Air Quality Assessment for the proposed development at 199 – 207 Henley Road, Reading

Report to Henley Road Limited
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Aether

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Author	Rosie Brook
Approved by	Melanie Hobson
Signature	[redacted]
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Aether Contact Details	www.aether-uk.com enquiries@aether-uk.com
Aether Ltd Oxford Centre for Innovation New Road Oxford OX1 1BY	01865 261466
Registered office: Oxford Centre for Innovation, New Road, Oxford, OX1 1BY. Registered in England 6630896	

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1. Introduction

Aether has been commissioned by Henley Road Limited to undertake an air quality assessment for the proposed demolition and redevelopment of 199 – 203 Henley Road, and redevelopment to the rear of 205-207 Henley Road. The development will comprise of 60 residential dwellings with access from Henley Road, and associated internal access roads and landscaping. Car parking spaces will be provided with the development. No air pollutant emitting on-site energy generation is planned.

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 (PM_{10}) or nitrogen dioxide (NO_2) 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.

In addition, in response to a discussion with the Council[1], an air quality neutral buildings assessment has been undertaken. Reading Borough Council's Air Quality Policy DM19, requires that developments have regard to the need to improve air quality and reduce the effects of poor air quality through design, mitigation and where required planning obligations to be used to help improve local air quality. An air quality neutral assessment has therefore been completed, and mitigation measures suggested, to fulfil the requirements of this policy.

The expected completion date of the proposed development is 2019. The assessment has therefore been completed for 2020, the expected first full year of occupation.

[1] E-mail corresponded with Ross Jarvis, Senior Technical Officer on 13/09/2016

1.1 The Location of the Development

The proposed development is located at 199 – 207 Henley Road in Caversham, Reading (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 Strategy[2], is presented in Table 1 below.

Table 1: UK Air Quality Objectives for NO_2 and PM_{10}

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)

[2] 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

The oxides of nitrogen (NO_x) comprise principally of nitric oxide (NO) and nitrogen dioxide (NO_2). NO_2 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. NO_2 can also form in the atmosphere due to a chemical reaction between NO and ozone (O_3). Health based standards for NO_x generally relate to NO_2, 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 PM_{10}.

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 Pollutants[3].

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 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 spend that amount of time. Therefore, in this assessment the hourly objectives 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 AQMA[4] in 2009 covering Reading Town Centre due to exceedances of the annual mean NO_2 objective. The proposed development site falls within the AQMA. Following the declaration of the AQMA, an AQAP was published in 2009[5], which outlines a

[3] https://www.gov.uk/government/collections/comeap-reports
[4] https://uk-air.defra.gov.uk/aqma/details?aqma_id=263
[5] https://uk-air.defra.gov.uk/assets/documents/no2ten/Local_zone16_Reading_AQActionplan_1.pdf

range of measures and policies to be implemented to improve local air quality. The most recent update on the implementation of these measures is given in the Reading Borough Council 2016 Annual Status Report (ASR)[6].

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 (v4.0) was issued in November 2015 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 four automatic monitoring sites which monitor nitrogen dioxide (NO_2) and particulate matter (PM_{10}). NO_2 concentrations are also measured passively at diffusion tube sites across the Borough. Unfortunately, none of the monitoring sites lie within close proximity to

[6] Reading Borough Council's 2016 ASR is not currently publically available.

the development site. Details of the monitoring sites nearest to the development site are given in Table 2.

Monitoring results for 2015 have been taken from the Council's latest Annual Status Report (ASR). Monitoring results for earlier years have been taken from the Council's 2015 Updating and Screening Assessment (USA) Report[7].

Table 2: Monitoring sites in Reading

Site Name	Site Type	Pollutant(s)	Grid Reference	Distance to Kerb (m)	Approx. Distance to development site (m)
RD1*	R	NO_2, PM_{10}	471153, 174429	3	2,010
241 Gosbrook Road	R	NO_2	471942, 174600	6	1,230
60 Prospect Street	R	NO_2	471557, 174944	3	1,470
45 Prospect Street	R	NO_2	471558, 174919	1	1,470

Note: R = roadside, * automatic monitor.

The diffusion tubes were analysed by Gradko International Ltd, who participate in the Proficiency scheme[8]. 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 (0.98) to their 2015 diffusion tube results.

Monitoring results are presented in Table 3. The data shows that there have been exceedances of the annual mean NO_2 objective at the RD1 automatic monitor and the Prospect Street diffusion tube sites in recent years; however in 2015 no exceedances of the annual mean NO_2 objective were recorded at any of the sites. No exceedances of the annual mean NO_2 objective have been recorded at the Gosbrook diffusion tube site in the past three years, although the annual concentration was very close to the objective in 2014. A handful of exceedances of the 1 hour mean NO_2 objective have been recorded at the automatic monitor in recent years; however 18 exceedances are allowed per year and therefore the hourly objective was met. Diffusion tubes do not provide information on hourly exceedances, but research[9] 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/m^3. Therefore, it is considered unlikely that any exceedances of the 1 hour mean objective have occurred in recent years at any of the diffusion tube sites.

No exceedances of either the annual PM_{10} objective have been recorded at the automatic monitoring site in the past three years. Exceedances of the daily PM_{10} objective have been recorded; however 35 exceedances are allowed per year and therefore the daily objective was met.

[7] At the time of completing this report, the 2015 USA and 2016 ASR were not publically available.
[8] This is a national QA/ QC scheme.
[9] As described in Box 5.2 of LAQM Technical Guidance (TG16).

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)	RD1*	**43**	**41**	38
	241 Gosbrook Road	38	39	34
	60 Prospect Street	**40**	37	33
	45 Prospect Street	**45**	**42**	37
Hourly mean NO_2 (no. exceedances)	RD1*	3	0	1
Annual mean PM_{10} (µg/m^3)	RD1*	34	33	28
Daily mean PM_{10} (no. exceedances)	RD1*	34	31	8

Note: Values exceeding the 40 µg/m^3 annual mean objective are shown in bold, * automatic monitor

Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website[10] and data has been extracted for Reading 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, NO_2 and PM_{10} concentrations around the development site are 25.6 µg/m^3, 17.5 µg/m^3 and 13.7 µg/m^3 respectively in 2015 (the baseline year used in the assessment). The background maps also provide projections to future years. For 2020 (the first estimated year of occupation), the concentrations obtained for the same pollutants are 20.9 µg/m^3, 14.7 µg/m^3 and 13.1 µg/m^3 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 2020 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 for the A4155 (Henley Road) from Department for Transport (DfT) Traffic Counts[11], 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 England' from the DfT National Road Traffic Survey, 2015[12]. Therefore, there will be some 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.

[10] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html
[11] http://www.dft.gov.uk/traffic-counts
[12] http://www.dft.gov.uk/statistics/series/traffic/

For the purpose of this assessment, the RTF[13] model has been utilised to project traffic growth. It has been assumed that traffic on local roads will increase by 6.6 % between 2015 and 2020.

The Transport Assessment concludes that the development will result in a maximum of 248 two-way additional daily vehicular trips[14]. 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 2020. Results (Section 3 of this report) therefore refer to concentrations modelled in 2020 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 60[15] 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)[16] 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.

[13] http://laqm.defra.gov.uk/documents/RTF-Automated-Traffic-Growth-Calculator-v3-1.xls

[14] Confirmed via email correspondence with James Perez, Senior Transport Planner, Peter Evans Partnership on 14/09/2016.

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

[16] 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

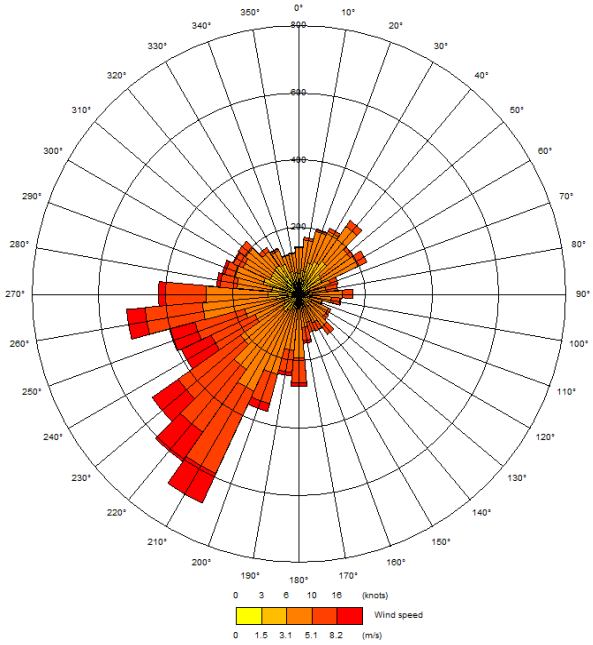
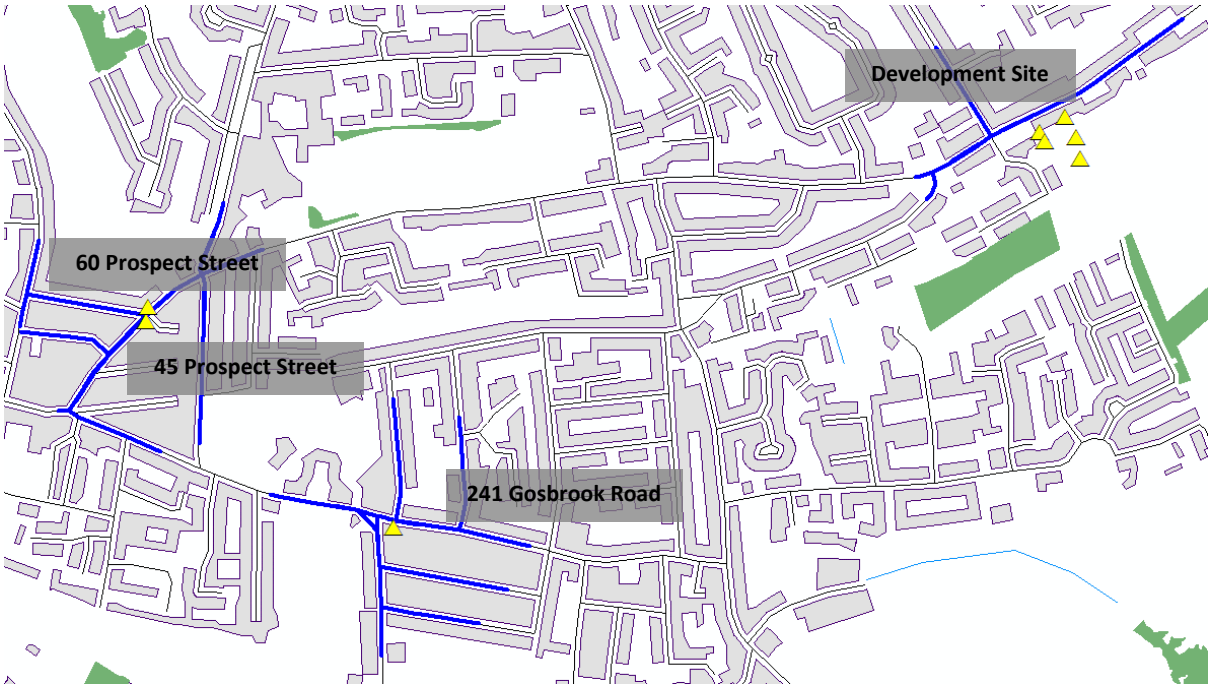


Figure 3: Road sources and receptors



Contains Ordnance Survey data © Crown copyright and database right [2016]

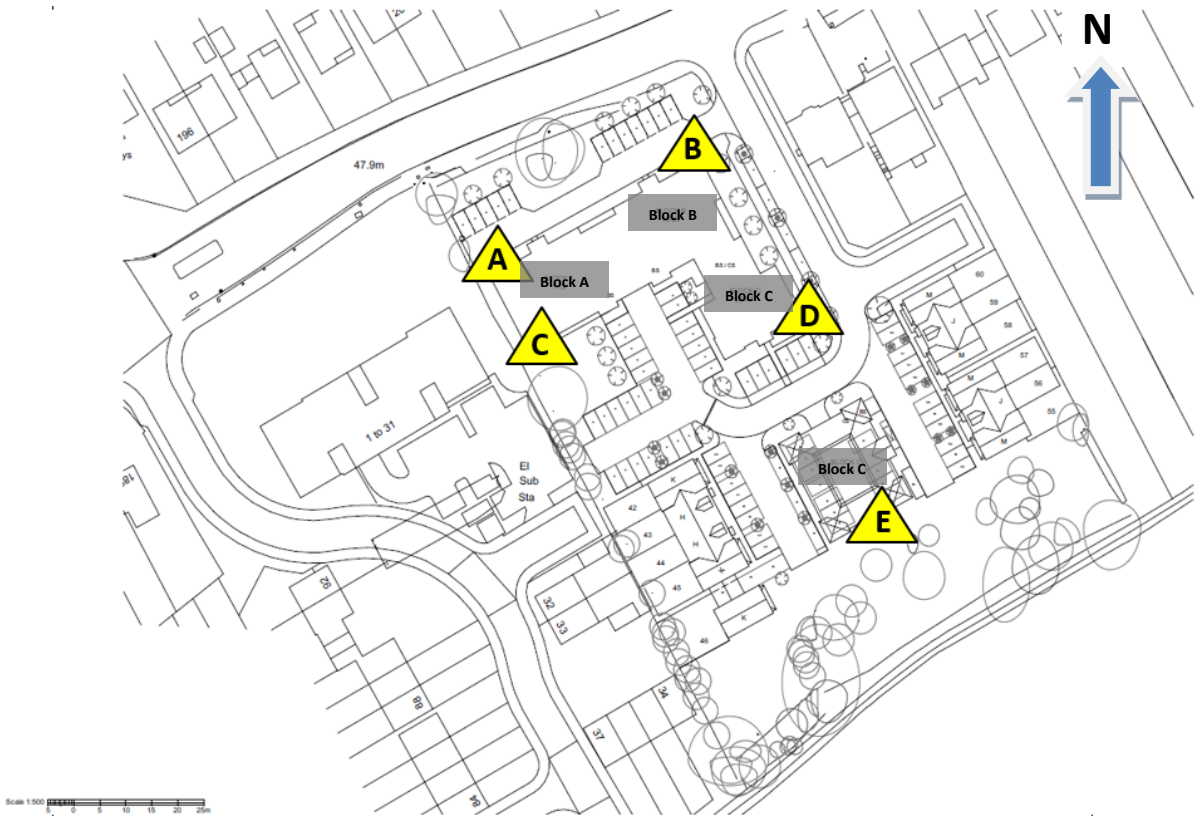
ArcMap software has been used to model the road source locations (blue lines) that are within 200 metres of the receptor locations (yellow triangles). This data can then be automatically uploaded to ADMS-Roads. This generates an accurate representation of the surrounding area to be assessed in the model 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 NO_2 and PM_{10} is included in the background concentrations.

Five sensitive ground floor receptor locations have been selected for the assessment:

A. Northwest corner of Block A, located closest to Henley Road (ground to third floor receptors, representing the drop-off in pollutant concentrations with height).
B. Northeast corner of Block B, located closest to Henley Road (ground to third floor receptors, representing the drop-off in pollutant concentrations with height).
C. Southwest corner of Block A (ground floor receptor).
D. Southeast corner of Block C (ground floor receptor).
E. Southern side of the rear Block C, representing the drop-off in pollutant concentrations with distance from the road (ground floor receptor).

These sites have been chosen to reflect the extremities of the site and their proximity to road traffic sources. The architects plans (Figure 4) show the development site in more detail with receptor locations highlighted (yellow triangles). 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.

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



2.4 Conversion of NO_x to NO_2

Recent evidence shows that the proportion of primary NO_2 in vehicle exhaust has increased[17]. This means that the relationship between NO_x and NO_2 at the roadside has changed from that currently used in the ADMS model. A NO_x to NO_2 calculator (Published in June 2016) [18] has therefore been developed and has been used in conjunction with the ADMS model to obtain a more accurate picture of NO_2 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 NO_2, 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 NO_2 concentration.

For this project, modelled annual mean road-NO_x estimates have been verified against the concentrations measured at the 241 Gosbrook Road, 45 Prospect Street and 60 Prospect Street diffusion tube sites (see Appendix A). These sites were chosen as they are the monitoring sites within the closest proximity to the development site. It is also worth noting that Prospect Street is a continuation of Henley Road (A4155) and traffic levels are thought to be similar at both locations. However, it is worth noting that none of these sites lie in close proximity to the development site and therefore there will be uncertainty in the modelled results.

The adjustment factor determined for annual mean NO_2 concentrations was also applied to the modelled annual mean PM_{10} concentrations. This was done as no PM_{10} monitoring data that is representative of the development site is available, and this approach was considered more appropriate than not applying any adjustment[19].

[17] http://uk-air.defra.gov.uk/assets/documents/reports/aqeg/primary-no-trends.pdf

[18] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc

[19] This is in accordance with Paragraph 7.528 of LAQM TG(16), which states that in the absence of any PM_{10} data for verification, it may be appropriate to apply the road NOx adjustment to the modelled road PM_{10}.

3. Results

3.1 Results of the Dispersion Modelling

Table 4 below provides the estimated pollutant concentrations in the development year (2020) without and with[20] development. Given the inherent uncertainties in the 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 2020 without and with the development (µg/m³)

Floor level	Receptor	Annual mean NO_2 concentration (µg /m³) Without development	Annual mean NO_2 concentration (µg /m³) With development	Annual mean PM_{10} concentration (µg /m³) Without development	Annual mean PM_{10} concentration (µg /m³) With development	NO_2 Change (µg/m³)	PM_{10} Change (µg/m³)
Ground	A	22.4	22.4	14.3	14.3	<0.1	<0.1
	B	20.1	20.1	14.0	14.1	<0.1	<0.1
	C	20.4	20.5	14.0	14.1	<0.1	<0.1
	D	19.0	19.0	13.9	13.9	<0.1	<0.1
First	A	18.5	18.6	13.8	13.8	<0.1	<0.1
	B	21.4	21.4	14.2	14.2	<0.1	<0.1
Second	A	19.7	19.8	14.0	14.0	<0.1	<0.1
	B	20.1	20.1	14.0	14.0	<0.1	<0.1
Third	A	19.2	19.2	13.9	13.9	<0.1	<0.1
	B	19.0	19.0	13.9	13.9	<0.1	<0.1

In the without development scenario, the model predicts annual mean NO_2 concentrations to be below (by > 44 %) the annual mean objective at all locations. The worst-case location is identified as receptor A located closest to Henley road and the traffic controlled junction at Henley Road – Ruskin/ All Hallows Road, where roadside concentrations will be maximised.

The annual mean NO_2 concentrations are much lower at the development site compared to the monitoring sites used for the model verification (see Table 3). This is due to the increased contribution of emission from road sources at the monitoring sites, as they are located closer to the road compared to the proposed development. In addition, the estimated mapped background NO_x, NO_2 and PM_{10} concentrations around the model verification site are much higher than the development site.

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.

[20] 'With' development includes the impact of the additional traffic that will be generated with the development

The model has also been run for a with development scenario. The results indicate that annual mean NO_2 concentrations would change by < 0.1 µg/m^3 at all locations.

The model estimates no exceedance against either the annual or daily mean PM_{10} objectives. Potential exceedances of the daily mean PM_{10} objective can be estimated based on the annual mean[21], such that:

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

On this basis, it is estimated that in 2020 there will be no exceedances of the daily mean PM_{10} limit value, regardless of whether the development takes place or not.

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 Document[22] 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% of 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.

In applying these criteria, it can be concluded that the impact of the development on local annual mean NO_2 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.

[21] Paragraph 7.92 of LAQM TG(16)

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

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/m^3 should attract less significance than an annual mean of 51 µg/m^3.

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 for estimated NO_2 and PM_{10} concentrations, it is recommended that there are no specific requirements for mitigation, as concentrations in the 'without' and 'with' development scenarios are estimated to be below the objective levels. In addition, the development will not cause a significant worsening of air quality as the impact is classed as 'negligible'.

However, the developer is encouraged to consider further mitigation measures in order to minimise the use of private vehicles by residents. Such measures include: providing cycle storage and installing electric charging points.

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

[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 PM_{10}, 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.

3.5 Air Quality Neutral Assessment

London Plan Policy 7.14 requires development proposals within Greater London to be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as AQMAs). A method for assessing this is outlined in the Sustainable Design and Construction Supplementary Planning Guidance (SPG) April 2014[24]. The Council has requested that an air quality neutral assessment is completed in order to fulfil the requirements of Reading Borough Council's Air Quality Policy DM19, which requires that developments have regard to the need to improve air quality and reduce the effects of poor air quality through design, mitigation and where required planning obligations to be used to help improve local air quality. Currently, there are no available transport emissions benchmarks for developments outside of London. Therefore, only a buildings air quality neutral assessment has been completed.

[24] https://www.london.gov.uk/sites/default/files/Revised%20SD%26C%20SPG_0.pdf

The SPG outlines building emission benchmarks for NO_x and PM_{10} for all land use classes and these are presented in Table 6 below. This development comes under land use class C3 (residential dwellings).

Table 6: Building Emission Benchmarks by Land Use Category

Land use class	NO_x (g/m^2)	PM_{10} (g/m^2)
A1 (Retail)	22.60	1.29
A3-A5 (Restaurants, drinking establishments, hot food takeaway)	75.20	4.32
A2, B1 (Financial/professional services/business)	30.80	1.77
B2-B7 (General industrial)	36.60	2.95
B8 (Storage and distribution)	23.60	1.90
C1 (Hotels)	70.90	4.07
C2 (Residential institutions)	68.50	5.97
C3 (Residential dwellings)	26.20	2.28
D1 (a) (Medical and health services)	43.00	2.74
D1 (b) (Crèche, day centres etc.)	75.00	4.30
D1 (c-h) (Schools, libraries, places of worship etc.)	31.00	1.78
D2 (a-d) (Cinemas, concert halls etc.)	90.30	5.18
D2 (e) (Swimming pools, gymnasium etc.)	284.00	16.30

New major developments[25] in London must meet these benchmarks, or implement mitigation measures to reduce emissions either on-site or off-site. Where this is not practical or desirable, some form of pollutant offsetting could be applied. One route would be to enforce the necessary "air quality neutral" measures via a Section 106 agreement. Reading Borough Council are also requesting that developments meet these benchmarks.

The guidance on application of Air Quality Neutral[26] has been followed in this assessment. Building Emissions have been developed for the proposed building based upon:

- Gross Floor Area (m^2) of development
- On-site emissions of NO_x and PM_{10} associated with building use (kg/annum) calculated from energy use (kWh/annum) and a default emission factor (kg/kWh)

Table 7 presents the input data used for the building emissions benchmark calculation. Figures on gross internal area (GIA) were provided by the architect. Annual energy use has been estimated based upon CIBSE TM46:2008 energy benchmarks[27] and it has been assumed that gas will be used as the fuel.

[25] As outlined in the London Plan (10 or more residential dwellings (or where the number is not given, an area of more than 0.5 ha; or for all other uses, where the floor space is 1,000 m^2 or more, or the site area is 1 ha or more).

[26] http://www.london.gov.uk/sites/default/files/GLA%20AQ%20Neutral%20Policy%20Final%20Report%20April%202014%20J1605.pdf

[27] CIBSE TM46:2008 Table 1 Benchmark categories and values – values for "long term residential" applied

Table 7: Building Emissions Input Data

Land use class	Boiler fuel	GIA (m^2)	Energy Use (kWh/ annum)	NO_x EF (kg/kWh)
C3 (Residential dwellings)	Gas	4,611.81	2,905,440	0.00004

It has been possible to estimate annual building NO_x emissions from the input data gathered and compare this total against the relevant Building Emissions Benchmarks (Table 8). The results indicate that the **proposed development site meets the air quality neutral requirements for buildings.** This conclusion is based on the assumption that CSH/ BREEAM Ultra-Low NO_x gas boilers (<40mg/Kwh) are installed, and that no other energy generation is associated with the development. Gas consumption will result in negligible particulate matter emissions and therefore compliance with the building emissions benchmarks for PM_{10} are not considered further.

In addition, the developer is directed to recent guidance manuals on reducing air pollution from boilers and buildings[28]. These manuals outline best practice guidance with advice including:

- Maximising energy efficiency
- Guidance on heating / cooling including choice of e.g. boiler systems (and fuel)
- Maintenance and control settings

Table 8: Comparison of development building emissions to NO_x Building Emissions Benchmark

Pollutant	Land use class	BEB (g/yr)	Development (g/yr)	+/- (kg/yr)
NO_x	C3 (Residential dwellings)	120,829	116,218	-4.6

[28] http://www.camden.gov.uk/ccm/content/environment/green/airquality/guidance-for-reducing-pollution-from-boilers-and-buildings.en

4. Summary and Conclusions

An air quality assessment has been undertaken for a proposed residential development at 199 – 207 Henley Road in Caversham, Reading. Reading Borough Council has declared an AQMA covering Reading Town Centre due to exceedances of the annual mean NO_2 objective. The proposed development lies within an 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 (2015) and the first year of occupation (2020). 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 NO_2 and PM_{10} concentrations are below the objectives in the 'without' and 'with' development scenarios. Based on the evidence it is also considered unlikely that there will be exceedances of either short term objective for NO_2 or PM_{10} under either scenario. Therefore the installation of mechanical ventilation is not required, and instead other measures such as providing cycle storage, and installing an electric charging point, should be considered to minimise the impact of private vehicles by residents. 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.

The proposed development has been assessed, and found to be compliant with London's 'air quality neutral' guidance for buildings. The assessment has been completed on the assumption that CSH/ BREEAM Ultra-Low NO_x gas boilers are installed. If the development plans regarding energy generation do not meet this requirement, re-assessment may be required.

Appendix A – Model Verification

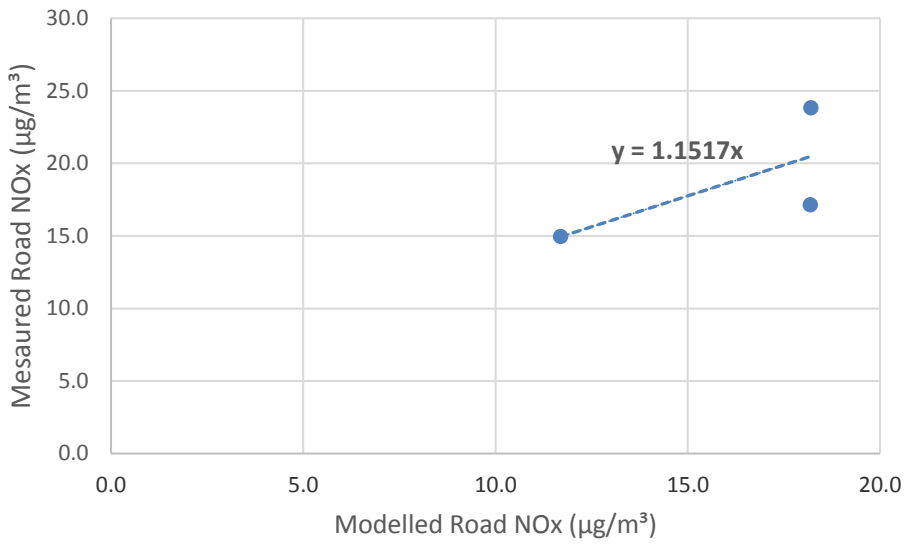
In order to verify modelled pollutant concentrations generated in the assessment, the model has been run to predict the annual mean road-NO_x concentration during 2015 at the 241 Gosbrook Road, 45 Prospect Road and 60 Prospect Road diffusion tube sites described in Table 2.

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 NO_2 calculator[18].

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 NO_2 concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the 2015 background NO_2 concentration.

The results imply that the model was slightly 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 values have been calculated:

NO_x: 9.6

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 objectives, which is 40 µg/m^3 for both NO_2 and PM_{10}. RMSE values of less than 10 µg/m^3 are obtained and therefore the model behaviour is acceptable.

Appendix B – Traffic Data

Table B.1: Traffic data for 2015 (and prediction for 2020 without development)

Road links	Annual Average Daily Traffic (AADT)	% Heavy Duty Vehicles (HDV)	Speed (kph)
A4155	9,571 (10,206)	2.7	48.3
Minor Roads	2,300 (2,453)	2.4	48.3

Note: With development results in an average daily traffic increase of 458 vehicles on all roads that have direct access to the site.

Oxford Centre for Innovation
New Road
Oxford
OX1 1BY

01865261466
www.aether-uk.com