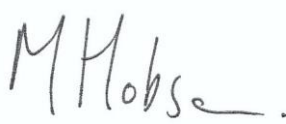


Air Quality Assessment for the proposed development at 118a Oxford Road & 2 Bedford Road Reading



Report to JR Properties
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1. Introduction

Aether has been commissioned by JR Properties to undertake an air quality assessment for the part redevelopment, refurbishment and expansion of the existing site at 118a Oxford Road and 2 Bedford Road, in order to accommodate thirteen residential apartments, two retail units (one of which already exists as part of the current site), and retail storage space. No car parking spaces will be provided with the development, nor is any communal air pollution emitting on-site energy generation planned.

The development falls within the administrative area of Reading Borough Council, which suffers from elevated levels of air pollution, primarily due to high levels of traffic. It is therefore important to assess whether there will be an exceedance of the air quality objectives for particulate matter (PM₁₀) or nitrogen dioxide (NO₂) at the proposed site and then advise whether any action is required to reduce the residents' exposure to air pollution. The assessment utilises ADMS-Roads, a comprehensive dispersion modelling tool for investigating air pollution problems due to small networks of roads and industrial sources.

The expected completion date of the proposed development is 2018. The assessment has therefore been completed for 2019, the expected first full year of residential occupation.

1.1 The Location of the Development

The proposed development is located just west of Reading's main city centre, and southwest from Reading station as shown [Figure 1](#).

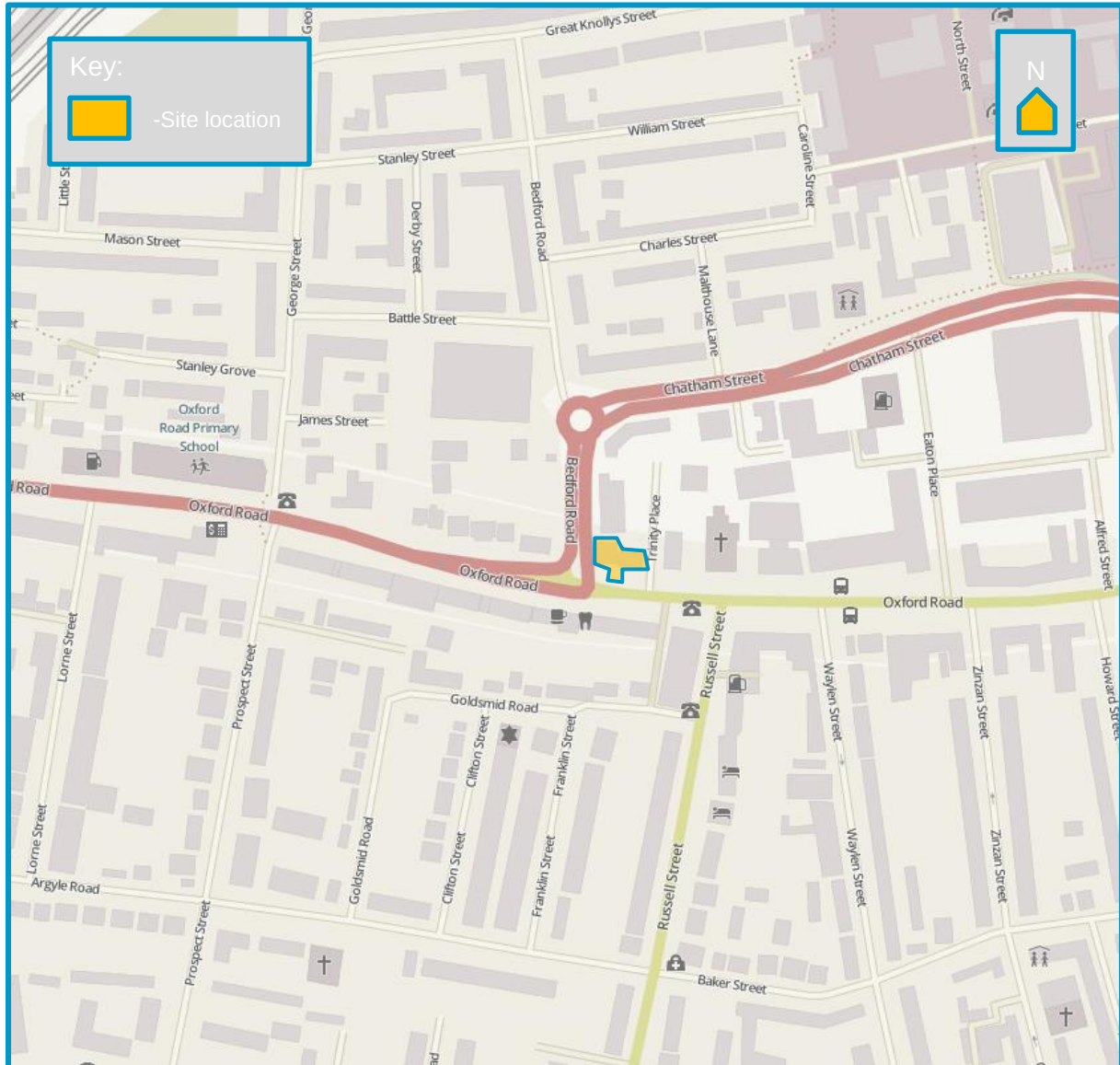


Figure 1: Location of the development site

1.2 Assessment Criteria

A summary of the air quality objectives relevant to the proposed development, as set out in the UK Air Quality Strategy¹, is presented in Table 1 below.

Table 1: UK Air Quality Objectives for NO₂ and PM₁₀

Pollutant	Concentration	Measured as
Nitrogen Dioxide (NO ₂)	40 µg/m ³	Annual mean
	200 µg/m ³	Hourly mean not to be exceeded more than 18 times per year (99.8 th percentile)
Particulate Matter (PM ₁₀)	40 µg/m ³	Annual mean
	50 µg/m ³	24 hour mean not to be exceeded more than 35 times a year (90.4 th percentile)

The oxides of nitrogen (NO_x) comprise principally of nitric oxide (NO) and nitrogen dioxide (NO₂). NO₂ is a reddish brown gas (at sufficiently high concentrations) and occurs as a result of the oxidation of NO, which in turn originates from the combination of atmospheric nitrogen and oxygen during combustion processes. NO₂ can also form in the atmosphere due to a chemical reaction between NO and ozone (O₃). Health based standards for NO_x generally relate to NO₂, where acute and long-term exposure may adversely affect the respiratory system.

Particulate matter is a term used to describe all suspended solid matter, sometimes referred to as Total Suspended Particulate matter (TSP). Sources of particles in the air include road transport, power stations, quarrying, mining and agriculture. Chemical processes in the atmosphere can also lead to the formation of particles. Particulate matter with an aerodynamic diameter of less than 10 µm is the subject of health concerns because of its ability to penetrate deep within the lungs and is known in its abbreviated form as PM₁₀.

Further information on the health effects of air pollution can be found in the reports produced by the Committee on the Medical Effects of Air Pollutants².

As defined by the regulations, the air quality objectives for the protection of human health are applicable:

- Outside of buildings or other natural or man-made structures above or below ground; and
- Where members of the public are regularly present.

Using these definitions, the annual mean objectives will apply at locations where members of the public might be regularly exposed such as building façades of residential properties, schools and hospitals and will not apply at the building façades of offices or other places of work, where members

¹ The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland

² <https://www.gov.uk/government/collections/comeap-reports>

of the public do not have regular access. The 24 hour objective will apply at all locations where the annual mean objective would apply together with hotels. Therefore, in this assessment the annual mean and 24 hour mean objectives will apply at all floors of the residential/retail development. The hourly objective will apply at all locations where members of the public could reasonably be expected to spend that amount of time. Therefore, in this assessment the hourly objective will also apply at all levels of the development.

1.3 Local Air Quality Management

Local authorities are required to periodically review and assess the current and future quality of air in their areas. Where it is determined that an air quality objective is not likely to be met, the authority must designate an Air Quality Management Area (AQMA) and produce an Air Quality Action Plan (AQAP).

Reading Borough council declared an AQMA³ in 2009, which covers all major arterial roads radiating out of Reading's main central area, in addition to covering the central area itself. The proposed development is positioned on one of the major arterial roads heading west from the central area, Oxford Road, and hence falls within the boundary of the AQMA. An AQAP was produced to introduce measures to improve air quality in 2009, which sets out a local transport plan, aiming for a greater modal share for sustainable travel modes, in addition to specific infrastructure measures such as improvements to the M4 junction, and the Park and Ride system. The AQAP also sets out a series of measures regarding developments and construction, which mainly focus on the proper assessment of developments, to ensure sufficient mitigation is in place when a development is proposed in an area of poor air quality.

1.4 The ADMS-Roads Method

Local air quality has been assessed using ADMS-Roads, a comprehensive dispersion model that can be used to predict concentrations of pollutants in the vicinity of roads and small industrial sources. The model has been used for many years in support of planning applications for new residential/commercial developments.

ADMS-Roads is able to provide an estimate of air quality both before and after development, taking into account important input data such as background pollutant concentrations, meteorological data, traffic flows and on-site energy generation (if applicable). The model output can be verified against local monitoring data to increase the accuracy of the predicted pollutant concentrations and this approach has been followed in this assessment.

The use of dispersion modelling enables estimates of concentrations to be made at varying heights. As a result, suggestions for appropriate mitigation measures can be made where necessary, taking into consideration the identification of worst-case locations.

³ 2009 Reading Borough Council Air Quality Action Plan, <http://aqma.defra.gov.uk/action-plans/ReadingBC%20AQAP%202009.pdf>

The most recent version of ADMS-Roads (v4.1) was issued in February 2017 and requires the following information to assess the impact at sensitive receptor locations:

- Setup: General site details and modelling options to be used;
- Source: Source dimensions and locations, release conditions, emissions;
- Meteorology: hourly meteorological data;
- Background: Background concentration data;
- Grids: Type and size of grid for output; and
- Output: Output required and sources/groups to include in the calculations.

2. Methodology

2.1 Local Pollutant Concentrations

It is good practice to include up-to-date local background pollutant concentrations in the assessment model, and also to verify modelled outputs against local monitoring data where available. This section provides an overview of the local data available for use in the assessment.

Local monitoring data

Reading Borough Council has 3 automatic monitoring sites which monitor nitrogen dioxide (NO₂) and particulate matter (PM₁₀). NO₂ concentrations are also measured passively via a network of 54 diffusion tube sites across their administrative area. 3 of these diffusion tube sites lie in close proximity to the development site. Details of the monitoring sites near to the development site are given in Table 2. No Automatic sites are placed in a suitable location for incorporation into the assessment.

Monitoring results have been taken from the Council's latest Annual Status Report (ASR)⁴.

Table 2: Monitoring sites in proximity to the proposed site.

Site Name	Site Type	Pollutant(s)	Grid Reference	Distance to Kerb (m)	Approx. Distance to development site (m)
10 Trinity Place	R	NO ₂	470738, 173433	7.5	30
165 Oxford Road	R	NO ₂	470717, 173373	4	50
4 Tilehurst Road	R	NO ₂	470628, 173076	3	350

Note: R = roadside,

The diffusion tubes were analysed by Gradko International Ltd, who participate in the Proficiency scheme⁵. Whilst diffusion tubes provide an indicative estimate of pollutant concentrations, they tend to under or over read. The data is therefore corrected using a bias adjustment factor. There are two types of bias adjustment factor – local and national. The local factor is derived from co-locating diffusion tubes (usually in triplicate) with automatic monitors, whereas the national factor is obtained from the average bias from all local authorities using the same laboratory. Reading did carry out two

⁴ Reading Borough Council, Annual Status Report (2016), http://www.reading.gov.uk/media/6388/Air-Quality-Annual-Status-Report/pdf/Reading_Annual_Status_Report_2016.pdf

⁵ This is a national QA/ QC scheme.

co-location studies in 2015; however they have applied a national bias adjustment factor (0.98) to their 2015 diffusion tube results to enable a consistent approach with previous years.

Monitoring results are presented in Table 3. The data shows exceedances of the annual mean NO₂ objective at the 165 Oxford Road diffusion tube site for the past 3 years of available monitoring data. The objective was met at the other sites shown. Diffusion tubes do not provide information on hourly exceedances, but research⁶ identified a relationship between the annual and 1 hour mean objective, such that exceedances of the latter were considered unlikely where the annual mean was below 60 µg/m³. Therefore, this objective is likely to have been met at all of the monitoring sites shown, for the years presented.

Table 3: Monitoring results for sites close to the proposed development site, 2013-2015

Objective	Site Name	2013	2014	2015
Annual mean NO ₂ (µg/m ³)	10 Trinity Place	37	31	30
	165 Oxford Road	48	50	45
	4 Tilehurst Road	35	30	28

Note: Values exceeding the 40 µg/m³ annual mean objective are shown in bold, values above 60 µg/m³ are also underlined, NA – data unavailable, * automatic monitor, ^a Low data capture (< 80%)

Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website⁷ and data has been extracted for Reading Borough Council for this assessment. These 2013 baseline, 1 kilometre grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites.

The estimated mapped background NO_x, NO₂ and PM₁₀ concentrations around the development site are 48.4 µg/m³, 29 µg/m³ and 17.3 µg/m³ respectively in 2015 (the baseline year used in the assessment). The background maps also provide projections to future years. For 2019 (the first estimated year of occupation), the concentrations obtained for the same pollutants are 43.5 µg/m³, 26.7 µg/m³ and 16.4 µg/m³ respectively.

Due to the lack of a nearby urban background monitoring site, the 2015 mapped background concentrations have been used in this assessment. To provide a conservative estimate, the projected improvements in background air quality by 2019 have not been used in the dispersion modelling.

2.2 Traffic data

Average annual daily traffic (AADT) count data for 2015 (the selected baseline year) has been obtained from Department for Transport (DfT) Traffic Counts⁸ for: Oxford Road, Chatham Street and Castel Hill.

⁶ As described in Box 5.2 of LAQM Technical Guidance (TG16).

⁷ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>

⁸ <http://www.dft.gov.uk/traffic-counts>

In the absence of any other data being available for the minor roads, estimates are based upon average values for an '*urban minor road, South East*' from the DfT National Road Traffic Survey, 2015⁹. Therefore there will be uncertainty in the model input. All roads within 200 metres of the modelled receptors have been included in the assessment. The values are shown in Appendix B.

For the purpose of this assessment, the RTF¹⁰ model has been utilised to project traffic growth. It has been assumed that traffic on local roads will increase by 5.3 % between 2015 and 2019.

The Transport Assessment¹¹ concludes that, as no on-site parking is supplied, there will be no material impact on the local road network. However, outputs from the TRICS database for similar developments also presented in the transport assessment indicates the development may potentially result in a maximum of 34 additional person trips¹² at peak times. As a conservative estimate, the peak estimates from the TRICS database have been assumed representative of the entire day and the impact of the development has been modelled according to all 34 person trips being taken by vehicle, however such a traffic impact is unlikely due to the lack of on-site parking provision. This estimated increase in daily trips has been taken into account in the assessment for roads with direct access to the site, in the 'with' development scenario in 2019. Results (Section 3 of this report) therefore refer to concentrations modelled in 2019 both 'without' and 'with' the proposed development.

In the absence of any other data being available, we have assumed average speeds on local roads based on the speed limit.

Queuing Traffic -

Special consideration has been given to notable junctions modelled in this assessment. CERC note 60¹³ has been used for estimating emissions from queuing traffic. This defines a representative AADT for queuing traffic to be 30,000 at 5 kph, assuming an average vehicle length of 4m. These figures, along with the traffic composition of the corresponding roads were then input into the Emission Factor Toolkit (EFT)¹⁴ to calculate emission rates. The emission rates were then used within the dispersion model as separate road sources (shown as blue lines in Figure 3) of pre-defined length, representing each queue with time-varying emission profiles applied to represent busy periods.

⁹ <http://www.dft.gov.uk/statistics/series/traffic/>

¹⁰ <http://laqm.defra.gov.uk/documents/RTF-Automated-Traffic-Growth-Calculator-v3-1.xls>

¹¹ Proposed Retail Units & Residential Development, 118a Oxford Road & 2 Bedford Road Reading, Transport Statement, Local Transport Projects (2017).

¹² Person trips represent a trip by one or more persons by any travel mode.

¹³ Cambridge Environmental Research Consultants Ltd, Modelling Queuing Traffic – note 60, 20th August 2004

¹⁴ Latest version 7.0, <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>

2.3 Model input data

Hourly meteorological data from Heathrow for 2015 has been used in the model. The wind-rose diagram (Figure 2) presents this below.

Figure 2: Wind-rose diagram for Heathrow meteorological data, 2015

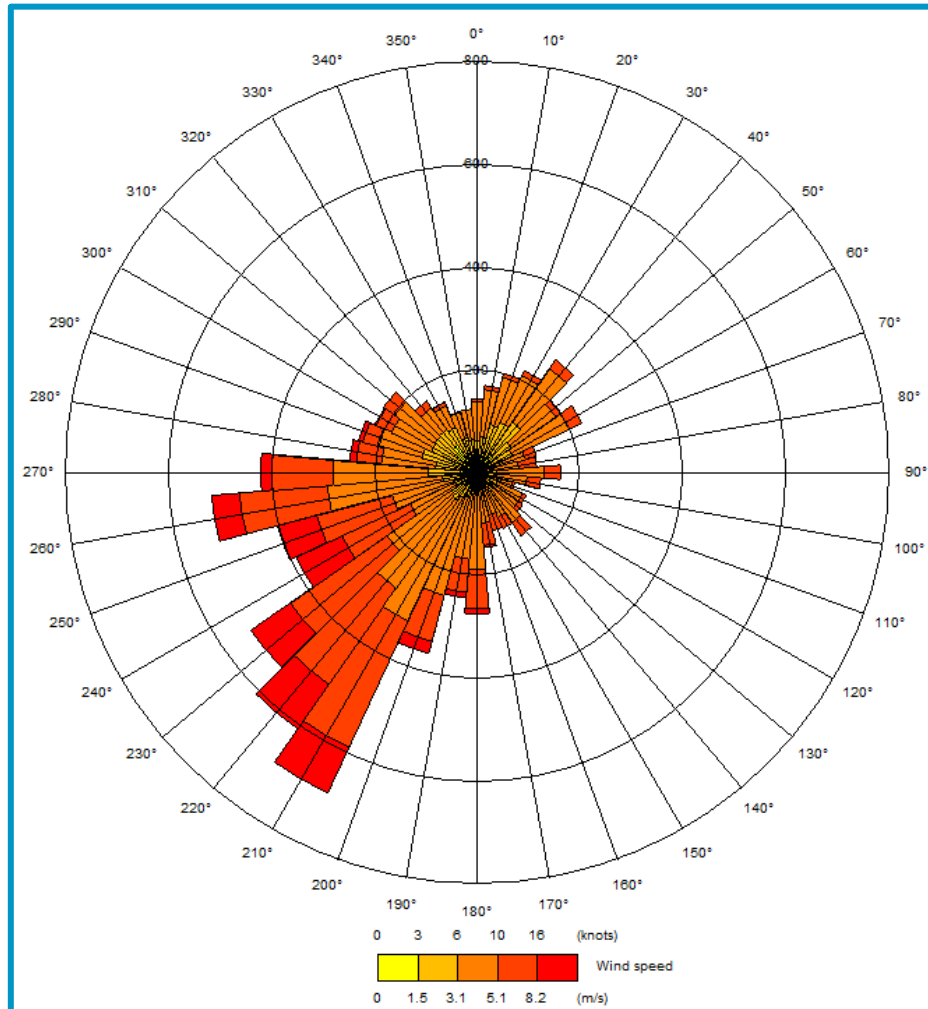
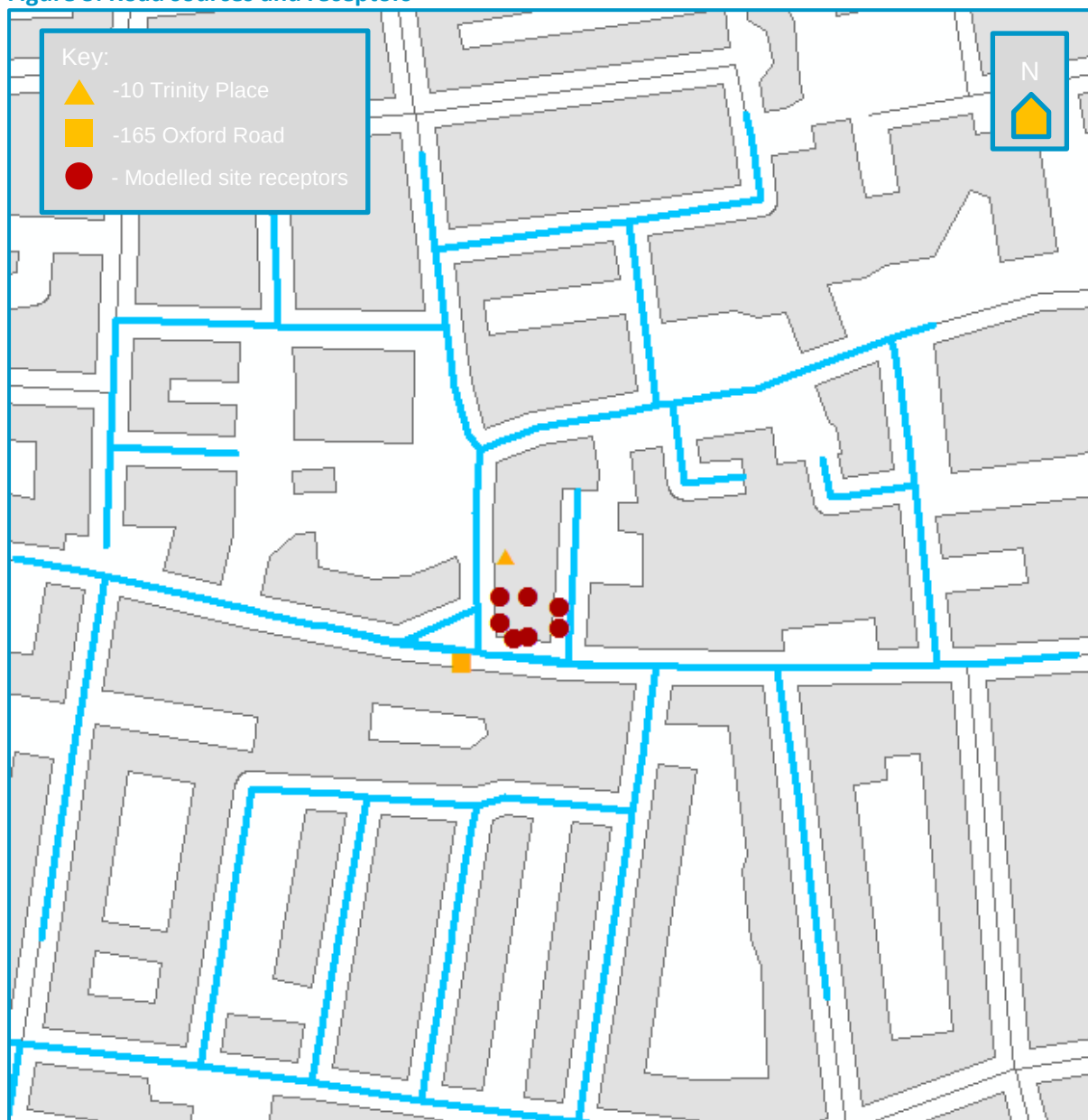


Figure 3: Road sources and receptors



Contains Ordnance Survey data © Crown copyright and database right [2017]

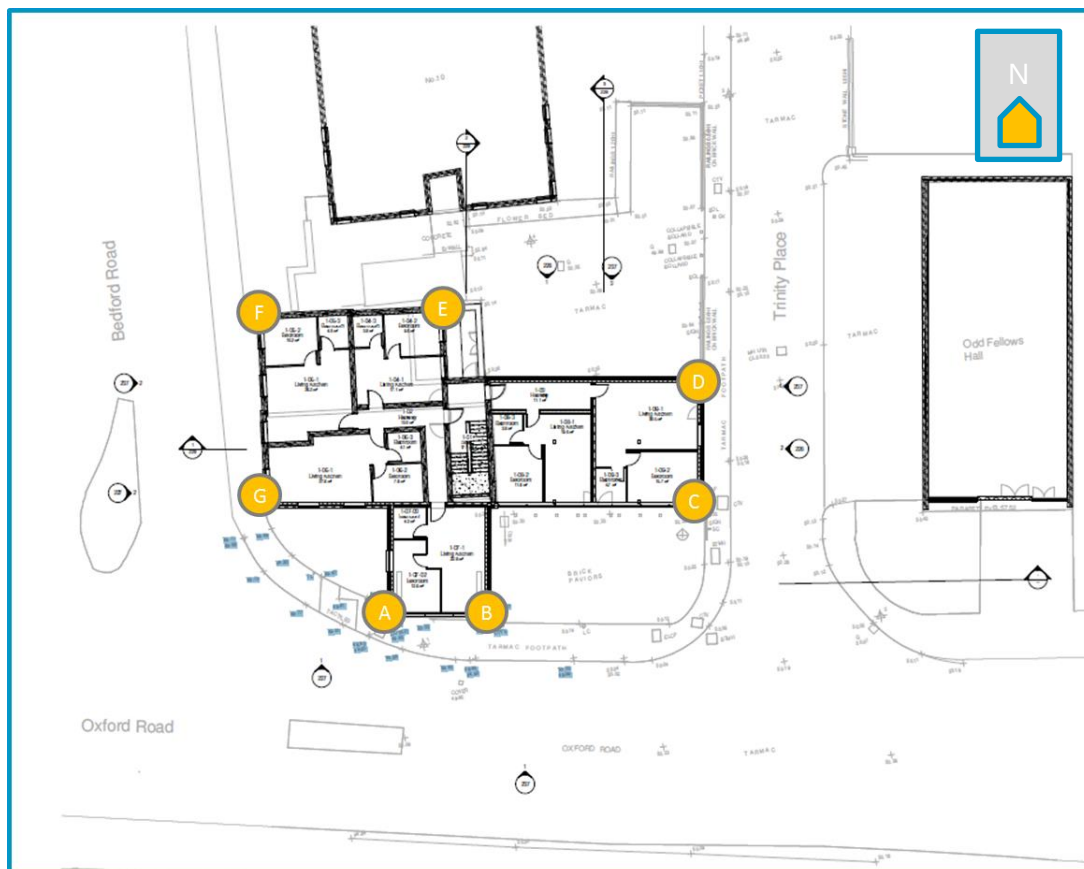
ArcMap software has been used to model the road source locations (blue lines) that are within 200 metres of the receptor locations (orange and red symbols). This data can then be automatically uploaded to ADMS-Roads. This generates an accurate representation of the surrounding area to be assessed in the model in terms of the length of roads and distances between sources and receptors. This is shown in [Figure 3](#) above. It is assumed that the contribution of other sources to NO₂ and PM₁₀ is included in the background concentrations.

7 sensitive receptor locations have been selected for the assessment:

- A. Front corner of the development overhang
- B. Opposite corner of the development overhang
- C. Front south-east facing corner of the development
- D. Rear North-east facing corner of the development
- E. Rear of the development
- F. Rear North-west facing corner, closest to Bedford Road
- G. Front South-west facing corner, closet to the traffic junction.

These sites have been chosen to reflect the extremities of the site and their proximity to road traffic sources. The architect's plans (Figure 4) show the development site in more detail with receptor locations highlighted (orange circles). An assessment is made for the receptors at varying heights to assess likely concentrations across floor levels. Exposure has been assumed to be represented at the mid-point of each floor. The mid-point of each floor has been calculated from the architectural plans supplied.

Figure 4 The location of the receptors used in the modelling



2.4 Conversion of NO_x to NO₂

Recent evidence shows that the proportion of primary NO₂ in vehicle exhaust has increased¹⁵. This means that the relationship between NO_x and NO₂ at the roadside has changed from that currently used in the ADMS model. A NO_x to NO₂ calculator (Published in June 2016)¹⁶ has therefore been developed and has been used in conjunction with the ADMS model to obtain a more accurate picture of NO₂ concentrations.

2.5 Model Verification

Model verification refers to checks that are carried out on model performance at a local level. This involves the comparison of predicted versus measured concentrations. Where there is a disparity, the first step is to check the input data and the model parameters in order to minimise the errors. If required, the second step will be to determine if an appropriate adjustment factor should be derived and applied.

In the case of NO₂, the model should be verified for NO_x as the initial step and should be carried out separately for the background contribution and the source (i.e. road traffic). Once the NO_x has been verified and adjusted as necessary, a final check should be made against the measured NO₂ concentration.

For this project, modelled annual mean road-NO_x estimates have been verified against the concentrations measured at the 2 closest monitoring sites (10 Trinity Place and 165 Oxford Road). Ideally three verification sites would have been used, but no other sites were deemed suitable. This is further described in Appendix A.

The adjustment factor determined for annual mean NO₂ concentrations was also applied to the modelled annual mean PM₁₀ concentrations. This was done as no PM₁₀ monitoring data that is representative of the development site is available, and this approach was considered more appropriate than not applying any adjustment¹⁷.

3. Results

3.1 Results of the Dispersion Modelling

Table 4 below provides the estimated pollutant concentrations in the base year (2015) and the development year (2019) without and with¹⁸ development. Given the inherent uncertainties in the

¹⁵ <http://uk-air.defra.gov.uk/assets/documents/reports/ageg/primary-no-trends.pdf>

¹⁶ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc>

¹⁷ This is in accordance with Paragraph 7.528 of LAQM TG(16), which states that in the absence of any PM₁₀ data for verification, it may be appropriate to apply the road NO_x adjustment to the modelled road PM₁₀.

¹⁸ 'With' development includes the impact of the additional traffic that will be generated with the development.

modelling, background pollutant concentrations and vehicle fleet emission factors have been maintained at 2015 levels in the development year scenarios to provide a conservative estimate. Traffic growth has been predicted using the RTF calculator.

Table 4: Estimated pollutant concentrations in 2015 and 2019 ($\mu\text{g}/\text{m}^3$)

Receptor	Annual mean NO ₂ concentration ($\mu\text{g}/\text{m}^3$)			Annual mean PM ₁₀ concentration ($\mu\text{g}/\text{m}^3$)			NO ₂ Change due to development (%)	PM ₁₀ Change due to development (%)
	2015	2019 without development	2019 with development	2015	2019 without development	2019 with development		
A1	33.6	33.8	33.8	18.0	18.0	18.0	<0.1	<0.1
A2	31.0	31.0	31.0	17.6	17.6	17.6	<0.1	<0.1
A3	30.1	30.1	30.1	17.5	17.5	17.5	<0.1	<0.1
A4	29.7	29.7	29.7	17.4	17.4	17.4	<0.1	<0.1
B1	33.7	33.8	33.8	18.0	18.0	18.0	<0.1	<0.1
B2	31.0	31.0	31.0	17.6	17.6	17.6	<0.1	<0.1
B3	30.1	30.2	30.2	17.5	17.5	17.5	<0.1	<0.1
B4	29.7	29.7	29.7	17.4	17.4	17.4	<0.1	<0.1
C0	39.0	39.3	39.3	18.7	18.7	18.7	<0.1	<0.1
C1	33.7	33.8	33.8	17.9	18.0	18.0	<0.1	<0.1
C2	31.1	31.1	31.1	17.6	17.6	17.6	<0.1	<0.1
D0	36.2	36.4	36.4	18.3	18.4	18.4	<0.1	<0.1
D1	33.3	33.4	33.4	17.9	17.9	17.9	<0.1	<0.1
D2	31.2	31.3	31.3	17.6	17.6	17.6	<0.1	<0.1
E0	35.7	35.9	35.9	18.3	18.3	18.3	<0.1	<0.1
E1	33.2	33.4	33.4	17.9	17.9	17.9	<0.1	<0.1
F0	37.9	38.2	38.2	18.8	18.8	18.8	<0.1	<0.1
F1	33.3	33.5	33.5	17.9	18.0	18.0	<0.1	<0.1
G0	39.8	40.1	40.1	19.0	19.1	19.1	<0.1	<0.1
G1	33.6	33.8	33.8	18.0	18.0	18.0	<0.1	<0.1
G2	31.0	31.1	31.1	17.6	17.6	17.6	<0.1	<0.1
G3	30.1	30.1	30.1	17.5	17.5	17.5	<0.1	<0.1

Note: exceedances of $40\mu\text{g}/\text{m}^3$ are shown in bold. This is the annual mean objective for residential locations.

In the base year scenario, the model predicts annual mean NO₂ concentrations to be very slightly above $40\mu\text{g}/\text{m}^3$ at G0, which is located close to the Oxford Road / Bedford Road junction. It is worth noting however, that the objective will not apply at this location, due to it being used for retail purposes and not being residential. At all other locations, concentrations below $40\mu\text{g}/\text{m}^3$ are predicted. Therefore, there are no exceedances of the annual mean objective are predicted at any location.

A reduction in concentrations can be observed with increases in height and distance from the main road sources.

The annual mean NO₂ concentrations are reasonable when compared to the data collected at the both the 165 Oxford Road and 10 Trinity Place monitoring sites, with concentrations representing values in between their respective 2015 annual means. Pollutant concentrations are expected to be lower at the development site than the 165 Oxford Road site due to the increased distance from the kerbside. In contrast, concentrations are expected to be higher at the development site than the 10 Trinity place site, due to this site being located further away from the main traffic intersection where Oxford Road is intersected by Bedford Road.

The Guidance states that authorities may assume exceedances of the mean hourly objective are only likely to occur where annual mean concentrations are 60 µg/m³ or above. Therefore, it is considered highly unlikely that this objective will be exceeded at any of the receptors.

The model has also been run for a with and without development scenario for 2019. The results indicate that annual mean NO₂ concentrations would change by <0.1 µg/m³ at all modelled receptor locations.

The model estimates no exceedance against the annual mean PM₁₀ objective. Potential exceedances of the daily mean PM₁₀ objective can be estimated based on the annual mean¹⁹, such that:

$$\text{No. 24 - hour mean exceedances} = -18.5 + 0.00145 \times \text{Annual Mean}^3 + \left(\frac{206}{\text{Annual Mean}} \right)$$

On this basis, it is estimated that in 2019 there will be 2 potential exceedances of the daily mean PM₁₀ limit value, regardless of whether the development takes place or not. Therefore, the daily mean PM₁₀ objective would be met as 35 exceedances of limit value are allowed per year.

3.2 Significance

Professional judgement is an important part of the assessment of significance. However, there are various documents available that attempt to qualitatively or quantitatively provide ways of assessing the significance of a development on air quality. The most commonly applied is Environmental Protection UK's Air Quality Guidance Document²⁰ which outlines how impacts may be assessed quantitatively. The assessment is made up of two steps – firstly to assess the magnitude of change in concentration (e.g. between with and without development) relative to the objective level, and secondly the percentage above / below the objective based upon the total modelled concentration at a given location or receptor. By combining these two values, you can obtain the impact descriptor. This method is presented in Table 5 below.

Table 5: Significance of change description

Long term average concentration at receptor in assessment year	% Change in concentration 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

¹⁹ Paragraph 7.92 of LAQM TG(16)

²⁰ <http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>

In addition to the criteria provided above, the Guidance document states that the table is intended to be used by rounding the change in percentage pollutant concentrations to whole numbers. Changes of 0% i.e. less than 0.5% are described as negligible.

In applying these criteria, it can be concluded that the impact of the development on local annual mean NO₂ concentrations is likely to be 'negligible', as the change in concentration due to the development is 0 % of the Air Quality Assessment Level (AQAL) at all locations.

However, this is a fairly simplistic conclusion and other factors may also need to be considered in order to make transparent conclusions. Specific factors to consider may include:

1. Number of properties affected by the slight, moderate or major impacts and a judgement of the overall balance.
2. Where new exposure is being introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant.
3. The magnitude of the changes and descriptions of the impacts at the receptors
4. Whether or not an exceedance of an objective or limit value is predicted to arise in the study area where none existed before or an exceedance area is substantially increased.
5. Whether or not the study area exceeds an objective or limit value and this exceedance is removed or the exceedance area is reduced.
6. Uncertainty, including the extent to which worst case assumptions have been made.
7. The extent to which an objective or limit value is exceeded, for example an annual mean of 41 µg/m³ should attract less significance than an annual mean of 51 µg/m³.

In this case, none of the above criteria are of significance, suggesting that there will be no concerns in terms of increasing exposure to harmful pollutant concentrations across the study area.

3.3 Mitigation Measures

Based on the ADMS results for estimated NO₂ concentrations, there is no specific requirement for mitigation as the residential component of the development is located from the first floor upwards, where concentrations are below the objectives.

However, the developer is encouraged to consider mitigation measures in order to reduce the emissions arising from the site. However, it is noted that cycle storage has already been proposed, the development is located in proximity to rail and bus services, and the lack of specific parking for residents will act as a deterrent for the use of private vehicles⁷.

In order to minimise potential cumulative effects from major developments²¹, the Institute of Air Quality Management (IAQM) has provided guidance on the principles of good practice²² which should be applied to all major development. Examples of good practice include:

- The provision of at least 1 Electric Vehicle (EV) “rapid charge” point per 10 residential dwellings and/or 1000 m² of commercial floor space. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made. This will not be applicable to this development as no car parking is being provided.
- Where the development generates significant additional traffic, a detailed travel plan should be implemented. This will not be applicable to this development as no / or a low traffic generation is predicted
- All gas-fired boilers to meet a minimum standard of < 40 mg NO_x/kWh
- All gas-fired CHP plant to meet a minimum emission standard of:
 - Spark ignition engine: 250 mg NO_x /Nm³
 - Compression ignition engine: 50 mg NO_x /Nm³
 - Gas turbine: 50 mg NO_x /Nm³
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of:
 - Solid biomass boiler: 275 mg NO_x /Nm³ and 25 mg PM /Nm³

3.4 Mitigating the Impacts of the Construction Phase

Emissions and dust from the construction phase of a development can have a significant impact on local air quality. The Institute of Air Quality Management (IAQM) has produced a document titled ‘Guidance on the assessment of dust from demolition and construction’²³ published in May 2015. This guidance contains a methodology for determining the significance of construction developments on local air quality using a simple four step process:

- STEP 1: Screen the requirement for a more detailed assessment
- STEP 2: Assess the risk of dust impacts
- STEP 3: Determine any required site-specific mitigation
- STEP 4: Define post mitigation effects and their significance

²¹ Major developments can be defined as developments where:

- The number of dwellings is 10 or above
- The residential development is carried out on a site of more than 0.5ha where the number of dwellings is unknown
- The provision of more than 1000 m² commercial floor space
- Development carried out on land of 1ha or more
- Developments which introduce new exposure into an area of existing poor air quality (e.g. an AQMA) should also be considered in this context.

²² <http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>

²³ <http://iaqm.co.uk/guidance/>

The risk of dust emissions from a demolition/ construction site causing loss of amenity and/ or ecological impacts is related to a number of factors, including: the activities being undertaken; the duration of these activities; the size of the site; the mitigation measures implemented and meteorological conditions. In addition, the proximity of receptors to the site and the sensitivity of these receptors to dust, impacts the level of risk from dust emissions. Receptors include both 'human receptors' and 'ecological receptors'. The former refers to a location where a person or property may experience adverse effects for airborne dust or dust soiling, or exposure to PM₁₀, over a time period relevant to the air quality objectives (see Table 1). Ecological receptors are defined as any sensitive habitat affected by dust soiling, through both direct and indirect effects. Following assessment of the impacts of dust as a result of the development, a qualitative risk impact level can be assigned, ranging from 'negligible' to 'high risk'. Based on the designated risk impact level, the mitigation measures which are appropriate for all sites and are applicable specifically to demolition, earthworks, construction and trackout can be determined. Examples of the general measures include:

- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site
- Ensure all vehicles switch off engines when stationary – no idling vehicles
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable
- Ensure all loads entering and leaving the site are covered
- Ensure an adequate water supply on the site for effective dust / particulate matter suppression / mitigation

The use of the outlined IAQM methodology for assessing the impacts of dust from demolition/ construction is considered to be current best practice. Therefore, it is recommended that the developer refers to the relevant IAQM documentation, to help reduce the impact of dust and vehicle exhaust emissions, and liaises with the Local Authority to come up with an acceptable dust management strategy.

4. Summary and Conclusions

An air quality assessment has been undertaken for a proposed mixed residential/retail development at 118a Oxford Road & 2 Bedford road. Reading Borough Council has declared an Air Quality Management Area (AQMA) due to exceedances of the annual mean nitrogen dioxide (NO₂) objective., across Reading's central extent and all arterial roads radiating outwards from its Centre. The proposed development lies within the AQMA along one of the major arterial roads.

A conservative approach has been taken in that no improvement in the pollutant background concentrations or road transport emission factors has been assumed between the base year (2015) and the first year of occupation (2019). With expected improvements to the traffic fleet, improvements in pollutant concentrations may however materialise.

An air quality assessment has been carried out using the ADMS-Roads dispersion model to determine the impact of emissions from road traffic on sensitive receptors. Predicted concentrations have been compared with the air quality objectives. The results of the assessment indicate that annual mean nitrogen dioxide (NO₂) concentrations are below the objective in the 'without' and 'with' development scenario. Concentrations of particulate matter (PM₁₀) are also predicted to be below the annual mean objective in the 'without' and 'with' development scenario. Based on the evidence, it is also estimated that there will be no exceedances of either short term objective for NO₂ or PM₁₀. There is no requirement for mitigation as concentrations are determined to be sufficiently below the annual mean NO₂ objective for the residential component of the development, located from the first floor upwards. However, the developer is encouraged to consider other measures to reduce the emissions arising from the development; this includes installing low NO_x boilers.

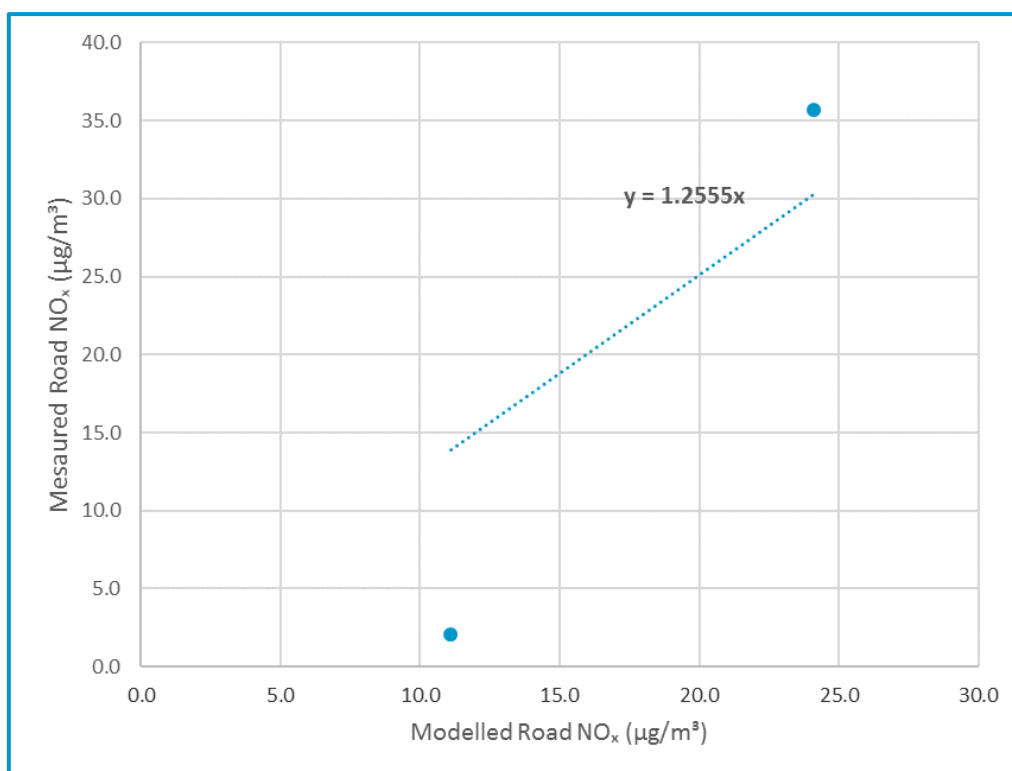
Appendix A – Model Verification

In order to verify modelled pollutant concentrations generated in the assessment, the model has been run to predict the annual mean road-NO_x concentration during 2015 at the Oxford Road and Trinity Place diffusion tube sites described in Table 2. Whilst the Tilehurst Road diffusion tube site is within close proximity to the development, it could not be used in the verification as the measured NO₂ concentration when converted to road NO_x, using the NO_x to NO₂ calculator gave negative values ¹⁵.

The model output of road-NO_x for the 2 sites has been compared with the 'measured' road-NO_x. Measured NO_x for the monitoring sites was calculated using the NO_x to NO₂ calculator.

A primary adjustment factor was determined to convert between the 'measured' road contribution and the model derived road contribution (Figure A.1). This factor was then applied to the modelled road-NO_x concentration for each receptor to provide adjusted modelled road-NO_x concentrations. Total NO₂ concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the 2015 background NO₂ concentration.

Figure A.1: Comparison of Measured road-NO_x to unadjusted modelled road-NO_x concentrations



RMSE

The root mean square error (RMSE) is used to define the average error or uncertainty of the model output. In the case of this assessment, the RMSE was performed on non-adjusted total NO₂ concentrations to assess whether the model was predicting comparative concentrations for 10

Trinity Place and 165 Oxford Road, diffusion tube sites. The following RMSE value has been calculated: 4.6

If the RMSE values are higher than $\pm 25\%$ of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. In this case the model is being assessed against the annual mean objectives, which is $40 \mu\text{g}/\text{m}^3$ for NO_2 . An RMSE value of less than $10 \mu\text{g}/\text{m}^3$ is obtained and therefore the model behaviour is deemed acceptable.

Appendix B – Traffic Data

Table B.1: Traffic data for 2015 (and prediction for 2019 without development)

Development / verification site	Road links	Annual Average Daily Traffic (AADT)	% Heavy Duty Vehicles (HDV)	Speed (kph)
Development site	Oxford Road	13,426 (14,139)	6.8	48
	Chatnam Road (also applied to Bedford Road)	16,245 (17,108)	3.9	48
	Castle Hill (also applied to Tilehurst Road)	21,371 (22,506)	3.4	48
	Minor Roads	2,300 (2,422)	2.4	48

Note: With development results in an average daily traffic increase of 34 vehicles on all roads that have direct access to the site.



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