

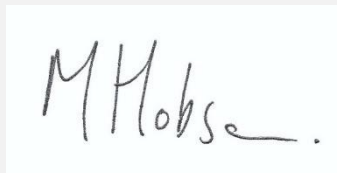
The background of the entire page is a photograph of a city street during the day. In the foreground, there is a line of traffic, including several white delivery vans and a dark SUV. The road has white lane markings and a yellow dashed line. In the background, there are trees with autumn-colored leaves and a tall, modern building. A large, semi-transparent white circle is overlaid on the left side of the image, containing the title and subtitle text.

**Air Quality Assessment for
the proposed development
at 33 Bedford Road, Reading**

Report to Rigby Architects

December 2018

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Author(s)	Lucy Garland
Reviewed by	Melanie Hobson
Signature	
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Company Details:	Aether Ltd Oxford Centre for Innovation New Road Oxford OX1 1BY UK Registered in England 6630896
Contact:	enquiries@aether-uk.com +44(0)1865 261466 www.aether-uk.com

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1 Introduction

Aether has been commissioned by Rigby Architects to undertake an air quality assessment for the proposed development at 33 Bedford Road, Reading. The development is residential, consisting of the demolition of the current building and the construction of nine flats and maisonettes.

The development falls within Reading Borough, 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 2020. The assessment has therefore been completed for 2021, the expected first full year of occupation.

1.1 The Location of the Development

The proposed development is located at the corner of Bedford Road and Battle Street. (Figure 1).

Figure 1: Location of the development site



1.2 Assessment Criteria

A summary of the air quality objectives relevant to the Reading 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 (99.8th 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 (90.4th 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
- 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 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 development. The hourly objective will apply at all locations where members of the public could reasonably be expected to spend that

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>

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 declared one AQMA³ in 2009 covering the central area along with all the major arterial roads into and out of town. This AQMA replaced the original six AQMAs, declared in 2006. The AQMAs were declared due to exceedances of the annual NO₂ objective. The proposed development falls within the AQMA. The most recent AQAP was published in 2016, which includes some specific measures such as expansion of the ReadyBike cycle hire scheme and improving traffic signals to reduce congestion³.

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.

The most recent version of ADMS-Roads (v4.1.1) was issued in January 2018 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
- **Output:** Output required and sources/groups to include in the calculations.

³ http://www.reading.gov.uk/media/6389/Air-Quality-Action-Plan/pdf/AQAP_Update_2016.pdf

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.

2.1.1 Local monitoring data

Reading Borough has four automatic monitoring sites which monitor nitrogen dioxide (NO₂) and particulate matter (PM₁₀). Unfortunately, none of these automatic monitoring sites lie within close proximity of the development. NO₂ concentrations are also measured passively at diffusion tube sites across the Borough. Seven of these diffusion tube sites lie within close proximity of the development site. Details of these monitoring sites are given in **Table 2**.

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

Table 2: Monitoring sites within 500 m of the 33 Bedford Road, Reading development

Site Name	Site Type	Pollutant(s)	Grid Reference	Distance to Kerb (m)	Approx. Distance to development site (m)
DT32	R	NO ₂	470294, 173445	6.5	410
DT33	R	NO ₂	470717, 173373	4.0	180
DT34	R	NO ₂	470738, 173433	7.5	130
DT35	R	NO ₂	471113, 173487	5.0	430
DT36	R	NO ₂	471177, 173641	0.5	500
DT17	R	NO ₂	470628, 173076	3.0	480
DT42	R	NO ₂	471123, 173734	3.0	470

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 Borough has applied a national bias adjustment factor (1.03) to their 2016 diffusion tube results.

Monitoring results are presented in **Table 3**. The data shows that the annual mean NO₂ objective was exceeded every year, between 2014 and 2016, at the DT17, DT32 and

⁴ http://www.reading.gov.uk/media/6388/Air-Quality-Annual-Status-Report/pdf/Reading_2017_Annual_Status_Report.pdf

⁵ This is a national QA/QC scheme.

DT33 monitoring sites and once (in 2014) at the DT 42 monitoring site. 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 $\mu\text{g}/\text{m}^3$. Therefore, no exceedances of the hourly mean objectives are expected at the diffusion tube monitoring sites.

Table 3: Monitoring results for sites close to the proposed development site, 2014-2016

Objective	Site Name	2014	2015	2016
Annual mean NO ₂ ($\mu\text{g}/\text{m}^3$)	DT32	48	45	44
	DT33	51	47	44
	DT34	32	31	31
	DT35	34	30	32
	DT36	35	29	30
	DT17	51	48	43
	DT42	43	40	37

Values exceeding the 40 $\mu\text{g}/\text{m}^3$ annual mean objective are shown in bold

2.1.2 Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website⁷ and data has been extracted for Reading Borough for this assessment. These 2015 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 42.7 $\mu\text{g}/\text{m}^3$, 26.8 $\mu\text{g}/\text{m}^3$ and 15.2 $\mu\text{g}/\text{m}^3$ respectively in 2016. For 2021 (the estimated first full year of occupation), the concentrations obtained for the same pollutants are 34.1 $\mu\text{g}/\text{m}^3$, 22.5 $\mu\text{g}/\text{m}^3$ and 14.3 $\mu\text{g}/\text{m}^3$ respectively.

Due to the lack of a nearby urban background monitoring site, the 2016 mapped background concentrations have been used in this assessment. To provide a conservative estimate, the projected improvements in background air quality by 2021 have not been used in the dispersion modelling.

2.2 Model input data

Hourly meteorological data from Heathrow for 2016 has been used in the model. The wind-rose diagram (**Figure 2**) presents this below.

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>

Figure 2: Wind-rose diagram for Heathrow meteorological data, 2016

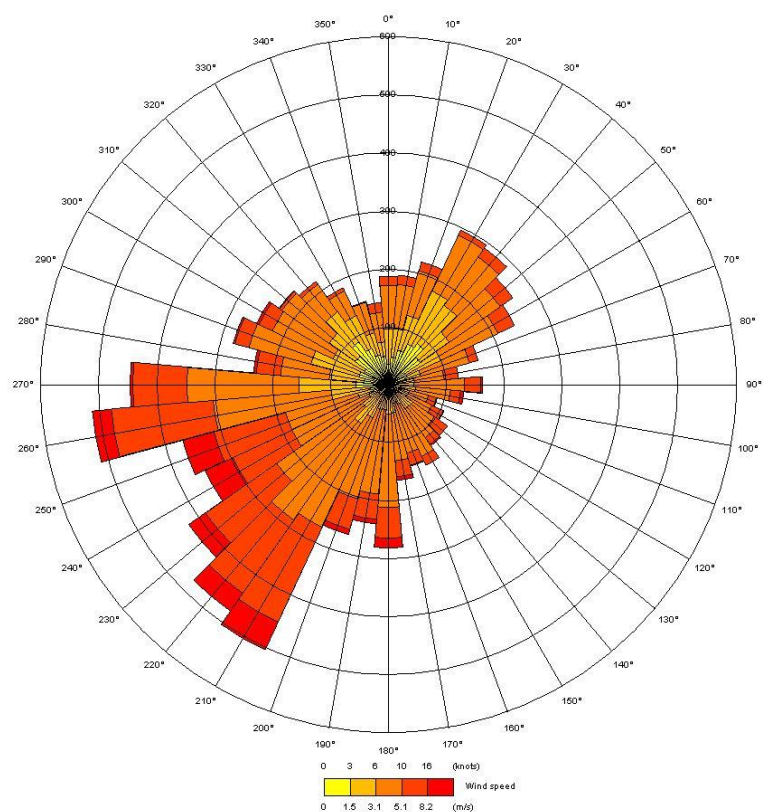
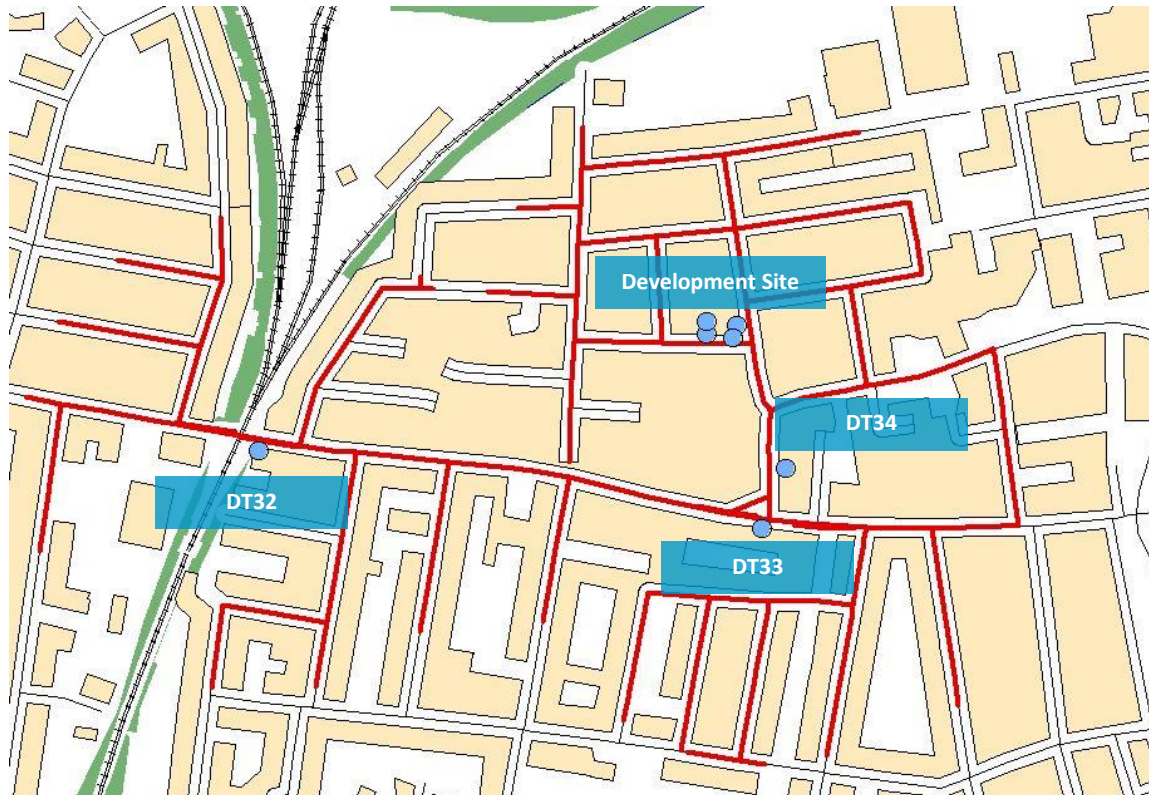


Figure 3: Road sources and receptors



Contains Ordnance Survey data © Crown copyright and database right [2018]

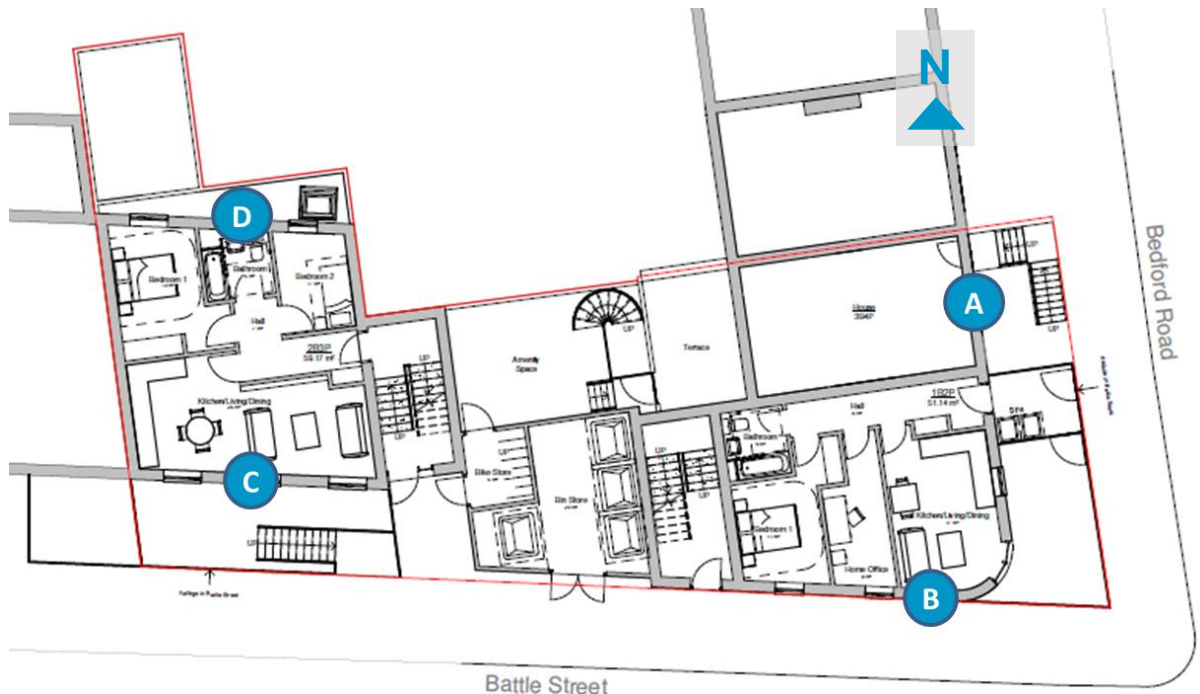
ArcMap software has been used to model the road source locations (red lines) that are within 200 metres of the receptor locations (blue circles). This data can then be automatically uploaded to ADMS-Roads. This generates an accurate representation of the surrounding area to be assessed in the model in 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.

Four sensitive receptor locations have been selected for the assessment:

- A façade of the development, located closest to Bedford Road.
- B façade of the development, located closest to Battle Street
- C façade of the development, located on Battle Street but set back from the kerb
- D façade at the back of the development, representing the drop off in pollutant concentrations with distance from the road.

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 (blue circles). An assessment is made for the receptors at varying heights to assess likely concentrations across floor levels. It has been assumed that background concentrations remain constant at all heights of the development based on the 2017 City Air Quality at Height report⁸. Exposure has been assumed to be represented at the mid-point of each floor. In the case of the lower ground floor, relevant for receptors A and C, ground height has been used.

Figure 4: The location of the receptors used in the modelling



⁸ <http://www.wsp-pb.com/PageFiles/80156/WSPPB%20City%20Air%20Quality%20at%20Height.pdf>

2.3 Traffic data

Average annual daily traffic (AADT) count data for 2016 (the selected baseline year) has been obtained for Chatham Street and Oxford Road from Department for Transport (DfT) Traffic Counts⁹, which provides data for major roads. 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, 2016¹⁰. Therefore there will be uncertainty in the model input. Bedford Road and Battle Street are minor roads and therefore no specific traffic data is available. 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 RTF¹¹ model has been utilised to project traffic growth. It has been assumed that traffic on local roads will increase by 6.6 % between 2016 and 2021.

The proposed development does not include car parking spaces and no Transport Assessment was undertaken; therefore it is assumed that the impact of the development on local traffic will be negligible and no additional trips a day has been assumed. Results (Section 3 of this report) therefore refer to concentrations modelled in 2021 regardless of whether the development takes place or not. As a result, the assessment and its conclusions are focused on the exposure of residents to currently elevated levels of pollutant concentrations, rather than assessing the impacts of the development per se.

An average speed of 25.2 kph has been assumed on all surrounding roads, which is the average traffic speed on 'A' roads in Reading in 2016¹².

2.3.1 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 4 m. 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 of pre-defined length, representing each queue with time-varying emission profiles applied to represent busy periods.

⁹ <http://www.dft.gov.uk/traffic-counts>

¹⁰ <http://www.dft.gov.uk/statistics/series/traffic/>

¹¹ <http://laqm.defra.gov.uk/documents/RTF-Automated-Traffic-Growth-Calculator-v3-1.xls>

¹² DfT road congestion statistics: <https://www.gov.uk/government/collections/road-congestion-and-reliability-statistics>

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

¹⁴ Latest version 8.0, <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>

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 October 2017)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 an appropriate adjustment factor that can be 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 DT32, DT33 and DT34 diffusion tube sites (see **Appendix A**). These sites were selected because they represent the monitoring sites closest to the proposed development.

The adjustment factor determined for annual mean NO_x 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 (2016) and the development year (2021)¹⁸. Given the inherent uncertainties in the modelling, background pollutant concentrations and vehicle fleet emission factors have been maintained at 2016 levels in the development year scenarios to provide a conservative estimate. Traffic growth has been predicted using the RTF calculator.

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

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

¹⁷ Paragraph 7.529 of LAQM TG(16)

¹⁸ The development is not expected to impact local air quality (see Section 2).

Table 4: Estimated pollutant concentrations in 2016 and 2021 ($\mu\text{g}/\text{m}^3$)

Floor level	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	PM ₁₀ change
		2016	2021	2016	2021		
Lower Ground	A	29.2	29.4	15.6	15.6	0.2	<0.1
Ground	B	29.2	29.4	15.6	15.6	0.2	<0.1
Lower Ground	C	29.1	29.3	15.5	15.6	0.2	<0.1
Lower Ground	D	28.7	28.9	15.5	15.5	0.1	<0.1
Ground	A	29.1	29.3	15.5	15.6	0.1	<0.1
First	B	28.9	29.1	15.5	15.5	0.1	<0.1
Ground	C	29.0	29.1	15.5	15.5	0.1	<0.1
Ground	D	28.7	28.8	15.5	15.5	0.1	<0.1
First	A	28.9	29.1	15.5	15.5	0.1	<0.1
Second	B	28.7	28.8	15.5	15.5	0.1	<0.1
First	C	29.2	29.4	15.6	15.6	0.2	<0.1
First	D	29.2	29.4	15.6	15.6	0.2	<0.1

Note: The changes in NO₂ and PM₁₀ presented may not exactly equal the difference in the constituent parts shown due to rounding.

In the base year scenario, the model predicts annual mean NO₂ concentrations to be below (by at least 27 %) the annual mean objective at all locations. The worst-case location is identified as receptors A (on the lower ground floor level) and B (on the ground floor level). This is expected as these receptors are located closest to Bedford Road and Battle Street respectively, where roadside concentrations will be maximised.

The estimated annual mean NO₂ concentrations at the development site are reasonable when compared to the data collected at the DT32, DT33 and DT34 monitoring sites. The measured NO₂ concentrations at DT32 and DT 33 are higher than at the development. However, while the receptor sites are located a similar distance from the road (5m and 3m) compared to DT32 and DT33 (6.5m and 4m) both are located on Oxford road, a much busier road. The measured concentrations at DT34 is only marginally higher to those modelled at the development site despite the diffusion tube being located on Chatham Street, a much busier road. However, the diffusion tube is located further away from the road (7.5 m) compared to the development site (5m and 3m).

The Guidance states that authorities may assume exceedances of the hourly mean 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 future year scenario taking into account predicted general increases to traffic levels on local roads. The results indicate that annual mean NO₂ concentrations would increase by 0.2 µg/m³ at worst-case 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:

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

On this basis, it is estimated that in 2021 there will be no exceedances of the daily mean PM₁₀ limit value, regardless of whether the development takes place or not.

3.2 Mitigation Measures

Based on the ADMS results, there is no specific requirement for mitigation.

However, it is widely acknowledged that there is no safe level of exposure to air pollution²⁰, and as such, the developer is encouraged to consider mitigation measures to reduce emissions arising from the site. The National Planning Policy Framework²¹, requires new developments to support sustainable travel and air quality improvements. A key theme of the NPPF is that developments “should ensure that appropriate opportunities to promote sustainable transport can be – or have been taken up”. It states that developments should be located and designed where practical to:

¹⁹ Paragraph 7.92 of LAQM TG(16)

²⁰ <https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution>

²¹ <https://www.gov.uk/government/publications/national-planning-policy-framework--2> Published in July 2018

- Give priority to pedestrian and cycle movements, and have access to high quality public transport facilities
- Incorporate facilities for charging plug-in and other ultra-low emission vehicles
- A key tool to facilitate the above will be a Travel Plan. All developments which generate a significant amount of movement should be required to provide a Travel Plan.

Building on the NPPF, the Institute of Air Quality Management (IAQM) has provided guidance on the principles of good practice²² which should be applied to all major development²³. Examples of good practice include:

- (Not applicable) 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.
- (Not applicable) Where the development generates significant additional traffic, a detailed travel plan should be implemented.
- All gas-fired boilers to meet a minimum standard of < 40 mg NO_x/kWh
- (Not applicable) All gas-fired CHP plant to meet a minimum emissions standard of:
 - Spark ignition engine: 250 mg NO_x/Nm³
 - Compression ignition engine: 400 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

3.3 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 IAQM has produced a document titled ‘Guidance on the assessment of dust from demolition and construction’²⁴ 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.

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

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

²³ 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.

²⁴ <http://iaqm.co.uk/guidance/>

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 residential development at 33 Bedford Road, Reading. Reading Borough has declared one Air Quality Management Area (AQMA) due to the exceedance of the annual mean nitrogen dioxide (NO₂) objective. The proposed development falls within the AQMA.

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 (2016) and the first year of occupation (2021). With expected improvements to the traffic fleet, improvements in pollutant concentrations may however materialise.

The ADMS-Roads dispersion model has been used 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 NO₂ concentrations are below the objective in the base year scenario. Concentrations of particulate matter (PM₁₀) are also predicted to be below the annual mean objective in the base year scenario. Based on the evidence it is estimated that there will be no exceedances of either short term objective for NO₂ or PM₁₀. Therefore, no mitigation is

required as the air quality objectives are predicted to be met. Instead, other measures such as providing secure and covered cycle storage, and installing low NO_x boilers (if applicable), should be considered to reduce the emissions arising from the development. In addition, the developer is encouraged to refer to the IAQM's 'Guidance on the assessment of dust from demolition and construction' in order to minimise the impact of the construction/demolition phase on local air quality.

Appendix A – Model Verification

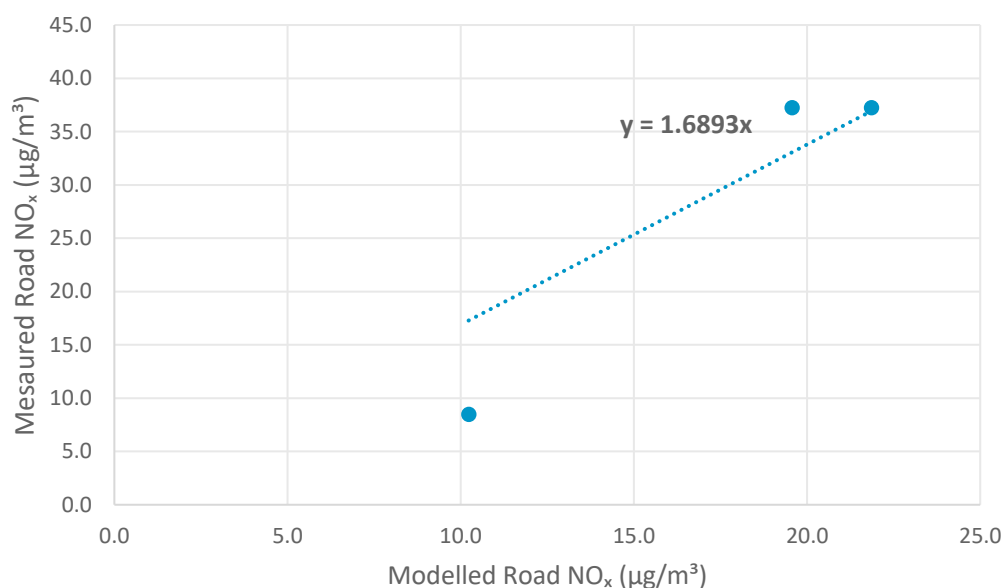
In order to verify modelled pollutant concentrations generated in the assessment, the model has been run to predict the annual mean road-NO_x concentration during 2016 at the no automatic monitor and three diffusion tube sites described in **Table 2**.

The model output of road-NO_x has been compared with the 'measured' road-NO_x. Measured NO_x for the monitoring sites was calculated using the NO_x to NO₂ calculator¹⁶.

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 2016 background NO₂ concentration.

The results imply that the model overall was under-predicting the road-NO_x contribution. The best match is with the DT34 site, with the DT32 and DT33 underpredicting road-NO_x contributions. For DT32 this could possibly be due to the site's close proximity to a raised railway line. For the DT33 monitoring site the underprediction could be due to underestimating the traffic flow. The traffic count data point for Oxford Road is located 700 m further west of the site while the site is located at the busy junction between Oxford Road and Chatham Road.

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. The following RMSE value has been calculated:

NO₂: 6

If the RMSE values are higher than ±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 objective, 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 acceptable.

Appendix B – Traffic Data

Table B.1: Traffic data for 2016 (and prediction for 2021 without development)

Development/ verification site	Road links	Annual Average Daily Traffic (AADT)	% Heavy Duty Vehicles (HDV)	Speed (kph)
Development site	Chatham Road	16,708 (17,802)	3.7	25
	Oxford Road	13,721 (14,620)	6.6	25
	Minor Roads	2,300 (2,451)	2.0	25
	Oxford Road traffic	30,000 (31,965)	6.6	5

Note: The development is not expected to result in any additional daily traffic



Air quality assessment for the proposed development at 33 Bedford Road, Reading



Oxford Centre for Innovation

New Road

Oxford

OX1 1BY UK

+44(0)1865 261466

www.aether-uk.com