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

Report to Davis Planning Ltd

July 2018

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1 Introduction

Aether has been commissioned by Davis Planning Ltd to undertake an air quality assessment for the proposed development at the Land to the rear of 173-175 & 177 Kings Road, Reading. Aether conducted an assessment for this site in 2015. Air quality concentrations on the ground and first floor of the development were found to be in exceedance of, or close to, the annual mean nitrogen dioxide (NO₂) objective. It was recommended that mechanical ventilation is installed with inlets at the rear of the building at the main roof level of the building and circulated to all other floors of the development. The site plans have now been updated, and on this basis a revised assessment is required.

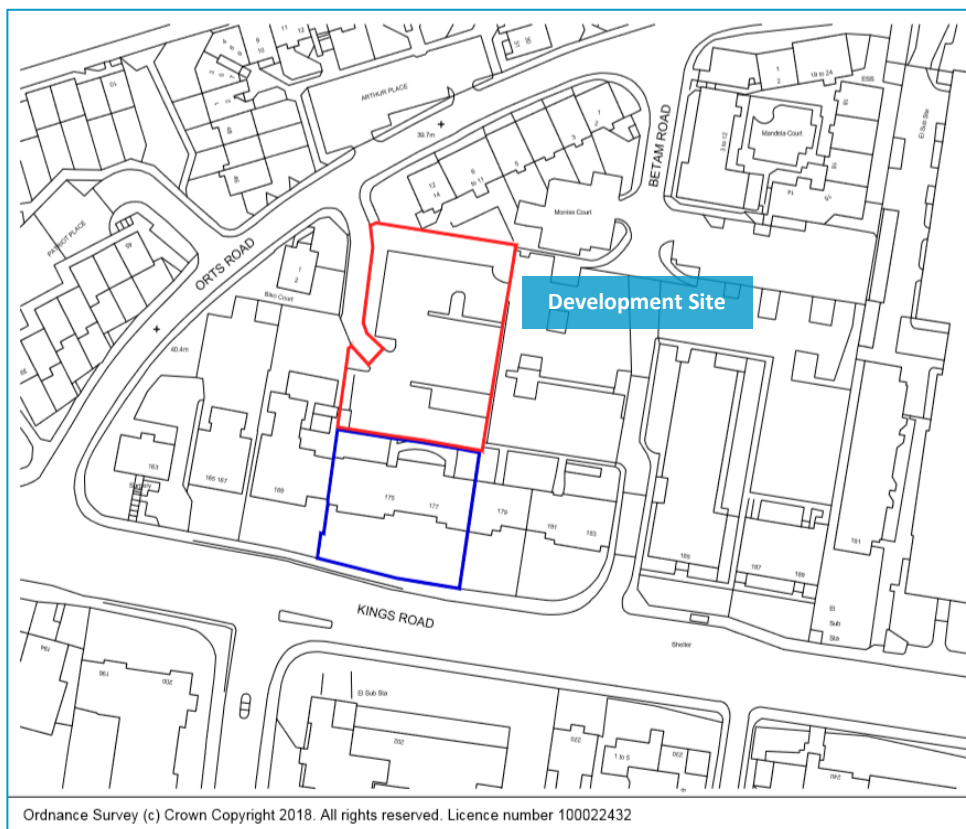
The development falls within Reading Borough Council, which suffers from elevated levels of air pollution, primarily due to high levels of traffic. It is therefore important to assess whether there will be an exceedance of the air quality objectives for particulate matter (PM₁₀) or NO₂ at the proposed 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 rear of 173-175 & 177 Kings Road, Reading (Figure 1).

Figure 1: Location of the development site



1.2 Assessment Criteria

A summary of the air quality objectives relevant to the Kings Road 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 residential development. The hourly objective will apply at all locations where members of the public could reasonably be expected to

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>

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 currently has one active Air Quality Management Area (AQMA) which covers all the major arterial roads in and out of the town as well as the central area. This AQMA was declared in 2009 due to exceedances of the annual mean NO₂ objective³. The proposed development lies within this AQMA. An AQAP has also been produced and was updated in 2016⁴. Examples of actions outlined in the action plan include the improvement of cycling infrastructure, electrification of the public vehicle fleet and reducing emissions from idling vehicles at hotspot locations.

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 https://uk-air.defra.gov.uk/aqma/details?aqma_ref=467

⁴ 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 Council has four automatic monitoring sites which monitor NO₂ and PM₁₀, although none of these lie in close proximity to the development site. NO₂ concentrations are also measured passively at 62 diffusion tube sites across the Borough. Three of these diffusion tube sites lie within 600 m of the development site. Details of the monitoring sites nearest to the development site are given in **Table 2**.

Monitoring results have been taken from the Council's latest Annual Status Report (ASR)⁵.

Table 2: Monitoring sites closest to the Kings Road development

Site Name	Site Type	Pollutant(s)	Grid Reference	Distance to Kerb (m)	Approx. Distance to development site (m)
276 Kings Rd	R	NO ₂	472716, 173218	10	250
Kings Oak Flat - Queens Rd	R	NO ₂	472010, 173222	5.5	480
Wycliffe Church	R	NO ₂	473072, 173204	2	600

*Note: R = roadside, * automatic monitor*

The diffusion tubes were analysed by Gradko International Ltd, who participate in the Proficiency scheme⁶. 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 Council 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 in 2016 at the Wycliffe Church monitor. Diffusion tubes do not provide information on hourly exceedances, but research⁷ identified a relationship between the annual and 1 hour mean objective, such that exceedances of the latter

⁵ http://www.reading.gov.uk/media/6388/Air-Quality-Annual-Status-Report/pdf/Reading_2017_Annual_Status_Report.pdf

⁶ This is a national QA/QC scheme.

⁷ As described in Box 5.2 of LAQM Technical Guidance (TG16).

were considered unlikely where the annual mean was below 60 $\mu\text{g}/\text{m}^3$. Therefore, no exceedances of the 1 hour mean objective for NO_2 are expected.

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

Objective	Site Name	2014	2015	2016
Annual mean NO_2 ($\mu\text{g}/\text{m}^3$)	276 Kings Rd	37	33	32
	Kings Oak Flat - Queens Rd	38	33	33
	Wycliffe Church	NA	NA	49

Note: Values exceeding the 40 $\mu\text{g}/\text{m}^3$ annual mean objective are shown in bold, NA – data unavailable.

2.1.2 Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website⁸ and data has been extracted for Reading Borough Council 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 , NO_2 and PM_{10} concentrations around the development site are 39.2 $\mu\text{g}/\text{m}^3$, 25.4 $\mu\text{g}/\text{m}^3$ and 15.3 $\mu\text{g}/\text{m}^3$ respectively in 2016 (the baseline year used in the assessment). The background maps also provide projections to future years. For 2021 (the first estimated year of occupation), the concentrations obtained for the same pollutants are 31.4 $\mu\text{g}/\text{m}^3$, 21.2 $\mu\text{g}/\text{m}^3$ and 14.5 $\mu\text{g}/\text{m}^3$ 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 Traffic data

Average annual daily traffic (AADT) count data for 2016 (the selected baseline year) has been obtained for two positions along the A329, on Kings Road and Queen's Road, from Department for Transport (DfT) Traffic Counts⁹, which provides data for major roads. In the absence of any other data being available for other A roads and the minor roads, estimates are based upon average values for an 'urban A road, South East' and 'urban minor road, South East' respectively from the DfT National Road Traffic Survey, 2016¹⁰. 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 6.5 % between 2016 and 2021.

⁸ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>

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>

The proposed development is situated next to an existing car park, as a conservative estimate an additional 36 trips a day has been assumed, which represents an average of 4 daily journeys per dwelling (9 dwellings in total). The resulting estimated increase in daily car trips has been taken into account in the assessment for roads with direct access to the site with development in 2021. Results (**Section 3** of this report) therefore refer to concentrations modelled in 2021 both without and with the proposed development.

An average speed of 25.3 kph has been assumed on all surrounding A roads, which is the average traffic speed for travelling on A roads in Reading in 2016¹². This provides a worst-case scenario, as it is the slowest time period reported, resulting in highest exhaust emissions. In the absence of any other data being available, average speeds on local minor roads have been assumed based on the speed limit.

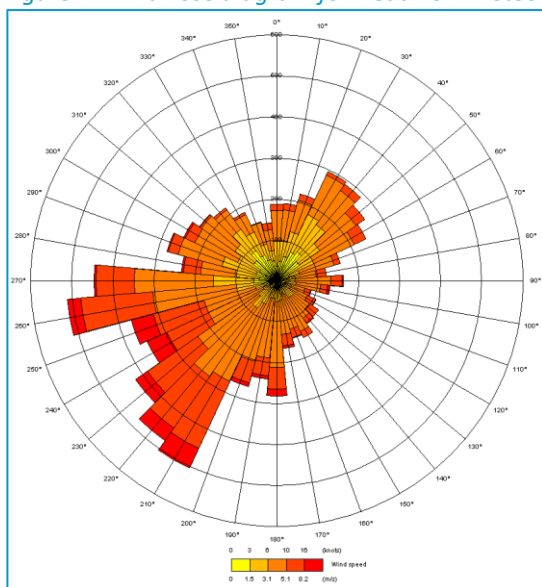
2.2.1 Queuing Traffic

Special consideration has been given to notable junctions modelled in this assessment. CERC note 60¹³ has been used for estimating emissions from queuing traffic on junctions along Queens Road, Kings Road and London Road. 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.

2.3 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.

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



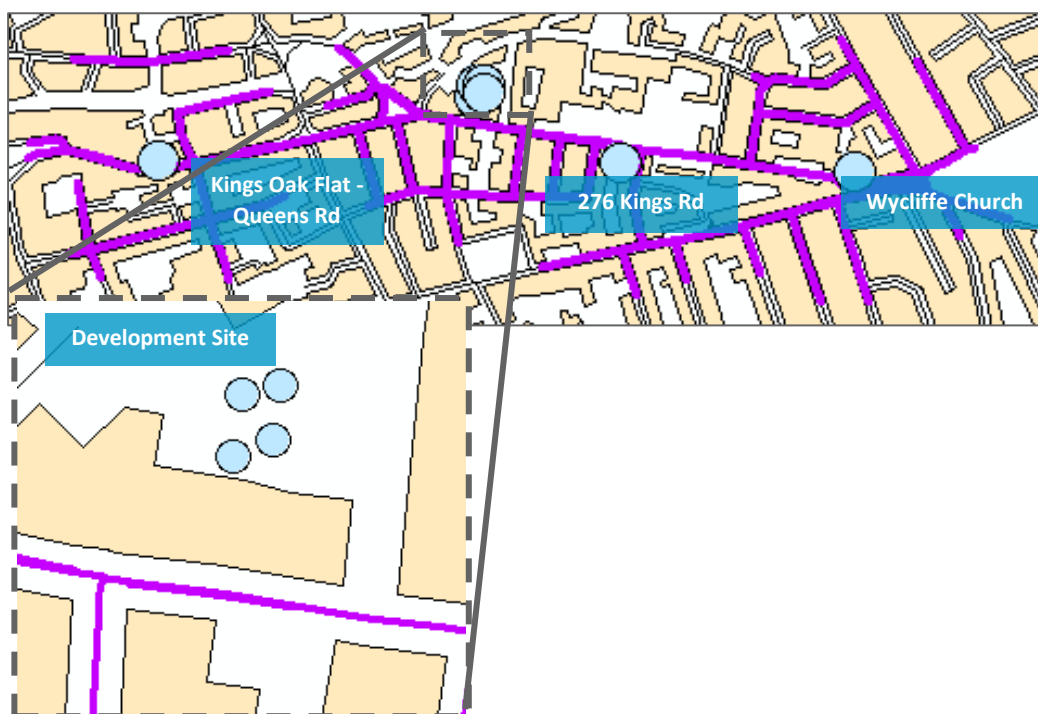
¹² Department for Transport statistics - Road congestion and travel times:

<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>

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 (purple 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.

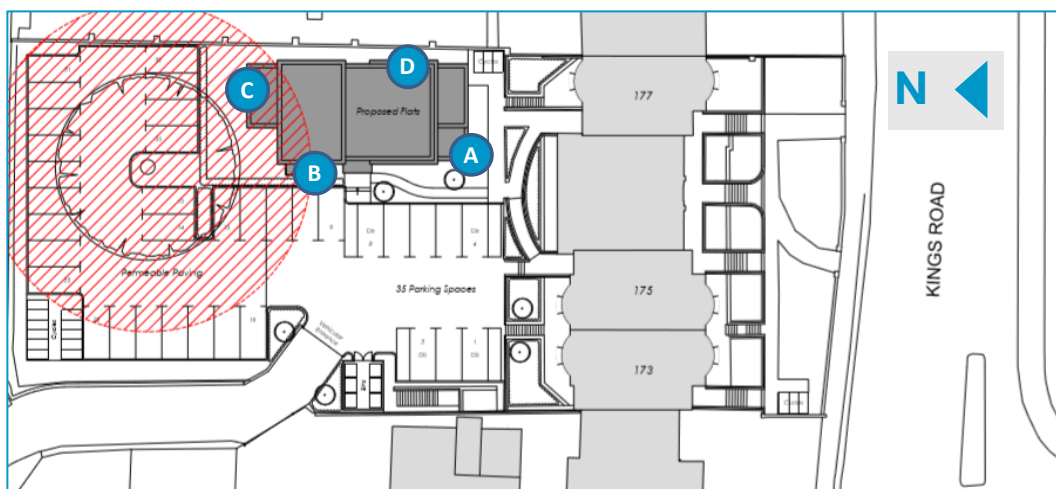
Four sensitive receptor locations have been selected for the assessment:

- A – South west corner of the development, located closest to Kings Road.
- B – Western facing façade of the development, located closest to Orts Road.
- C – Northern facing façade of the development, representing the drop off in emissions from Kings Road.
- D – Eastern facing façade of the development, close to Kings 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 report¹⁵. Exposure has been assumed to be represented at the mid-point of each floor.

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 increased¹⁶. 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)¹⁷ 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 three diffusion tube sites presented in Table 2 (see **Appendix A**). These sites were chosen due to their proximity to the proposed development and roadside location along the A329. However, it is worth noting that the Wycliffe Church site does not lie in close proximity to the development site and therefore there will be uncertainty in the modelled results.

¹⁵ <http://www.wsp-pb.com/PageFiles/n/80156/WSPPB%20City%20Air%20Quality%20at%20Height.pdf>

¹⁶ <http://uk-air.defra.gov.uk/assets/documents/reports/ageg/primary-no-trends.pdf>

¹⁷ <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc>

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 from Reading Borough Council, and this approach was considered more appropriate than not applying any adjustment¹⁸.

¹⁸ Paragraph 7.529 of LAQM TG(16)

3 Results

3.1 Results of the Dispersion Modelling

Table 5 below provides the estimated pollutant concentrations in the development year (2021) without and with¹⁹ development. 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.

¹⁹ 'With' development includes the impact of the additional traffic that will be generated with the development and the impact of the energy centre.

Table 5: Estimated pollutant concentrations in 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
		Without development	With development	Without development	With development		
Ground	A	33.0	33.1	15.3	15.3	<0.1	<0.1
	B	30.9	30.9	15.3	15.3	<0.1	<0.1
	C	30.3	30.3	15.3	15.3	<0.1	<0.1
	D	31.7	31.7	15.3	15.3	<0.1	<0.1
First	A	32.2	32.2	15.3	15.3	<0.1	<0.1
	B	30.5	30.5	15.3	15.3	<0.1	<0.1
	C	30.0	30.0	15.3	15.3	<0.1	<0.1
	D	31.1	31.1	15.3	15.3	<0.1	<0.1
Second	A	30.8	30.9	15.3	15.3	<0.1	<0.1
	B	29.8	29.8	15.3	15.3	<0.1	<0.1
	C	29.4	29.4	15.3	15.3	<0.1	<0.1
	D	30.2	30.2	15.3	15.3	<0.1	<0.1
Third	A	29.4	29.5	15.3	15.3	<0.1	<0.1
	B	28.9	28.9	15.3	15.3	<0.1	<0.1
	C	28.7	28.7	15.3	15.3	<0.1	<0.1
	D	29.1	29.1	15.3	15.3	<0.1	<0.1
Fourth	A	28.3	28.3	15.3	15.3	<0.1	<0.1
	B	28.1	28.1	15.3	15.3	<0.1	<0.1
	C	28.0	28.0	15.3	15.3	<0.1	<0.1
	D	28.1	28.2	15.3	15.3	<0.1	<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 without development, the model predicts annual mean NO₂ concentrations to be below (by > 17.4 %) the annual mean objective at all locations. The worst-case location is identified as receptor A (ground floor). This is expected given its proximity to Kings Road, 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 closest monitoring sites, 276 Kings Street and Kings Oak Flat - Queens Rd. The NO₂ concentrations measured at these monitoring sites are very similar to those modelled at receptor A, which is expected given their roadside position along the A329. Concentrations measured at the Wycliffe Church monitoring site are higher than those modelled at the proposed development, however this monitoring site is located kerbside at a busy junction between London Road (A4) and Kings Road (A329).

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 with development scenario taking into account predicted increases to traffic levels on local roads. The results indicate that annual mean NO₂ concentrations would change by <0.1 µg/m³ at all 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 mean²⁰, 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. Therefore, the daily mean PM₁₀ objective would be met.

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 Document²¹ 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 6** below.

Table 4: Significance of change description

²⁰ Paragraph 7.92 of LAQM TG(16)

²¹ <http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>

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

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.

The long term average concentration at the ground floor A receptor in the assessment year is 83% of the Air Quality Assessment Level (AQAL) and the change in concentration relative to the AQAL is <0.1%.

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 exposure to harmful pollutant concentrations across the study area.

3.3 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 pollution²², and as such, the developer is encouraged to consider further mitigation measures to reduce emissions arising from the site. The National Planning Policy Framework²³, requires new developments to support sustainable travel and air quality improvements. A key theme of the NPPF is that developments “should protect and exploit opportunities for the use of sustainable transport modes for the movements of good and people”. It states that developments should be located and designed where practical to:

- 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 development which generate significant amounts 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 practice²⁴ which should be applied to all major development²⁵. 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.
- 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

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 IAQM has produced a document titled ‘Guidance on the assessment of dust from demolition and construction’²⁶ 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

²² <https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution>

²³ <https://www.gov.uk/government/publications/national-planning-policy-framework--2> In March 2018, a new draft NPPF was published in March 2018.

²⁴ <http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>

²⁵ 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.

²⁶ <http://iaqm.co.uk/guidance/>

➤ 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 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 the Land to the rear of 173-175 & 177 Kings Road, Reading. Reading Borough Council currently has one active Air Quality Management Area (AQMA) which covers all the major arterial roads in and out of the town as well as the central area. This AQMA was declared in 2009 due to exceedances of the annual mean nitrogen dioxide (NO₂) objective. The proposed development lies within this 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.

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 NO₂ concentrations are below the objective in the 'without' and 'with' development scenarios. Concentrations of particulate matter (PM₁₀) are also predicted to be below the annual mean objective in the 'without' and 'with' development scenarios. Based on the evidence it is also 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 (included in the site plans), car share schemes, and installing an electric charging point, 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 phase on local air quality.

Appendix A – Model Verification

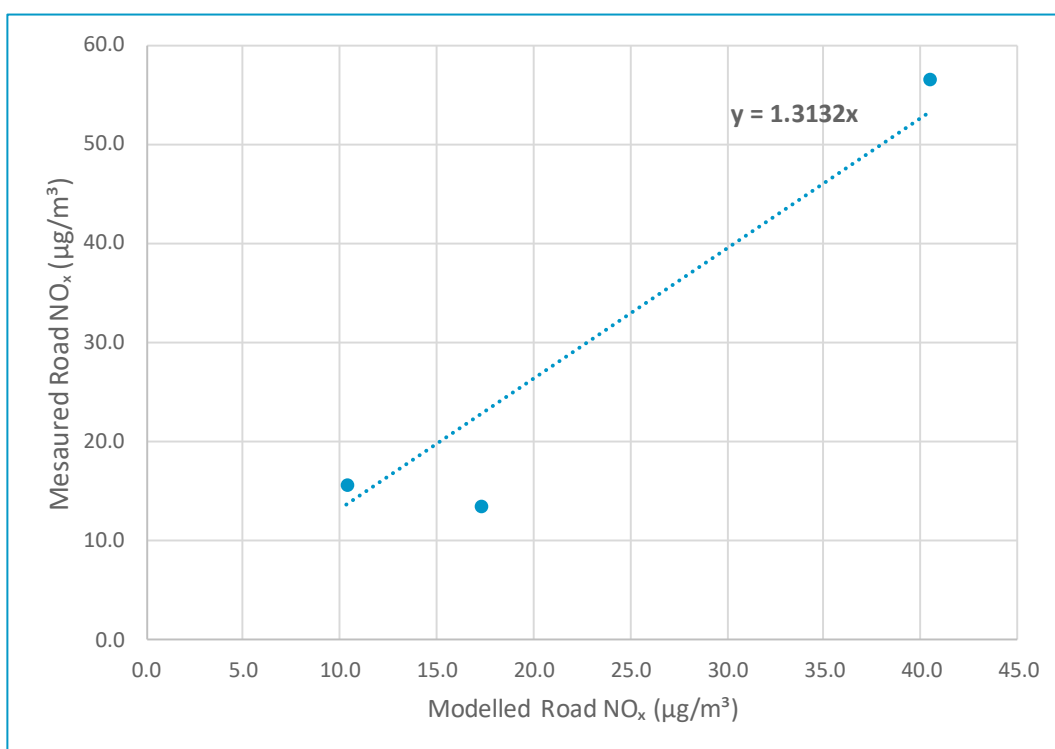
In order to verify modelled pollutant concentrations generated in the assessment, the model has been run to predict the annual mean road-NO_x concentration during 2016 at the three diffusion tube sites described in **Table 2**.

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 calculator¹⁷.

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 was under-predicting the road-NO_x contribution. This is a common experience with ADMS and most other models.

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: 4.17

If the RMSE value is 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 acceptable.

Appendix B – Traffic Data

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

Road links	Annual Average Daily Traffic (AADT)	% Heavy Duty Vehicles (HDV)	Speed (kph)
A329	21,396 (22,797)	5.2	25.3
A329 - W	20,773 (22,134)	2.3	25.3
Average minor roads	2,400 (2,557)	2.0	48.3
Average A roads	19,000 (20,245)	4.6	25.3

Note: With development results in an average daily traffic increase of 36 vehicles on all roads that have direct access to the site.



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