in January 2017, provides general guidance on air quality and planning. Specifically, the guidance provides details on the scoping of effects, how to assess the impacts in relation to air quality, as well as details on how to assess the significance of impacts.

2.5. Local Air Quality Management Technical Guidance TG16 - (2016)

Specifically designed to provide technical guidance to Local Planning Authorities (LPAs) in relation to their review and assessment of air quality, TG(16) provides useful guidance in relation to the appropriate methods of air quality modelling and monitoring, which can be as equally useful to the assessment of air quality impacts.

2.6. Guidance on the Assessment of Dust from Demolition and Construction (2014)

Published in 2014, the IAQM's Guidance on the Assessment of Dust from Demolition and Construction provides guidance on preparing an Air Quality Statement for construction and demolition activities, specifically in relation to dust risk assessments, as well as providing details on how best to mitigate the impacts of construction dust. Much of the detail within the IAQM's Guidance was adopted within the Control of Dust and Emissions from Construction and Demolition SPG.

3. ASSESSMENT METHODOLOGY

3.1. Methodology Overview

The assessment of air quality considered several different areas, specifically:

1. The constraints that the existing air quality has on the Proposed Development;
2. The impact of the changes in road traffic flows on air pollutant concentrations, at nearby sensitive receptors;
3. The impact of emissions from the Proposed Development's plant (such as biomass boilers or combined heat and power (CHP) plants) on air pollutant concentrations at nearby sensitive receptors; and
4. The impact of construction and demolition dust at nearby sensitive receptors.

Land-Use Planning & Development Control: Planning for Air Quality states with respect to the identification of local receptors, they should include *"residential and other properties close to and within the proposed development, as well as alongside roads significantly affected by the development, even if well away from the development site, and especially if within AQMAs. These receptors will represent locations where people are likely to be exposed for the appropriate averaging time (dependent on the air quality objective being assessed against)"*. The last point is critical as this identifies that sensitivity in relation to air quality is directly related to the amount of time one spends in a location. For example, when considering annual mean objectives (such as that of NO₂), any area where one might spend large parts of the year might be considered a sensitive receptor. An example could be a dwelling, where one might expect to spend at least half of their time during one day. Health centres, hospitals, schools and nurseries could all expect to be considered sensitive receptors, partially due to the length of exposure spent in these locations, but also due to vulnerable members of society (e.g. the very young, the very old, or the ill) spending significant amounts of time at these locations. Offices would not normally be considered to be a highly sensitive receptor since most visitors would be healthy adults and would only spend around 8 hours per day, 5 days per week there (i.e. less than 25% of the year), whereas people could spend over 50% of their time within a dwelling. Hotels would not be considered sensitive receptors in terms of the annual mean since residents would only normally expect to spend a small number of nights in that location; however, hostels, sheltered accommodation and student accommodation would be considered as sensitive as dwellings, as residents could be expected to stay for several months.

The baseline scenario will consider two separate sets of site conditions, specifically the existing 2016 baseline conditions (the latest date for which data is available) and the future 2021 baseline site conditions, which represents the opening year of the proposed development. The consideration of a future baseline for air quality is important as it takes into account future changes in both traffic flow, but also pollutant concentrations, which could vary.

To determine the baseline conditions, the following was undertaken:

- A review of the most recent progress reports on air quality carried out by the local planning authority, as submitted to the Department for the Environment, Food and Rural Affairs (Defra);

- Determination of whether the site is situated within a designated Air Quality Management Area (AQMA);
- A review of local air quality monitoring within the area of the site;
- A review of the Environment Agency's register of industrial sites under the EC Integrated Pollution Prevention and Control Directive (IPPC) to determine whether industrial sources of air pollution could be affecting the site;
- Review of the list of registered Part A2 and Part B permitted premises under the PPC Regulations to determine whether any other sources of air pollution could be affecting the site;
- Using the methodology described in the ADMS-Roads Detailed Dispersion Model (details of which can be seen in **Appendix 2**, utilising data described in **Appendix 3**), predict concentrations of air pollutants on-site within the current baseline year and the future baseline year.

3.2. Methodology for Determining Demolition and Construction Effects

The determination of demolition and construction effects of the Proposed Development was based on the IAQM's Guidance on the Assessment of Dust from Demolition and Construction, which provides a risk-based assessment methodology to determine the significance of an air quality impact arising from the construction of a new development, based on the magnitude of change. The methodology provides a five-step approach to determining the significance:

***“STEP 1** is to screen the requirement for a more detailed assessment. No further assessment is required if there are no receptors within a certain distance of the works.*

***STEP 2** is to assess the risk of dust impacts. This is done separately for each of the four activities (demolition; earthworks; construction; and trackout) and takes account of:*

the scale and nature of the works, which determines the potential dust emission magnitude (STEP 2A); and the sensitivity of the area (STEP 2B).

These factors are combined in STEP 2C to give the risk of dust impacts.

Risks are described in terms of there being a low, medium or high risk of dust impacts for each of the four separate potential activities. Where there are low, medium or high risks of an impact, then site-specific mitigation will be required, proportionate to the level of risk.

Based on the threshold criteria and professional judgement one or more of the groups of activities may be assigned a 'negligible' risk. Such cases could arise, for example, because the scale is very small and there are no receptors near to the activity.

***STEP 3** is to determine the site-specific mitigation for each of the four potential activities in STEP 2. This will be based on the risk of dust impacts identified in STEP 2. Where a local authority has issued guidance on measures to be adopted at demolition/construction sites, these should also be taken into account.*

***STEP 4** is to examine the residual effects and to determine whether or not these are significant.*

***STEP 5** is to prepare the dust assessment report.”*

3.3. Methodology for Determining Operational Effects

To determine the operational effects of the Proposed Development, the change in traffic flow at sensitive receptors in the future opening year of the proposed development, both with and without development related traffic, was modelled using the methodology described in the ADMS-Roads Detailed Dispersion Model (details of which can be seen in **Appendix 2**, utilising data described in **Appendix 3**).

To determine the impact of the proposed development on surrounding local sensitive receptors, the impact magnitude has been derived from Land-Use Planning & Development Control: Planning for Air Quality, jointly published by the IAQM and EPUK. **Table 3.1** identifies the advice given in the IAQM / EPUK Guidance regarding impact descriptors upon individual receptors.

Table 3.1: Impact Descriptors for Individual Receptors

Long-Term Average Concentration at Receptor in Assessment Year	% Change in Concentrations Relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Source: Table 6.3 of the IAQM Guidance

The guidance goes on to offer the following explanation (taken from the footnotes of Table 6.3 of the IAQM Guidance):

“AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency ‘Environmental Assessment Level (EAL)’.

The Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e.. less than 0.5% will be described as Negligible.

The Table is only designed to be used with annual mean concentrations.

Descriptors for individual receptors only; the overall significance is determined using professional judgement (see Chapter 7). For example, a ‘moderate’ adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.

When defining the concentration as a percentage of the AQAL, use the ‘without scheme’ concentration where there is a decrease in pollutant concentration and the ‘with scheme,’ concentration for an increase.

The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.

It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it."

3.4. Significance Criteria

Land-Use Planning & Development Control: Planning for Air Quality provides a framework to assess significance in air quality assessments. As described in the guidance, the "assessment framework for describing impacts can be used as a starting point to make a judgement on significance of effect, but there will be other influences that might need to be accounted for. The impact descriptors set out in Table 6.3 [Replicated in **Table 3.1** of this chapter] are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual receptors. Whilst it may be that there are 'slight', 'moderate' or 'substantial' impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances (Paragraph 7.4)".

The Land-Use Planning & Development Control guidance goes on to state that any significance needs to be assessed using a certain amount of professional judgement and should take into account "the existing and future air quality in the absence of the development; the extent of current and future population exposure to the impacts; and the influence and validity of any assumptions adopted when undertaking the prediction of impacts" (Paragraph 7.7). For example, for a large development, a major adverse impact on a single dwelling might be considered insignificant; however, a minor impact to 100,000 dwellings might be considered to be highly significant. Furthermore, the absolute level of pollutant concentrations are also important in determining significance; for example, a moderate impact to a small group of dwellings might be considered highly significant if the concentrations of NO₂ were well in excess of the NAQO level, however, that same moderate impact might be considered insignificant if concentrations were well below the NAQO.

4. SCOPING

4.1. Overview

The National Planning Practice Guidance on Air Quality is explicit in stating that “Assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality”. This is reiterated in *Land-Use Planning & Development Control: Planning for Air Quality*, jointly published by the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) in May 2015 and updated in January 2017, which provided guidance on screening as to whether an air quality assessment is required and what needs to be assessed.

4.2. Impacts of the Local Area on the Development

The IAQM/EPUK Guidance suggests that whether an assessment of the impacts of the local area on the proposed development is required is a matter of judgement, but should take into account:

- “the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;
- the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;
- the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular NO₂), that would cause unacceptably high exposure for users of the new development; and
- the presence of a source of odour and/or dust that may affect amenity for future occupants of the development.”

4.3. Impacts of the Development on the Local Area

To determine whether an assessment of the impacts of the development on the local environment is required, the IAQM/EPUK Guidance suggests a two-stage approach. The guidance states that “The **first stage** is intended to screen out smaller development and/or developments where impacts can be considered to have insignificant effects. The **second stage** relates to specific details regarding the proposed development and the likelihood of air quality impacts.”

Figure 4.1 reproduces Stage 1 of the IAQM/EPUK Guidance’ two-stage approach. In order to proceed to Stage 2, development needs to meet both one of the criteria in “A”, and one of the criteria in “B”. If the development fails to meet these criteria, then an air quality assessment looking at the impacts of the development on the local area will not be required.

Figure 4.2 reproduces Stage 2 of the IAQM/EPUK Guidance’ two-stage approach. If the development meets the criteria contained within Stage 1, “more specific guidance as to when an air quality assessment is likely to be required to assess the impacts of the proposed development on the local area.” If the development then meets any of the eight criteria in Stage 2, an assessment of the impacts of the proposed development on the surrounding environment will be required.

Figure 4.1: IAQM/EPUK Guidance – Stage 1 Criteria

Criteria to Proceed to Stage 2
A. If any of the following apply: 10 or more residential units or a site area of more than 0.5ha - more than 1,000 m² of floor space for all other uses or a site area greater than 1ha
B. Coupled with any of the following: - the development has more than 10 parking spaces - the development will have a centralised energy facility or other centralised combustion process
Note: Consideration should still be given to the potential impacts of neighbouring sources on the site, even if an assessment of impacts of the development on the surrounding area is screened out.

Figure 4.2: IAQM/EPUK Guidance – Stage 2 Criteria

The development will:	Indicative Criteria to Proceed to an Air Quality Assessment ^a
1. Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors. (LDV = cars and small vans <3.5t gross vehicle weight)	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA - more than 500 AADT elsewhere
2. Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors. (HDV = goods vehicles + buses >3.5t gross vehicle weight)	A change of HDV flows of - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere
3. Realign roads, i.e. changing the proximity of receptors to traffic lanes.	Where the change is 5m or more and the road is within an AQMA
4. Introduce a new junction or remove an existing junction near to relevant receptors.	Applies to junctions that cause traffic to significantly change vehicle accelerate/decelerate, e.g. traffic lights, or roundabouts.
5. Introduce or change a bus station.	Where bus flows will change by: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere
6. Have an underground car park with extraction system.	The ventilation extract for the car park will be within 20 m of a relevant receptor Coupled with the car park having more than 100 movements per day (total in and out)
7. Have one or more substantial combustion processes	Where the combustion unit is: - any centralised plant using bio fuel - any combustion plant with single or combined thermal input >300kW - a standby emergency generator associated with a centralised energy centre (if likely to be tested/used >18 hours a year)
8. Have a combustion process of any size	Where the pollutants are exhausted from a vent or stack in a location and at a height that may give rise to impacts at receptors through insufficient dispersion. This criterion is intended to address those situations where a new development may be close to other buildings that could be residential and/or which could adversely affect the plume's dispersion by way of their size and/or height.

4.4. Site Specific Scoping Assessment

The proposed development is located in an Air Quality Management Area and is located adjacent to Oxford Road which is known to be a highly trafficked road, where exceedances of the National Air Quality Objective for NO₂ often occur; therefore, **an assessment of the impacts of the local area on the development is required.**

The proposed development consists of 7 bed HMO with no additional car parking spaces or new energy processes, thus Stage 1 criteria (as above) are not met and **an assessment of the impacts of the development on the local area is not required.**

5. BASELINE CONDITIONS

5.1. Air Quality Review and Assessment

Local Authorities have been required to carry out a review of local air quality within their boundaries to assess areas that may fail to achieve the NAQO's. Where these objectives are unlikely to be achieved, local authorities must designate these areas as Air Quality Management Areas (AQMA's) and prepare a written action plan to achieve the NAQO's.

The review of air quality takes on several prescribed stages, of which each stage is reported. The review of historic Air Quality Assessment reports for the Reading Borough indicates that exceedances of the annual mean objective for NO₂ have been experienced across the Borough, primarily centred on the main roads, and these exceedances are predicted to continue. It is understood that exceedances of the annual mean objectives for both PM₁₀ and PM_{2.5} are not expected within the Borough in future years.

As a consequence of the exceedances of the NAQOs, Reading Borough Council have declared an Air Quality Management Area (AQMA) encompassing all of the major arterial roads in and out of the town as well as the central area. Concentrations of SO₂, Benzene, Lead and CO are not considered to be significant within the Borough. Consequently, no further consideration is given to these pollutants as it is highly unlikely that they would be of concern on the proposed development site.

5.2. Local Air Quality Monitoring

Reading Borough Council has conducted air quality monitoring, including at seven sites in the vicinity of the proposed development site. All seven sites are designated to be roadside monitoring locations and therefore would be suitable for verification. **Table 5.1** summarises the air quality monitoring data.

Table 5.1: Air Quality Monitoring

Location	Annual Mean Concentrations of NO ₂ (µg/m ³)				
	2012	2013	2014	2015	2016
DT17 4 Tilehurst Road	33	35	35	29	30
DT18 162a Castle Hill	40	39	40	36	37
DT30 327 Oxford Road	50	47	49	43	40
DT31 252 Oxford Road	41	43	37	32	35
DT32 281 Oxford Road	47	49	48	45	44
DT33 165 Oxford Road	52	48	51	47	44
DT34 10 Trinity Place	33	37	32	31	31

5.3. Industrial Emissions

Both the Environment Agency's register of industrial sites under the EC Integrated Pollution Prevention and Control Directive (IPPC) and the Local Authority's list of registered Part A2 and Part B permitted premises under the Pollution, Prevention and Control Act 1999 and the Environmental Permitting (England and Wales) Regulations 2010 have shown that there are no sites within close proximity of the development site that could be affecting air pollutant levels.

5.4. Baseline Onsite Pollution Concentrations

To characterise the air quality at the development site at present, predictions of air pollutant concentrations at the development site have been made using the air quality model for the baseline year (2016). **Appendix 2** provides a description of the methodology used in the assessment, including the method to calculate NO₂ from NO_x. **Appendix 3** outlines the input data, including traffic data, background concentrations and receptor locations. In addition, details of the verification factor applied to the predicted concentrations of NO_x can also be found in **Appendix 3**.

Concentrations have been calculated for two representative points across the development site. The locations of these receptor locations can be seen on the site plan in **Appendix 3**. For each location, concentrations have been calculated for each floor level. The results of these predictions can be seen in **Table 5.2**.

Table 5.2: Baseline Air Quality Concentrations 2016 – Development Site

Receptor	NO ₂ (µg/m ³)	PM ₁₀ (µg/m ³)		PM _{2.5} (µg/m ³)
	Annual Mean	Annual Mean	Days >50 µg/m ³	Annual Mean
17 Lorne St Front Ground Floor	29.30	15.71	0.23	9.71
17 Lorne St Front 1 st Floor	29.15	15.69	0.23	9.70
17 Lorne St Front 2 nd Floor	28.88	15.64	0.22	9.67
17 Lorne St Rear Ground Floor	29.32	15.71	0.24	9.71
17 Lorne St Rear 1 st Floor	29.17	15.69	0.23	9.70
17 Lorne St Rear 2 nd Floor	28.90	15.65	0.22	9.67
NAQO	40	40	35	25

If pollutant concentrations in **Table 5.2** are compared to the National Air Quality Objectives, it can be seen that on the development site during the baseline year of 2016, concentrations of NO₂ are below the National Air Quality Objectives. The modelled results show that concentrations on Oxford Road are in places in excess of the National Air Quality Objectives; however, the modelling results show that concentrations decrease rapidly

with distance from Oxford Road, such that at the development site (74m from the kerb of Oxford Road) concentrations are significantly reduced and below the National Air Quality Objectives.

6. IMPACTS OF THE LOCAL AREA ON THE DEVELOPMENT

6.1. Annual Mean Concentrations

To characterise the air quality at the development site when constructed, predictions of air pollutant concentrations at the development site have been made using the air quality model for the proposed year of occupation (2021). **Appendix 2** provides a description of the methodology used in the assessment, including the method to calculate NO₂ from NO_x. **Appendix 3** outlines the input data, including traffic data, background concentrations and receptor locations. In addition, details of the verification factor applied to the predicted concentrations of NO_x can also be found in **Appendix 3**.

Concentrations have been calculated for two representative points across the development site. The locations of these receptor locations can be seen on the site plan in **Appendix 3**. For each location, concentrations have been calculated for each floor level. The results of these predictions can be seen in **Table 6.1**.

Table 6.1: Predicted Future Air Quality Concentrations 2021 – Development Site

Receptor	NO ₂ (µg/m ³)	PM ₁₀ (µg/m ³)		PM _{2.5} (µg/m ³)
	Annual Mean	Annual Mean	Days >50 µg/m ³	Annual Mean
17 Lorne St Front G	28.31	15.70	0.23	9.69
17 Lorne St Front 1	28.21	15.67	0.23	9.67
17 Lorne St Front 2	28.03	15.63	0.22	9.65
17 Lorne St Rear G	28.33	15.70	0.23	9.69
17 Lorne St Rear 1	28.22	15.67	0.23	9.67
17 Lorne St Rear 2	28.04	15.63	0.22	9.65
NAQO	40	40	35	25

If pollutant concentrations in **Table 7.1** are compared to the National Air Quality Objectives, it can be seen that on the development site during the opening year, concentrations of NO₂ are below the National Air Quality Objectives.

It is known that NO_x and NO₂ concentrations are not declining as predicted, especially in the southeast of England. Consequently, it is now commonplace to consider future concentrations of air pollutants without future reductions in emissions rates, as was predicted, alongside future concentrations of air pollutants with future reductions in emissions rates, with the likely onsite future pollutant concentrations considered to be somewhere between the two.

Table 6.1 shows the future concentrations of air pollutants with future reductions in emissions rates, with **Table 5.2** effectively showing future concentrations of air pollutants without future reductions in emissions rates. At the rear façade at ground-floor level (the worst affected area of the proposed development), the annual mean concentration of NO₂ will be somewhere between 29.30 µg/m³ and 28.31 µg/m³.

To more accurately predict future baseline concentrations in light of the fact that NO_x and NO₂ concentrations are not declining as predicted, Air Quality Consultants Ltd have developed the CURED (Calculator Using Realistic Emissions for Diesel) emissions factor dataset for predicting future NO_x and NO₂ concentrations. The model uses the same COPERT (V5.0) emissions factors and fleet compositions as Defra's Emissions Factors Toolkit (EFT) V8.0.1 as used in the modelled predictions above, however it takes a more pessimistic view than the EFT regarding the efficacy of forthcoming phases on the Euro 6 standard for diesel cars and vans. Modelling future baseline pollutant concentrations with the CURED emissions factor dataset should provide a more accurate representation of future concentrations of NO₂.

Concentrations have been calculated for the same two representative points at the same floor levels across the development site as per the above, this time using the CURED emissions factor dataset that takes into account the models adjusted expectations for contributions from diesel vehicles. The results of these predictions can be seen in **Table 6.2**.

Table 6.2: Predicted Future Air Quality Concentrations 2021 – Using CURED Emissions Factors

Receptor	NO ₂ (µg/m ³)
	Annual Mean
17 Lorne St Front G	28.43
17 Lorne St Front 1	28.32
17 Lorne St Front 2	28.14
17 Lorne St Rear G	28.44
17 Lorne St Rear 1	28.34
17 Lorne St Rear 2	28.16
NAQO	40

Pollutant concentrations in **Table 6.2** are higher than their respective concentrations calculated without the CURED emissions factors, albeit still closer in absolute value to the 2021 concentrations than the 2016 concentrations. Regardless of whether expectations of diesel emissions are adjusted or not, it can be seen that on the development site during the opening year, concentrations of NO₂ are below the National Air Quality Objectives.

6.2. NO₂ 1-hour Exposure

In order to meet the hourly Air Quality Standard on NO₂, the average hourly concentration of NO₂ must not exceed the hourly objective level of 200 µg/m³ more than 18 times in one calendar year. If this standard is not met, there would be concern that even short duration exposure to pollutant concentrations could be prejudicial to health, which could be a concern for gardens, balconies and other outdoor amenity spaces associated with the development.

According to research conducted in 2003¹, there is only a risk that the NO₂ 1-hour objective (200 µg/m³) could be exceeded if the annual mean nitrogen dioxide concentration is greater than 60 µg/m³. At the development site, the worst-case annual mean is 29.30 µg/m³, therefore hourly exceedances are not expected to occur. Consequently, local short duration pollutant concentrations would not be considered a cause for concern in gardens, balconies and other outdoor amenity spaces associated with the development.

¹ Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marnier, 2003.

7. IMPACTS OF THE DEVELOPMENT ON THE LOCAL AREA

The scoping assessment contained within **Section 4** of this report identifies that the impact of the proposed development on the local environment is likely to be insignificant and therefore no further assessment is required.

8. CONSTRUCTION DUST IMPACT ASSESSMENT

8.1. Overview

The main air quality impacts that may arise during construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes; and
- An increase in concentrations of airborne particles (e.g. PM₁₀, PM_{2.5}) and nitrogen dioxide due to exhaust emissions from site plant and traffic that can impact adversely on human health.

The most common impacts are dust soiling and increased ambient PM₁₀ concentrations due to dust arising from the site. Most of this PM₁₀ is likely to be in the PM_{2.5-10} fraction, known as coarse particles.

It is very difficult to quantify emissions of dust from construction activities. It is, therefore, common practice to provide a qualitative assessment of potential impacts. The Institute of Air Quality Management's *Guidance on the assessment of dust from demolition and construction (February 2014)* contains a complex methodology for determining the significance of construction impacts on air quality. The following sections outline the steps outlined in the IAQM methodology.

8.2. Step 1 – Screening the Need for a Detailed Assessment

The IAQM guidance states that:

"An assessment will normally be required where there is:

- *a 'human receptor' within:*
 - *350 m of the boundary of the site; or*
 - *50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).*
- *an 'ecological receptor' within:*
 - *50 m of the boundary of the site; or*
 - *50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s)."*

There are existing receptors within 350m of the boundary of the development site and within 50m of the route used by construction vehicles on the public highway. Therefore, a detailed assessment is required to determine potential dust impacts.

Step 1 Summary:

A detailed assessment is required to determine potential dust impacts.

8.3. Step 2 – Assess the Risks of Dust Impacts

The IAQM guidance states that:

“The risk of dust arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high risk.

A site is allocated to a risk category based on two factors:

- *the scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large (STEP 2A); and*
- *the sensitivity of the area to dust impacts (STEP 2B), which is defined as low, medium or high sensitivity.*

These two factors are combined in STEP 2C to determine the risk of dust impacts with no mitigation applied. The risk category assigned to the site can be different for each of the four potential activities (demolition, earthworks, construction and trackout). More than one of these activities may occur on a site at any one time.”

8.3.1. Step 2a – Dust Emission Magnitude

The first step (Step 2a) is therefore to assess the magnitude of the anticipated works. **Table 9.1** summarises the dust emission magnitude for each activity.

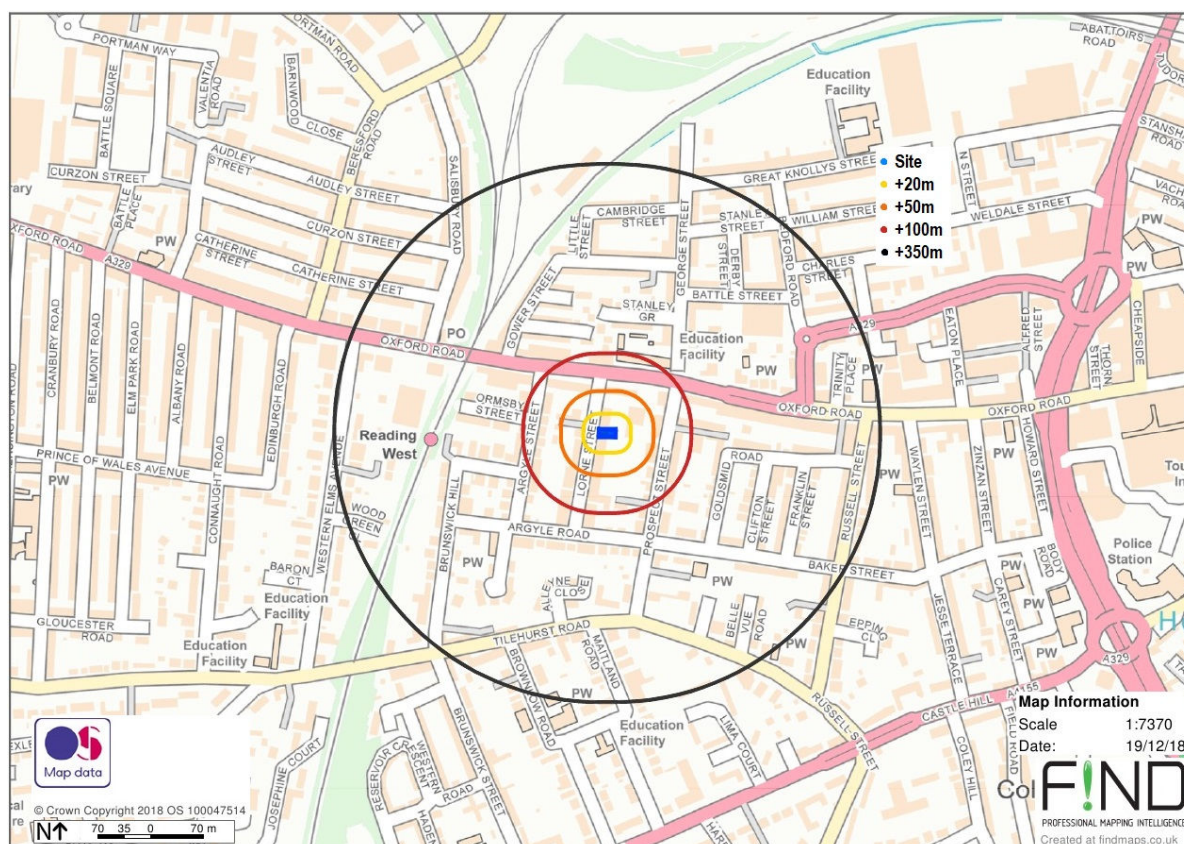
Table 8.1: Dust Emission Magnitude

Activity	Dust Emission Magnitude	Justification
Demolition	Small	Only possible minor internal demolition and removal of the chimney flue.
Earthworks	N/A	No earthworks required.
Construction	Small	Only internal construction of bathrooms required.
Trackout	N/A	No HGV movements or sections of unpaved road required.

8.3.2. Step 2b – Sensitivity of the Area

The next step (Step 2b) is therefore to assess the sensitivity of the area that could be affected by the anticipated works. Figure 8.1 shows the distances bands for sensitive receptors as described in the IAQM guidance.

Figure 8.1: Distance bands for sensitive receptors as described in IAQM guidance



There are a number of existing dwellings in the area that are considered to be high sensitivity receptors. There are between 10 and 100 high sensitivity receptors within 50m of the site boundary; therefore, the sensitivity to dust soiling effects on people and property is “medium” for demolition and construction.

The annual mean concentration of PM₁₀ is less than 24 µg/m³; given the number of high sensitivity receptors outlined above, this results in a “low” sensitivity of the area to human health impacts.

There are no ecological receptors that are considered to be anything greater than low sensitivity receptors within 50m of the site; this results in a “low” sensitivity of the area to ecological impacts for all activities. Table 9.2 summarises the sensitivity of the area for demolition and construction.

Table 8.2: Outcome of Defining the Sensitivity of the Area

Potential Impact	Sensitivity of Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low	N/A	Low	N/A
Human Health	Low	N/A	Low	N/A
Ecological	Low	N/A	Low	N/A

8.3.3. Step 2c – Define the Risks

The next step (Step 2c) is to assign the level of risk for each activity, based on the receptor sensitivity and the dust emission magnitude. **Table 9.3** summarises the dust risk for each activity.

Table 8.3: Summary Dust Risk Table to Define Site-Specific Mitigation

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low	N/A	Negligible	N/A
Human Health	Low	N/A	Negligible	N/A
Ecological	Low	N/A	Negligible	N/A

Step 2 Summary:

- Dust Emission Magnitude is “Small” for demolition and construction.
- The Sensitivity of the area of is “Low” for dust soiling, human health and ecological impacts.
- The site is considered a “Low Risk Site” in respect of demolition.

8.4. Step 3 – Site Specific Mitigation

Stage 2 determines that the site is a “*Low Risk Site*” in respect of demolition.

The IAQM guidance provides a list of potential mitigation measures and suggests where these measures are highly recommended, desirable or not required based upon the risk of the site. For all sites that are a “*Low Risk Site*” or higher, a Dust Management Plan is highly recommended and should incorporate the mitigation measures recommended based on the site risk.

The IAQM's Guidance states that the following measures are highly recommended or desirable as mitigation for all low risk sites:

- Communications: Display the name and contact details of person(s) accountable for air quality and dust issues on the Site boundary.
- Communications: Display the head or regional office contact information.
- Communications: Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the LPA. The level of detail will depend on the risk and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the Site. In London, additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, real-time PM₁₀ continuous monitoring and/or visual inspections.

- Site management: Record all dust and air quality complaints, identify the cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Site management: Make the complaints log available to the local authority when asked.
- Site management: Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.
- Monitoring: Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the LPA when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of Site boundary, with cleaning to be provided if necessary.
- Monitoring: Carry out regular Site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
- Monitoring: Increase the frequency of Site inspections by the person accountable for air quality and dust issues on-site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Preparing and maintaining the Site: Plan Site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Preparing and maintaining the Site: Erect solid screens or barriers around dusty activities (or the Site boundary) that are at least as high as any stockpiles on-site.
- Preparing and maintaining the Site: Fully enclose Site or specific operations where there is a high potential for dust production and the Site is active for an extensive period.
- Preparing and maintaining the Site: Avoid Site runoff of water or mud.
- Preparing and maintaining the Site: Keep Site fencing, barriers and scaffolding clean using wet methods.
- Preparing and maintaining the Site: Remove materials that have a potential to produce dust from Site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
- Preparing and maintaining the Site: Cover, seed or fence stockpiles to prevent wind whipping.
- Operating vehicle/machinery and sustainable travel: Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable.
- Operating vehicle/machinery and sustainable travel: Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Operating vehicle/machinery and sustainable travel: Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- Operating vehicle / machinery and sustainable travel: Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long-haul routes are

required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate)

- Operations: Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Operations: Ensure an adequate water supply on the Site for effective dust / particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Operations: Use enclosed chutes and conveyors and covered skips.
- Operations: Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Operations: Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
- Waste management: Avoid bonfires and burning of waste materials.

The IAQM's Guidance states that the following measures are highly recommended or desirable as mitigation for all low risk sites in relation to demolition:

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

In addition to the mitigation contained within the IAQM Guidance, the Control of Dust and Emissions from Construction and Demolition SPG contains more specific detailed mitigation measures with regards to precise construction processes, which should be incorporated into the DMP as appropriate.

The Control of Dust and Emissions from Construction and Demolition SPG also includes details on construction dust site monitoring.

Step 3 Summary:

The site is considered a "Low Risk Site" overall and a Dust Management Plan is recommended incorporating a number of specific mitigation measures based on the site-specific risks.

8.5. Step 4 – Determining Significant Effects

The site is considered a “Low Risk Site” overall and if appropriate mitigation measures are put in place, as identified in Step 3, significant effects on receptors are unlikely to occur. Considering both the construction details and the specific characteristics of the site, it is anticipated that effective mitigation will be possible and residual effects will not be considered significant.

Step 4 Summary:

With risk appropriate mitigation, residual effects will not be considered significant.

8.6. Step 5 – Dust Assessment Report

Step 5 Summary:

Dust and other pollutant emissions from the construction, demolition, earthworks and trackout phases of the construction of the proposed development will see the site designated a “Low Risk Site”. However, with risk-appropriate mitigation, residual effects will not be considered significant.

9. MITIGATION

As a consequence of the proposed development, there will not be a significant increase in pollutant concentrations and therefore mitigation is not seen to be necessary, other than those routinely used to control construction dust, as detailed in the previous section. Similarly, concentrations of all pollutants are below the National Air Quality Objectives at the development site and therefore it is not necessary to implement mitigation to reduce the exposure from NO₂ or any other pollutant to future occupiers of the proposed development.

10. CONCLUSIONS & SUMMARY

An air quality assessment has been undertaken in accordance with the Department of Environment, Food and Rural Affairs' (Defra) current *Technical Guidance on Local Air Quality Management (LAQM) (TG16)* and addresses the effects of air pollutant emissions from traffic using the adjacent roads, and emissions associated with the development of the site. In addition, a risk-based assessment of the likely impact of construction on the air quality of the local environment has been conducted in accordance with the Institute of Air Quality Management's 2014 edition of the *Guidance on the assessment of dust from demolition and construction*.

Baseline pollutant concentrations on site have been investigated using both existing monitoring data and through predictions using the ADMS-Roads Detailed Dispersion Model methodology. At present, and in the opening year of the proposed development (2021), concentrations of all pollutants are below the Air Quality Objectives.

With regards to the impacts of construction on air quality, dust and other pollutant emissions from the construction and demolition phases of the construction of the proposed development will see the site designated a "Low Risk Site". However, with risk-appropriate mitigation, residual effects will not be considered significant.

Since it has been shown that the proposed development meets the guidance contained within *Technical Guidance on Local Air Quality Management (LAQM) (TG16)*, IAQM/EPUK's *Land-Use Planning & Development Control: Planning for Air Quality* and IAQM's *Guidance on the assessment of dust from demolition and construction*, it is considered that the proposed development adheres to the principles of the National Planning Policy Framework since the new development will not be "put at risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution". Since it has been shown that in terms of air quality, the proposals adhere to local and national planning policy, it is considered that the air pollution should not be a constraint on the proposed residential development.

Appendix 1 Glossary of Terms

Appendix 1: Glossary of Terms

Air Quality Standard/Air Quality Objective: The concentrations of pollutants in the atmosphere, which can broadly be taken to achieve a certain level of environmental quality. The standards are based on an assessment of the effects of each pollutant on human health including the effects on sensitive subgroups.

Annual mean: The average of the concentrations measured for each pollutant for one year. In the case of the Air Quality Objectives, this is for a calendar year.

Air Quality Management Area (AQMA): An area that a local authority has designated for action, based upon predicted exceedances of Air Quality Objectives.

Concentration: The amount of a (polluting) substance in a volume (of air), typically expressed as a mass of pollutant per unit volume of air (for example, microgrammes per cubic metre, $\mu\text{g}/\text{m}^3$) or a volume of gaseous pollutant per unit volume of air (parts per million, ppm).

Exceedance: A period of time where the concentration of a pollutant is greater than the appropriate Air Quality Objective.

Nitrogen Oxides: Nitric oxide (NO) is mainly derived from road transport emissions and other combustion processes such as the electricity supply industry. NO is not considered to be harmful to health. However, once released into the atmosphere, NO is usually very rapidly oxidised to nitrogen dioxide (NO₂), which is harmful to health. NO₂ and NO are both oxides of nitrogen and together are referred to as nitrogen oxides (NO_x).

Particulate Matter: Fine Particles are composed of a wide range of materials arising from a variety of sources including combustion sources (mainly road traffic), and coarse particles, suspended soils and dust from construction work. Particles are measured in a number of different size fractions according to their mean aerodynamic diameter. Most monitoring is currently focused on PM₁₀ (less than 10 microns in diameter), but the finer fractions such as PM_{2.5} (less than 2.5 microns in diameter) is becoming of increasing interest in terms of health effects.

$\mu\text{g}/\text{m}^3$ microgrammes per cubic metre of air: A measure of concentration in terms of mass per unit volume. A concentration of 1 $\mu\text{g}/\text{m}^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.

Appendix 2 Air Quality Model

Appendix 2: Air Quality Model

ADMS-Roads

In the UK, the Department for Environment, Food & Rural Affairs (Defra) provides guidance on the most appropriate methods to estimate pollutant concentrations for use in Local Air Quality Management (LAQM). Defra regularly updates its Technical Guidance, with the latest LAQM Technical Guidance TG16 published in 2016.

The methodology in TG16 directs air quality professionals to a number of tools published by Defra to predict and manage air quality. One of the main tools for modelling air pollutants is ADMS-Roads, which is a refined air dispersion model produced by Cambridge Environmental Research Consultants. ADMS-Roads has been specifically developed for use with UK roads and as such is considered to be one of the most appropriate tools for use in UK air quality modelling and therefore is widely used in the UK.

ADMS-Roads is an air dispersion modelling suite that predicts the air quality impacts of nitrogen dioxide, particulate matter and other inert pollutant concentrations from moving and idling motor vehicles at or alongside roads and junctions.

The methodology utilised by ADMS-Roads is significantly more advanced than that of most other air dispersion models, such as CALINE, which Breeze Roads is based upon, which is the other commonly used detailed air dispersion model in the UK. ADMS-Roads incorporates the latest understanding of the boundary layer structure and goes beyond the simplistic Pasquill-Gifford stability categories method used in other dispersion models and utilises the Monin-Obukhov length for greater accuracy. The model also uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions.

Unlike the 'DMRB Screening Method', ADMS-Roads can take into account annualised meteorological data; it can take into account source, receiver and terrain heights; canyon effects can be modelled, and the model can calculate hourly concentrations.

TG16 provides detailed guidance on the modelling of air pollutants and in particular highlights a procedure to validate models. The procedure discusses the comparison of modelled results against measured levels, either from diffusion tubes (for NO₂) or continuous monitors (for NO₂ or PM₁₀).

Model verification and subsequent adjustment for oxides of nitrogen is undertaken based upon NO_x as most models (including ADMS-Roads) predict NO₂ based upon its relationship to NO_x. Consequently, the verification process requires conversion to NO_x of any measurements of NO₂ in order to compare against modelled levels of NO_x.

Defra has published in 2009 a methodology to calculate NO_x from NO₂ and as part of its LAQM toolkit². The calculation method allows local authorities and air quality consultants to derive NO₂ and NO_x wherever NO_x is predicted by modelling emissions from roads. The calculation method incorporates the impact of expected changes in the fraction of NO_x emitted as NO₂ ($f - \text{NO}_2$) and changes in regional concentrations of NO_x, NO₂ and O₃.

² <http://laqm.defra.gov.uk/tools-monitoring-data/no-calculator.html>

Background concentrations for various pollutants are published and updated regularly by Defra, so it is possible to calculate the contribution of NO_x from road traffic at a particular location. If the ratio of the monitored road traffic contribution to the modelled road traffic contribution of NO_x is calculated, this factor can be applied to the component derived from road traffic emissions for any predictions of NO_x in the area. Therefore, it is possible to validate the model such that predictions should be within 10% of air quality measurements.

Appendix 3 Modelling Procedure and Input Data

Appendix 3: Modelling Procedure and Input Data

The following Appendix summarises the input data and assumptions used in the modelling of air pollutants.

Model Input Data

Traffic flows in the vicinity of the site have been attained from the Department for Transport's traffic database for the year 2016. High traffic growth factors have been applied to this data to predict traffic flows for the proposed opening year (2020).

Since lower traffic speeds increase emissions from vehicles, it is necessary to take into account the reduction in traffic speeds around junctions. TG16 suggests that *"there is no simple factor that can be applied to the average speed to calculate a speed applicable to congested periods"* and that one should exercise professional judgement when taking into account congestion and decreasing speeds around junctions. However, in the absence of any more detailed site-specific information, TG16 does suggest that *"For a busy junction, assume that traffic approaching the junction slows to an average of 20kph ...(for) approach distances of approximately 25m"*. This is the approach adopted at this site.

Input road links, traffic flows, the percentage of Heavy Goods Vehicles (HGVs) and traffic speeds are shown below.

Model Input Data

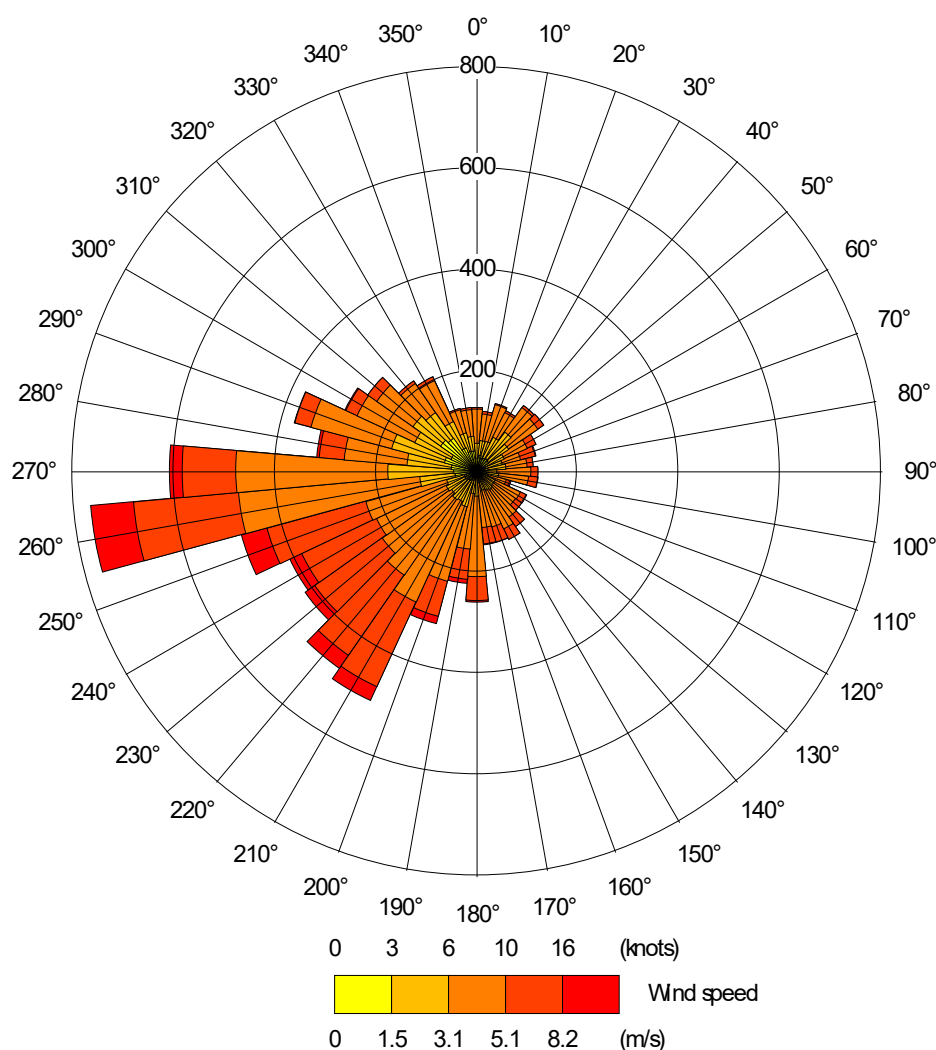
Road	AADT 2016	AADT 2021	% HGV	Speed km/h
Oxford Rd 1	13721	14781	6.6	48
Oxford Rd 2	13721	14781	6.6	32
Oxford Rd 3	13721	14781	6.6	48
Oxford Rd 4	13721	14781	6.6	20
Bedford Rd 1	16708	17999	3.7	20
Bedford Rd 2	16708	17999	3.7	48
Bedford Rd 3	16708	17999	3.7	20
Chatham St 1	16708	17999	3.7	20
Chatham St 2	16708	17999	3.7	48
Chatham St 3	16708	17999	3.7	20
Chatham St 4	16708	17999	3.7	48
Chatham St 5	16708	17999	3.7	20
Caversham Rd 1	47743	51433	2.4	112

Road	AADT 2016	AADT 2021	% HGV	Speed km/h
Caversham Rd 2	47743	51433	2.4	112
Caversham Rd 3	47743	51433	2.4	112
Castle Hill 1	21848	23537	3.3	20
Castle Hill 2	21848	23537	3.3	48
Castle Hill 3	21848	23537	3.3	48
Bath Rd 1	21848	23537	3.3	48
Bath Rd 2	21848	23537	3.3	20
A33 1	52393	56442	3.3	112
A33 2	13209	14230	3.4	112
A329 to A33	16145	17393	3.4	112
A33 to A329	34795	37484	4.1	112

Meteorological Data

TG16 suggests that a single year's meteorological data will be sufficient to predict air pollution concentrations. Meteorological data was obtained for the nearest meteorological station to the proposed development site, which is situated at London Heathrow Airport (Surface Station Number 3772). The meteorological data consists of hourly sequential data of wind speed, wind direction, surface temperature, precipitation rate and cloud cover data. This data was used for both model verification and future year scenarios. The figure below shows the wind rose data used in the modelling.

Wind Rose – London Heathrow Airport



Advanced Modelling Parameters

The following modelling parameters have been used in the ADMS-Roads Model:

Parameter	Value	Justification
Latitude	51.5°	The default for southern England
Surface Roughness ^{Note 1}	1m	Recommended for cities/woodland
Minimum Monin-Obukhov Length	30m	Recommended for cities and large towns
Surface Albedo	0.23	The default for non-snow-covered ground
Priestley-Taylor Parameter	1.0	Model default

Note 1: The same surface roughness has been applied to both the dispersion site and the meteorological measurement site, as both are considered to be located in large urban areas.

Background Concentration of Air Pollutants

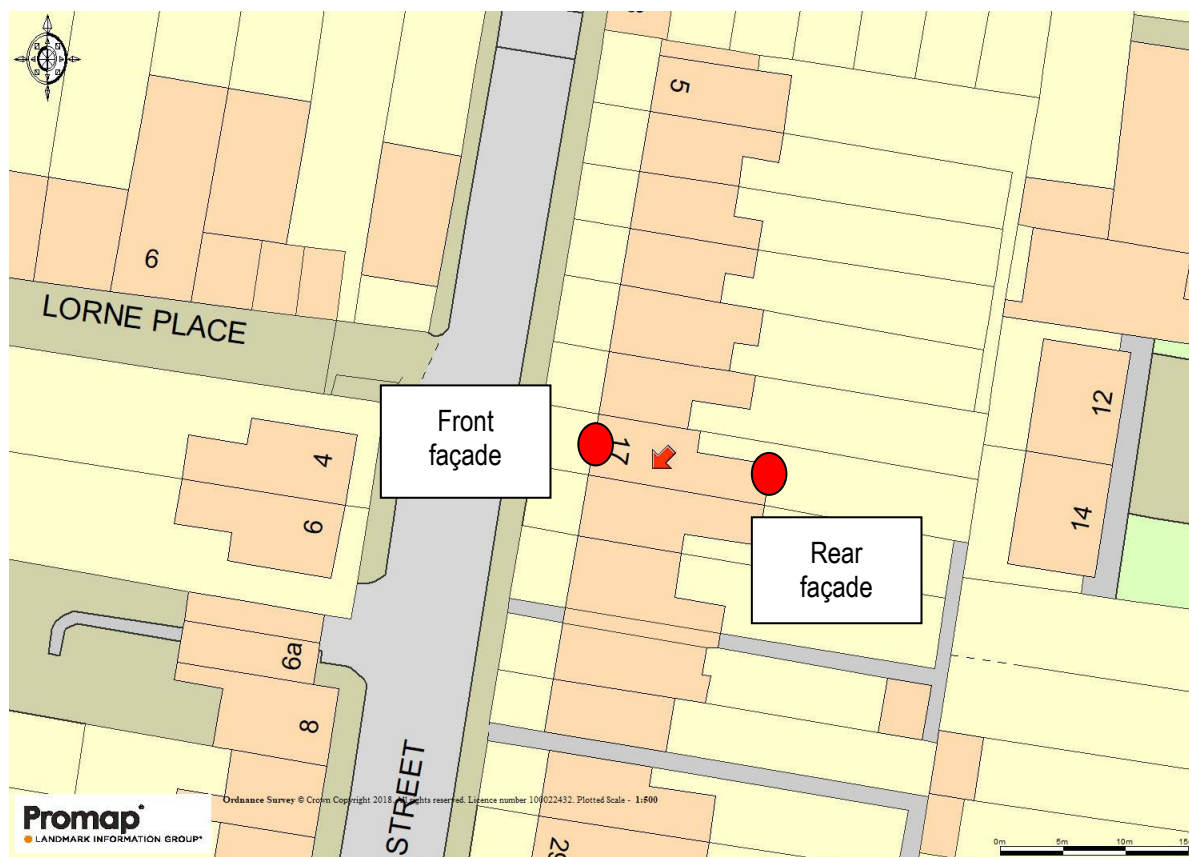
Background concentrations of air pollutants for the modelling were obtained from the UK National Air Quality Information Archive, in accordance with Local Air Quality Management Technical Guidance TG16. The Table below identifies the background concentrations used in the model for the baseline year (2016). The same background data was used in the modelling of future scenarios to indicate a worst-case scenario. In order to avoid 'double counting', major road sources within the grid square identified were removed from the total background as they have been explicitly modelled as part of the assessment.

Background Concentrations of Pollutants

Year	Grid Reference	NO _x µg/m ³	NO ₂ µg/m ³	PM ₁₀ µg/m ³	PM _{2.5} µg/m ³
2016	470500, 173500	41.50	26.19	15.22	9.42

Receptor Locations

The site plan below shows the locations of the sample sensitive receptor locations used within the modelling:

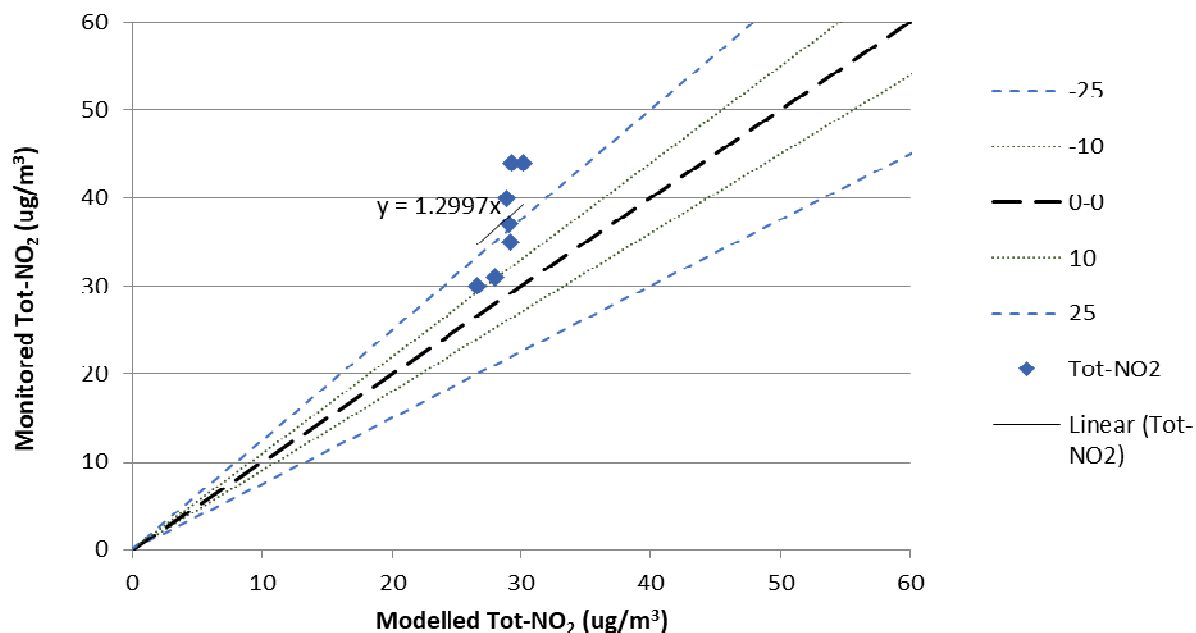


Verification and Adjustment

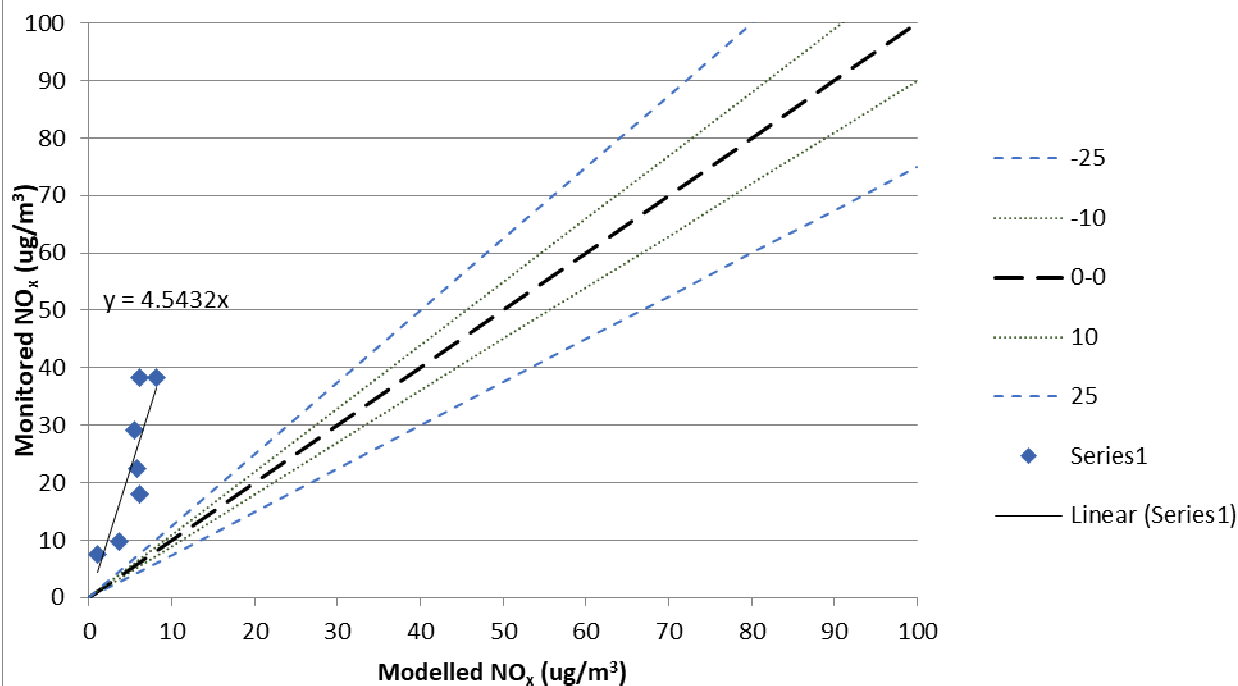
Verification of the air pollutant model was carried out in accordance with LAQM Technical Guidance TG16 using the data from the diffusion tubes located in the vicinity of the site for 2016. The exercise required the modelling of the diffusion tube location for 2016 and comparing the modelled results with the monitoring results. The verification data is summarised below and shows that pollutant concentrations were under predicted using the model; therefore, an adjustment factor of 4.5432 was applied to the model contribution of NO_x.

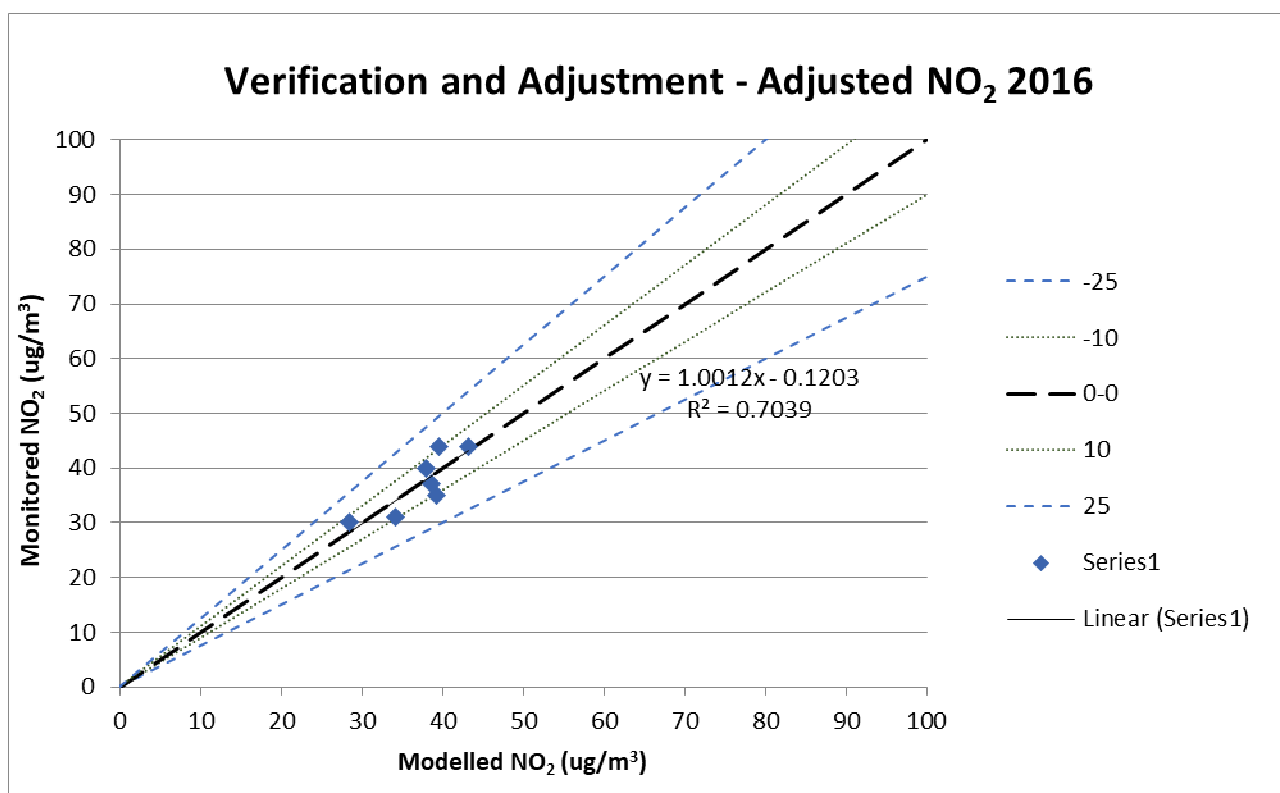
	Modelled Rds NO _x	Modelled Tot-NO ₂	Monitored Tot-NO ₂	%Diff Mod/Mon Tot-NO ₂	Modelled Rd-NO _x	Monitored Rd-NO _x	NO _x ADJ Corr1	Adj Mod Rd-NO _x	Adj Mod Tot-NO ₂	Monitored Tot-NO ₂	%Diff Mod/Mon Adj Tot- NO ₂
DT17 4 Tilehurst Road	0.97	26.68	30	-11.07	0.97	7.62	7.89	4.39	28.40	30.00	-5.33
DT18 162a Castle Hill	5.75	29.08	37	-21.41	5.75	22.39	3.89	26.14	38.70	37.00	4.59
DT30 327 Oxford Road	5.45	28.93	40	-27.68	5.45	29.05	5.33	24.76	38.08	40.00	-4.80
DT31 252 Oxford Road	6.07	29.24	35	-16.46	6.07	18.07	2.97	27.60	39.35	35.00	12.4
DT32 281 Oxford Road	6.18	29.29	44	-33.43	6.18	38.26	6.19	28.08	39.57	44.00	-10.07
DT33 165 Oxford Road	8.06	30.21	44	-31.34	8.06	38.26	4.75	36.62	43.30	44.00	-1.59
DT34 10 Trinity Place	3.56	27.99	31	-9.71	3.56	9.67	2.72	16.18	34.12	31.00	10.06

Verification and Adjustment Total NO₂ 2016



Verification and Adjustment Unadjusted Road NO_x 2016





Model Uncertainty

TG16 recommends the use of statistical parameters to assess uncertainty in the verified model. The table below describes the three parameters it recommends and the corresponding value for the verified model at this site.

Parameter	Value	Description
Correlation Coefficient	0.7	Used to measure the linear relationship between predicted and observed data. The ideal value (an absolute relationship) is 1.
Root Mean Square Coefficient	2.9	RMSE defines the average error/uncertainty of the model verification and is in the same units as the model outputs ($\mu\text{g}/\text{m}^3$). Values should be $<10\mu\text{g}/\text{m}^3$ or ideally $<4\mu\text{g}/\text{m}^3$ where concentrations are near the AQO. The ideal value is $0\mu\text{g}/\text{m}^3$.
Fractional Bias	0.00	Identifies if the model shows a systematic tendency to over/under predict concentrations. The ideal value is 0 and range between ± 2 . Negative values suggest an over prediction whilst positive values suggest under prediction.

TG16 notes that the Correlation Coefficient is a less reliable indicator when validating with a small dataset; therefore, for sites such as this validated with smaller datasets, the Root Mean Square Coefficient is the main parameter used. An R^2 value of 0.7 nonetheless suggests a strong correlation; and the table above notes that the Root Mean Square Coefficient is 2.9, i.e. less than 4 and therefore the model can be used with a reasonable level of confidence. The Fractional Bias is just less than 0, indicating that on average, the validated model is likely to underpredict very marginally, but overall should be reasonably accurate.

PM₁₀ Exceedances

The number of exceedances of 50 µg/m³ as a 24-hour mean PM₁₀ concentration has been calculated from the modelled total annual mean concentration following the relationship advised by Defra:

$$A = -18.5 + 0.00145 B^3 + 206/B$$

where A is the number of exceedances of 50 µg/m³ as a 24-hour mean PM₁₀ concentration and B is the annual mean PM₁₀ concentration.