

EP Collier Primary School, Reading

Air Quality Assessment

On behalf of **Reading Borough Council**



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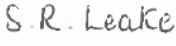
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1 Introduction

1.1 Background

- 1.1.1 Reading Borough Council has commissioned Peter Brett Associates LLP (PBA) to undertake an air quality assessment to fulfil the requirement of Condition 25 of the Planning Permission for the development at EP Collier Primary School, Reading:

“25. No part of the development hereby approved shall be occupied until an air quality assessment has been submitted to and approved in writing by the Local Planning Authority. The submission should include recommendations for mitigation for poor air quality, if this is indicated as necessary by the assessment.

Reason: In accordance with Policy DM19: Air Quality of the SDPD 2012 as the site lies within the Borough’s defined Air Quality Management Area (AQMA).”

1.2 Scope

- 1.2.1 This report describes existing air quality at the proposed school development site. The level of traffic generated by the development is assessed to ascertain if it will have an effect on existing air quality, and therefore the need for mitigation.
- 1.2.2 The main pollutants of concern related to road traffic are nitrogen dioxide (NO₂) and PM₁₀.
- 1.2.3 The assessment has been prepared taking into account relevant local and national guidance and regulations.

1.3 Methodology

- 1.3.1 Whether the traffic from the development will have a significant effect on air quality depends on the amount of additional traffic that is generated. The first part of the methodology is therefore to determine the magnitude of the additional traffic. If the additional traffic is below the threshold provided in professional guidance for an assessment to be necessary, then it will have an insignificant effect on local air quality. In effect, future air quality would be the same as existing air quality with or without the development in place.
- 1.3.2 The second stage of the assessment is to undertake dispersion modelling to ascertain the effect of traffic on pollutant concentrations in the vicinity of the site. If the additional traffic from the development is insignificant, then the dispersion modelling only takes account of existing traffic levels. If the additional traffic is above relevant guidelines, then it could have a significant effect and the additional traffic is added to the existing traffic.
- 1.3.3 The impact of traffic emissions is determined at specific locations within the vicinity of the site, representing residential locations or the school itself and these locations are termed receptors. By convention, receptor locations within the school site are termed ‘proposed receptors’ as they are associated with the proposed development. For the assessment that has been undertaken, receptor locations for the school site have been placed on the boundary of the site as these will be closest to the roads and therefore worst case. Receptor locations for existing residential properties were placed on the façade of the buildings based on their proximity to the school and road junctions.

2 Legislation and Policy

2.1 The Air Quality Strategy

- 2.1.1 The Air Quality Strategy (2007) establishes the policy framework for ambient air quality management and assessment in the UK. The primary objective is to ensure that everyone can enjoy a level of ambient air quality which poses no significant risk to health or quality of life. The Strategy sets out the National Air Quality Objectives (NAQOs) and Government policy on achieving these objectives.
- 2.1.2 Part IV of the Environment Act 1995 introduced a system of Local Air Quality Management (LAQM). This requires local authorities to regularly and systematically review and assess air quality within their boundary, and appraise development and transport plans against these assessments. The relevant NAQOs for LAQM are prescribed in the Air Quality (England) Regulations 2000 and the Air Quality (Amendment) (England) Regulations 2002.
- 2.1.3 Where an objective is unlikely to be met, the local authority must designate an Air Quality Management Area (AQMA) and draw up an Air Quality Action Plan (AQAP) setting out the measures it intends to introduce in pursuit of the objectives within its AQMA.
- 2.1.4 The Local Air Quality Management Technical Guidance 2009 (LAQM.TG(09); Defra, 2009), issued by the Department for Environment, Food and Rural Affairs (Defra) for Local Authorities provides advice as to where the NAQOs apply. These include outdoor locations where members of the public are likely to be regularly present for the averaging period of the objective (which vary from 15 minutes to a year). Thus, for example, annual mean objectives apply at the façades of residential properties, whilst the 24-hour objective (for PM₁₀) would also apply within the garden. They do not apply to occupational, indoor or in-vehicle exposure.

2.2 EU Limit Values

- 2.2.1 The Air Quality Standards Regulations 2010 implements the European Union's Directive on ambient air quality and cleaner air for Europe (2008/50/EC), and includes limit values for NO₂. These limit values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and the legal responsibility for ensuring that they are complied with. The compliance date for the NO₂ EU Limit Value was 1 January 2010, five years later than the date for the NAQO.
- 2.2.2 Directive 2008/50/EC consolidated the previous framework directive on ambient air quality assessment and management and its first three daughter directives. The limit values remained unchanged, but it now allows Member States a time extension for compliance, subject to European Commission (EC) approval.
- 2.2.3 The Directive limit values are applicable at all locations except:
- Where members of the public do not have access and there is no fixed habitation;
 - On factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and
 - On the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access.

2.3 Planning Policy

National Policy

- 2.3.1 The National Planning Policy Framework was published in March 2012. This sets out the Government's planning policies for England and how they are expected to be applied. In relation to conserving and enhancing the natural environment, paragraph 109 states that;

"The planning system should contribute to and enhance the natural and local environment by.... preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability."

- 2.3.2 Paragraph 124, also states that;

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

- 2.3.3 Paragraph 203 goes on to say;

"Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition."

Planning Practice Guidance

- 2.3.4 Planning Practice Guidance (PPG) was published in March 2014 to support the National Planning Policy Framework. Paragraph 001, Reference 32-001-20 of the PPG provides a summary as to why air quality is a consideration for planning;

"...Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit....The local air quality management (LAQM) regime requires every district and unitary authority to regularly review and assess air quality in their area. These reviews identify whether national objectives have been, or will be, achieved at relevant locations, by an applicable date....If national objectives are not met, or at risk of not being met, the local authority concerned must declare an air quality management area and prepare an air quality action plan.....Air quality can also affect biodiversity and may therefore impact on our international obligations under the Habitats Directive.....Odour and dust can also be a planning concern, for example, because of the effect on local amenity."

- 2.3.5 Paragraph 002, Reference 32-002-20140306, of the PPG concerns the role of Local Plans with regard to air quality;

"....Drawing on the review of air quality carried out for the local air quality management regime, the Local Plan may need to consider;

- *the potential cumulative impact of a number of smaller developments on air quality as well as the effect of more substantial developments;*
- *the impact of point sources of air pollution...; and*
- *ways in which new development would be appropriate in locations where air quality is or likely to be a concern and not give rise to unacceptable risks from pollution. This could be through, for example, identifying measures for offsetting the impact on air quality arising from new development including supporting measures in an air quality action plan or low emissions strategy where applicable."*

2.3.6 Paragraph 005, Reference 32-005-20140306, of the PPG identifies when air quality could be relevant for a planning decision;

"...When deciding whether air quality is relevant to a planning application, considerations could include whether the development would;

- *Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more.*
- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area.*
- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.*
- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.*
- *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites."*

2.3.7 Paragraph 007, Reference 32-007-20140306, of the PPG provides guidance on how detailed an assessment needs to be;

"Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific."

2.3.8 Paragraph 008, Reference 32-008-20140306, of the PPG provides guidance on how an impact on air quality can be mitigated;

"Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact....Examples of mitigation include;

- *the design and layout of development to increase separation distances from sources of air pollution;*
- *using green infrastructure, in particular trees, to absorb dust and other pollutants;*
- *means of ventilation;*
- *promoting infrastructure to promote modes of transport with low impact on air quality;*
- *controlling dust and emissions from construction, operation and demolition; and*
- *contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development.”*

2.3.9 Paragraph 009, Reference 32-009-20140306, of the PPG provides guidance on how considerations about air quality fit into the development management process by means of a flowchart. The final two stages in the process deal with the results of the assessment;

“Will the proposed development (including mitigation) lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or national objectives for pollutants or fail to comply with the requirements of the Habitats Regulations.” If Yes:

“Consider how the proposal could be amended to make it acceptable or, where not practicable, consider whether planning permission should be refused.”

Local Policy

2.3.10 The ‘Reading Borough Local Development Framework: Core Strategy adopted in January 2008 as amended in January 2015’ (Reading Borough Council, 2015), sets out how planning and development will achieve the Reading 2020 vision for the town. Policy CS34 on ‘Pollution and Water Resources’ relates to air quality and states:

“Development will only be permitted where it would not be damaging to the environment through air, land, noise or light pollution;” and;

“Proposals for development that are sensitive to the effects of air, noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.”

Reading Borough Council Air Quality Action Plan

2.3.11 The Reading Borough Council Air Quality Action Plan (Reading Borough Council, 2009) sets out current and new policies and measures to address air quality issues in order to work toward meeting the air quality objectives for NO₂. The measures are broken down into ‘Air Pollution Transport Measures’, ‘Air Pollution Other Sources’, ‘Air Pollution Development Control and Air Pollution Other Measures’. Measures within the action plan include:

- Continue to implement “Quality Travel for Reading” including a new cycling strategy;
- Continue to work with Reading buses to reduce air quality impacts and greenhouse gas emissions per passenger kilometre from the Reading bus fleet, setting targets for emissions reductions;
- Investigate mechanisms to reduce the impact of Heavy Goods Vehicles (HGVs) on local air quality in Reading; and

- Ensure through the planning process that future development does not result in any future deterioration of air quality where possible.

3 Methodology

3.1 Existing Conditions

- 3.1.1 Information on existing air quality has been obtained by collating the results of monitoring carried out by Reading Borough Council (RBC). Background concentrations for the site have been defined using the national pollution maps published by Defra. These cover the whole country on a 1x1 km grid (Defra, 2015).

3.2 Development Traffic

- 3.2.1 The first stage in the assessment is to determine whether or not the development traffic could have a significant effect on air quality and therefore whether or not it needs to be included within the dispersion modelling.
- 3.2.2 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have published the 'Land-Use Planning and Development Control: Planning for Air Quality' (May 2015) guidance to ensure air quality is adequately considered in the land-use planning and development control process (Moorcroft and Barrowcliffe et al, 2015). The indicative criteria for requiring an air quality assessment include:
- a. A change of Light Duty Vehicles (LDVs) flows of more than 100 Annual Average Daily Traffic (AADT) within or adjacent to an AQMA or more than 500 AADT elsewhere.
 - b. A change of Heavy Duty Vehicles (HDVs) flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere.
- 3.2.3 The above thresholds are for when an air quality assessment may be necessary. If development traffic is above the thresholds consideration would need to be given as to whether a modelling assessment is necessary.
- 3.2.4 Traffic flows generated by the development proposals are contained in the Transport Statement provided for the Planning Application by WSP (WSP, 2015). The school is estimated generate an additional 27 trips for pupils and 13 for staff in the am and pm periods. On the assumption that the pupil trips are associated with pupils being dropped off in the morning and picked up in the evening, and the staff arrive in the morning and leave in the evening, the maximum daily trips during a school day are 134 per day. This would be equivalent to approximately 70 per day on an annual average basis, as the pupils are only in school for 190 days per year. The traffic generated by the development is therefore well below the threshold of 100 AADT for an assessment of the impact of development traffic to be necessary.
- 3.2.5 As the traffic generation is below the threshold for an assessment to be necessary, it will have an insignificant effect on air quality in the local area. It is therefore not necessary to model the effects of the development traffic and the assessment of air quality has been based on existing traffic levels.

3.3 Receptor Locations

- 3.3.1 Six receptor locations within the proposed development site have been chosen in order to assess the air quality at the proposed development site, as shown in **Figure 1**. Receptor locations were modelled at a height of 1.5m representing exposure at ground floor level and were placed on the school site boundary.
- 3.3.2 Five existing properties have been identified as existing receptors for the assessment based on their proximity to the school and road junctions. These locations are described in **Table 4.1**

and shown in **Figure 1**. Receptors were modelled at a height of 1.5m representing ground floor exposure.

Table 4.1: Description of Existing Receptors

Receptor	Location
R1	63 York Road
R2	61 York Road
R3	70 York Road
R4	69 Swansea Road
R5	32 Swansea Road

- 3.3.3 The air quality modelling has been verified using four monitoring locations positioned on Caversham Road (see **Appendix C** for further details on the verification method).

3.4 Dispersion Modelling

- 3.4.1 Predictions have been carried out using the ADMS-Roads dispersion model (v3.2.4.0). The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of Heavy Duty Vehicles (HDVs), road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. It also requires meteorological data. The model has been run using 2014 meteorological data from the Heathrow Airport monitoring station, which is considered suitable for this area.
- 3.4.2 AADT flows and the proportions of HDVs for the main roads within 250m of the proposed development site have been calculated from ATC data and Department for Transport traffic flows. This data was used to determine a model verification factor as shown in Appendix C. The equivalent traffic flows on Cardiff Road have been calculated in order to give the same verification factor at the Cardiff Road monitoring station taking into account the proximity of the monitoring location to the main line railway. The calculated traffic flow was then applied to all of the roads around the school site which is considered to give a conservative assessment of the AADT traffic flows on the roads around the school.
- 3.4.3 Traffic emissions were calculated within the model based on vehicle flow, composition and speed using the Emission Factor Toolkit (EFT) v6.0.2, which utilises NO_x emission factors taken from the European Environment Agency COPERT 4 (v10) emission tool. In order to take account of uncertainties relating to future year vehicle emissions, an assessment has been carried out utilising 2014 emission factors and background concentrations, thus assuming no improvement in vehicle emissions or concentrations in the future. This is likely to be a conservative assumption as although there is some uncertainty how rapidly vehicle emissions will improve in the future, some improvement is anticipated with the introduction of Euro 6/VI vehicles into the vehicle fleet.

3.5 Assessment Criteria

- 3.5.1 The NAQOs for NO₂ and PM₁₀ set out in the Air Quality Regulations (England) 2000 and the Air Quality (England) (Amendment) Regulations 2002, are shown in **Table 4.2**.

Table 4.2: Nitrogen Dioxide and PM₁₀ Objectives

Pollutant	Time Period	Objective
Nitrogen dioxide (NO ₂)	1-hour mean	200µg/m ³ not to be exceeded more than 18 times a year
	Annual mean	40µg/m ³
Particulate matter (PM ₁₀)	24-hour mean	50µg/m ³ not to be exceeded more than 35 times a year
	Annual mean	40µg/m ³

- 3.5.2 The objectives for NO₂ and PM₁₀ were to have been achieved by 2005 and 2004, respectively, and continue to apply in all future years thereafter. Analysis of long term monitoring data suggests that if the annual mean NO₂ concentration is less than 60µg/m³ then the one-hour mean NO₂ objective is unlikely to be exceeded where road transport is the main source of pollution. This concentration has been used to screen whether the one-hour mean objective is likely to be achieved (Defra, 2009).

4 Baseline Conditions

4.1 LAQM

- 4.1.1 RBC has investigated air quality within its area as part of its responsibilities under the LAQM regime. An Air Quality Management Area (AQMA) has been declared due to exceedances of the annual NO₂ objectives. The AQMA comprises Reading city centre and extends out along major roads including the A33 and A327.

4.2 Monitoring

Nitrogen Dioxide

- 4.2.1 RBC carries out monitoring of NO₂ concentrations at a number of locations across the borough. The closest and most representative locations are described below and shown in **Figure 1**. Data for these sites are presented in **Table 5.1**.

Table 5.1: Measured NO₂ Concentrations, (2010-2014)

ID	Site Type	Within AQMA	Annual Mean (µg/m³)				
			2010	2011	2012	2013	2014
Automatic Sites							
Caversham Road*	R	Y	48	46	47	43	41
Diffusion Tubes							
197 Caversham Road	R	Y	36	40	44	42.2	43.4
108 Caversham Road	R	Y	41	39	42	43.9	47.7
131 Caversham Road	R	Y	40	49 (50)	44	43.4	46.9
50 Cardiff Road ^a		Y	-	-	-	38.4	35.6
Objective			40				

R= Roadside

2010-2012 data taken from the Reading Borough Council Progress Report 2013

Data for 2013 and 2014 obtained through correspondence with the Council's Environmental Health Officer

*Used for model verification

^aData for 2010, 2011 and 2012 is unavailable

- 4.2.2 Measured concentrations at monitoring locations along Caversham Road have generally been above the objective over the 2010 – 2014 time period. There is no clear trend in concentrations.
- 4.2.3 Concentrations at Cardiff Road are below the objective and this monitoring location is more typical of the development site than Caversham Road. However, concentrations at Cardiff Road are higher than would be anticipated from the level of traffic on the road, especially as the road is blocked in the middle. It is therefore likely that measured concentrations are being influenced by emissions from the railway lines to the south. The influence of railway line emissions would be much less at the school site.

PM₁₀

- 4.2.4 PM₁₀ monitoring is carried out using three monitors within the Borough. The closest and most representative location is along Caversham Road. Data for this site is presented in **Table 5.2**.

Table 5.2: Measured PM₁₀ Concentrations, (2010-2014)

Site Site ID	Site Type	2010	2011	2012	2013	2014
Annual Mean (µg/m ³) ^(a)						
RD1	R	48	46	47	29	33
Objective		40				
Number of days > 50µg/m ³ (b)						
RD1	R	7	30	32	24	31
Objective		35				

2010-2012 data taken from the Reading Borough Council Progress Report 2013

2012-2014 data taken from Air Quality England website

4.3 Background Concentrations

- 4.3.1 In addition to these measured concentrations, estimated background concentrations for the site have been obtained from the national maps provided by Defra (Defra, 2015) (shown in **Table 5.3**). The background concentrations are all well below the relevant objectives.

Table 5.3: Estimated Annual Mean Background Concentrations

Year	Annual Mean ($\mu\text{g}/\text{m}^3$)		
	NO _x	NO ₂	PM ₁₀
2014	41.5	26.0	20.3
Objectives	-	40	40

5 Modelling Assessment

5.1 Road Traffic Impacts

School Site

- 5.1.1 Predicted concentrations of NO₂ and PM₁₀ at receptor locations on the boundary of the school are presented in **Table 6.1**.

Table 6.1: Predicted Concentrations of NO₂ and PM₁₀ for Proposed Receptors within the Proposed Development

Receptor	Annual Mean (µg/m ³)	
	NO ₂	PM ₁₀
PR1	32.7	21.0
PR2	32.7	21.0
PR3	31.7	20.9
PR4	30.9	20.8
PR5	31.5	20.8
PR6	31.1	20.8
Objectives	40	40

- 5.1.2 Predicted concentrations of NO₂ and PM₁₀ are all below the relevant objectives on the boundary of the site.

Existing Receptors

- 5.1.3 Predicted NO₂ and PM₁₀ concentrations at existing residential properties are presented in **Table 6.2**.

Table 6.2: Predicted Concentrations of NO₂ at Existing Receptors

Receptor	Predicted Annual Average Concentrations	
	NO ₂	PM ₁₀
R1	29.9	20.7
R2	30.0	20.7
R3	31.7	20.9
R4	31.8	20.9
R5	31.6	20.9
Objectives	40	40

- 5.1.4 The predicted NO₂ and PM₁₀ concentrations are well below the relevant objectives at all existing receptor locations in the vicinity of the school.

Uncertainty

- 5.1.5 There are many components that contribute to the uncertainty in predicted concentrations. The model used in this assessment is dependent upon the traffic data that have been input which will have inherent uncertainties associated with them. There is then additional uncertainty as the model is required to simplify real-world conditions into a series of algorithms.
- 5.1.6 A disparity between the national road transport emission projections and measured annual mean concentrations of nitrogen oxides (NO_x) and NO_2 has been identified in recent years. Whilst projections suggest that both annual mean NO_x and NO_2 concentrations from road traffic emissions should have fallen significantly over the past 6 to 8 years, at many monitoring sites levels have remained relatively stable, or have even shown a slight increase. Monitoring data compiled for this assessment indicate that measured nitrogen dioxide concentrations have remained stable in recent years.
- 5.1.7 The road traffic modelling has been based on 2014 emission factors and background concentrations, whilst utilising traffic flows for 2014. The model has been verified against 2014 monitoring data. This is considered to provide conservative assessment, as no improvement in vehicle emissions is assumed to occur in the future.

6 Mitigation

6.1 Mitigation

- 6.1.1 As air quality for the future staff and pupils of the school is predicted to be below air quality objectives, no additional on-site mitigation is required.
- 6.1.2 The additional traffic from the development will have an insignificant effect on local air quality and therefore mitigation of the development traffic is not required.

7 Conclusions

- 7.1.1 The air quality impacts associated with the proposed redevelopment of EP Collier Primary School located within the boundary of Reading Borough Council have been assessed in order to satisfy the requirements of Condition 25 of the planning permission for the development.
- 7.1.2 An AQMA has been declared in Reading due to exceedances of the annual mean and daily mean NO₂ objectives. The proposed site is located within the AQMA which encompasses the centre of Reading and the major arterial roads into and out of the town.
- 7.1.3 The development will lead to additional traffic movements well below thresholds for an air quality assessment to be necessary. Additional traffic from the development will therefore have an insignificant effect on local air quality, and therefore no mitigation of development traffic is required.
- 7.1.4 There are no predicted exceedances of the air quality strategy objectives at any of the receptor locations on the boundary of the school site. The site is considered suitable for development without the need for additional mitigation.
- 7.1.5 There are no predicted exceedances of any of the air quality strategy objectives at any of the existing receptor locations in the vicinity of the school site.

Appendix A Glossary

AADT	Annual Average Daily Traffic
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
Diffusion Tube	A passive sampler used for collecting NO ₂ in the air
EFT	Emission Factor Toolkit
HDV	Heavy Duty Vehicle; a vehicle with a gross vehicle weight greater than 3.5 tonnes Includes Heavy Gross Vehicles and buses
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
NAQO	National Air Quality Objective as set out in the Air Quality Strategy and the Air Quality Regulations
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen oxides, generally considered to be nitric oxide and NO ₂ . Its main source is from combustion of fossil fuels, including petrol and diesel used in road vehicles
PM ₁₀	Small airborne particles less than 10µm in diameter
PPG	Planning Practice Guidance
RBC	Reading Borough Council
Receptor	A location where the effects of pollution may occur

Appendix B References

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Statutory Instrument 2002, No 3034, '*The Air Quality (England) (Amendment) Regulations 2002*' HMSO, London.

Statutory Instrument 2010, No. 1001, '*The Air Quality Standards Regulations 2010*' HMSO, London

Appendix C Model Verification

Nitrogen Dioxide

Most nitrogen dioxide is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emission of nitrogen oxides ($\text{NO}_x = \text{NO} + \text{NO}_2$). The model has been run to predict the 2014 annual mean road- NO_x contribution at four monitoring locations (identified in [Table 5.1](#)). Concentrations have been modelled at a height of 2.0m for 197 Caversham Road, 108 Caversham Road and 131 Caversham Road, 1.5m for Reading Caversham.

The model output of road- NO_x has been compared with the 'measured' road- NO_x , which was calculated from the measured NO_2 concentrations and the adjusted background NO_2 concentrations within the NO_x from NO_2 calculator.

A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero ([Figure C.1](#)). This factor was then applied to the modelled road- NO_x concentration for each monitoring site to provide adjusted modelled road- NO_x concentrations. The total nitrogen dioxide concentrations were then determined by combining the adjusted modelled road- NO_x concentrations with the predicted background NO_2 concentration within the NO_x from NO_2 calculator. A secondary adjustment factor was finally calculated as the slope of the best fit line applied to the adjusted data and forced through zero ([Figure C.2](#)).

The following primary and secondary adjustment factors have been applied to all modelled nitrogen dioxide data:

Primary adjustment factor:	1.358
Secondary adjustment factor:	1.0071

The results imply that overall, the model was under-predicting the road- NO_x contribution. This is a common experience with this and most other models. The final NO_2 adjustment is minor.

[Figure C.3](#) compares final adjusted modelled total NO_2 at each of the monitoring sites, to measured total NO_2 , and shows the 1:1 relationship, as well as $\pm 10\%$ and $\pm 25\%$ of the 1:1 line. Two data points lie within $\pm 25\%$, Triplicate 2 lies outside the $\pm 25\%$ on the 1:1 line.

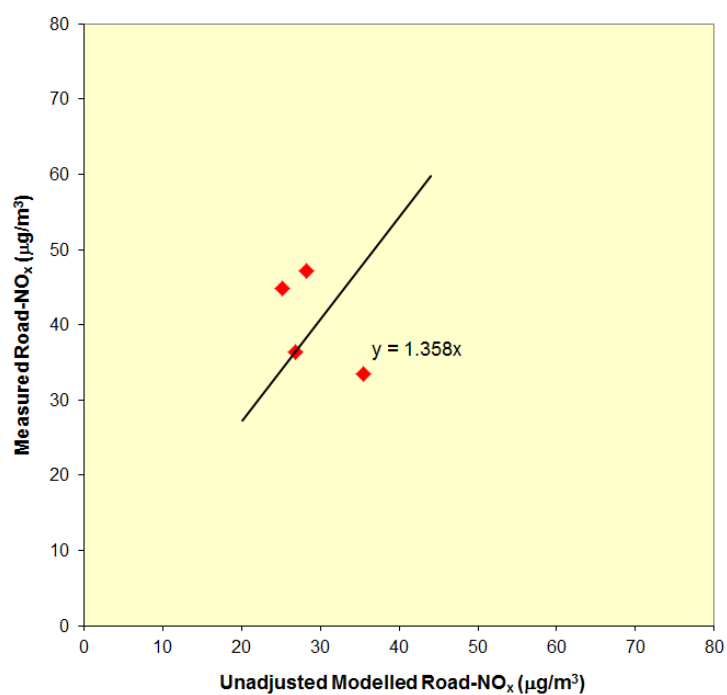


Figure C.1: Comparison of Measured Road-NO_x with Unadjusted Modelled Road-NO_x Concentrations

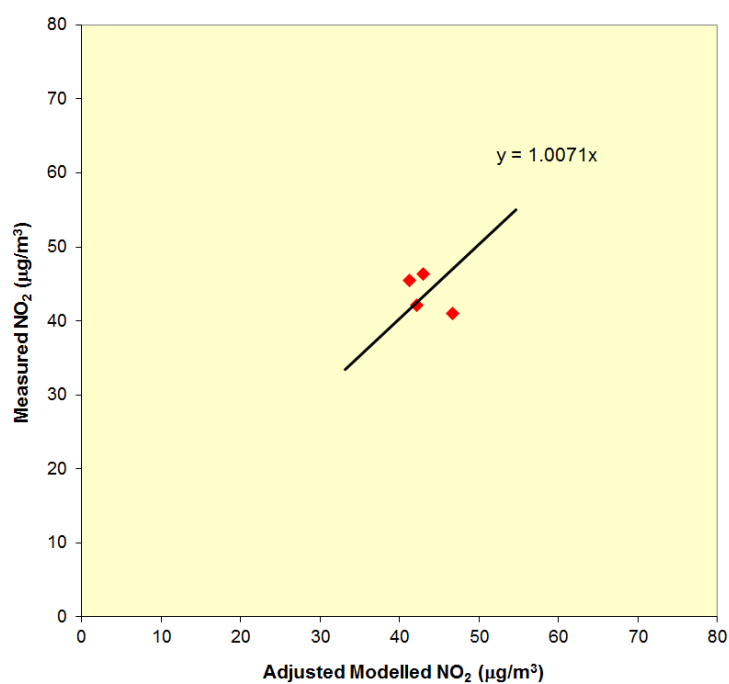


Figure C.2: Comparison of Measured NO₂ with Primary Adjusted Modelled NO₂ Concentrations

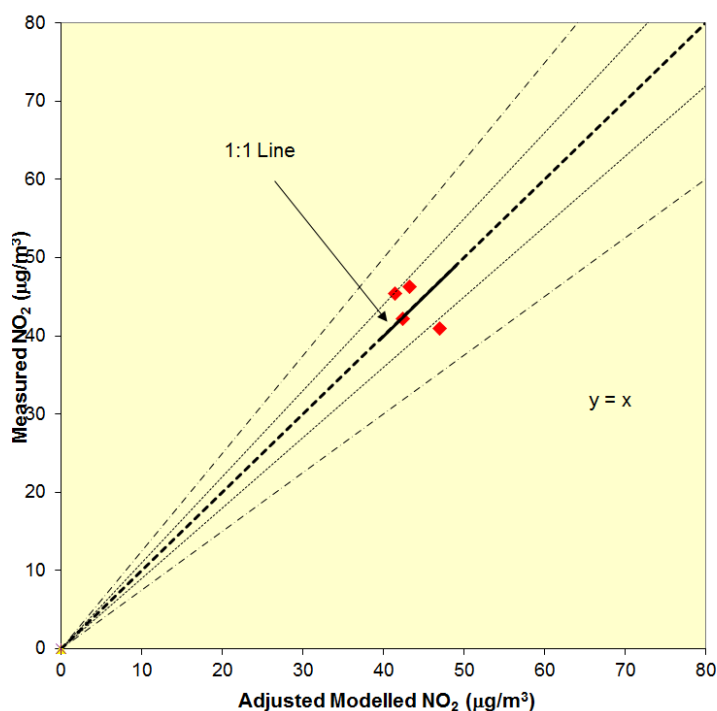


Figure C.3: Comparison of Measured NO₂ with Fully Adjusted Modelled NO₂ Concentrations

PM₁₀

PM₁₀ monitoring is carried out at the Reading Caversham automatic monitoring station. The following adjustment factor for PM₁₀ has been calculated and applied to the modelled road-PM₁₀ concentrations data:

Measured PM ₁₀ :	33.0
Background PM ₁₀ :	23.0
Measured Road PM ₁₀ :	10.00
Modelled Road PM ₁₀ :	1.72
Adjustment Factor:	$10.0/1.72 = 5.80$

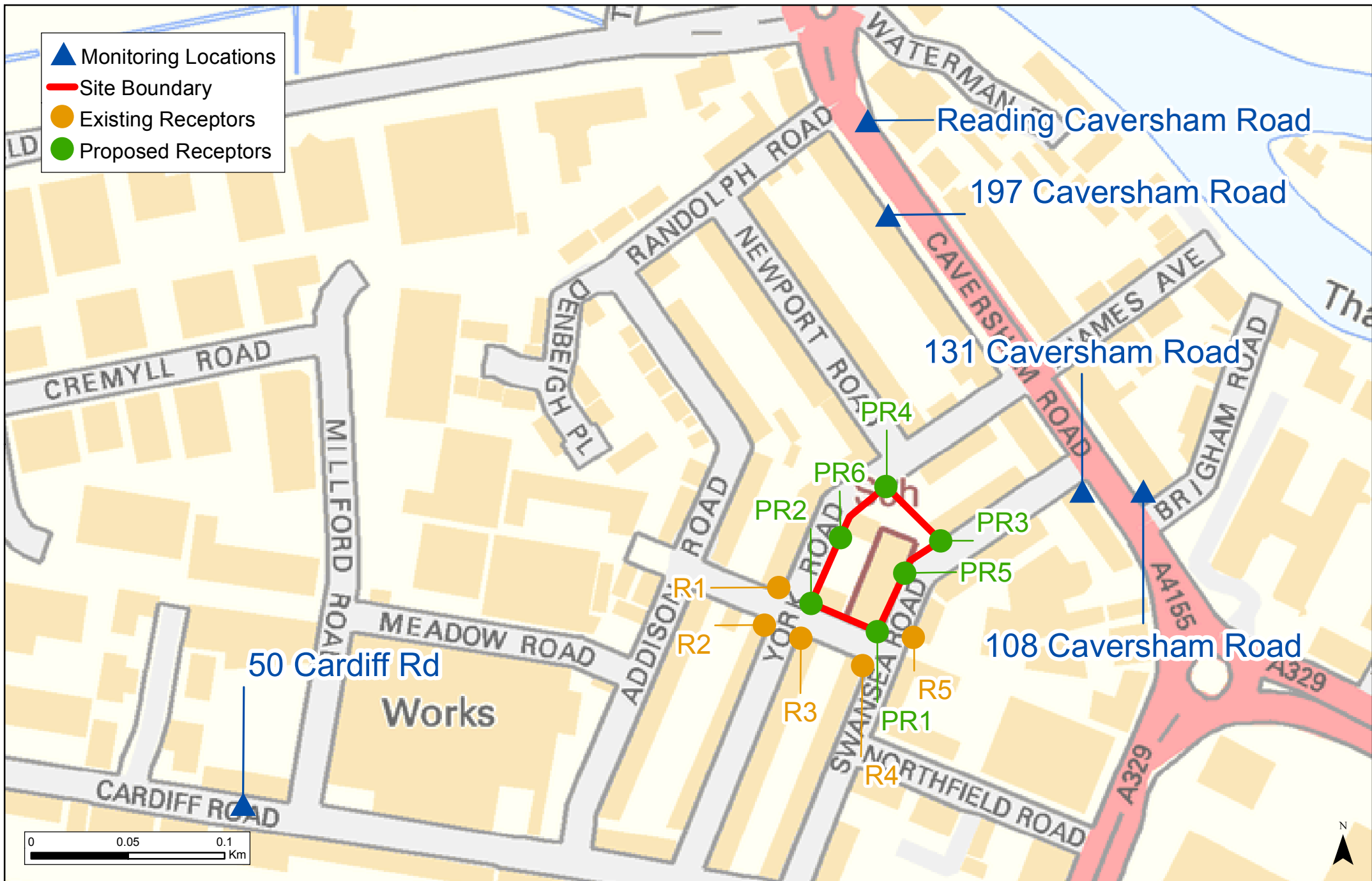
Appendix D Traffic Data

Location	2014 Baseline With Development	
	AADT	HDV (%)
Bridge Road	29,634	4.44
Caversham Road (A4155)	29,931	4.71
Richfield Avenue	18,355	4.71
Caversham Road (A329)	35,237	4.97
Vastern Road	21,322	6.84
Cardiff Road	5,330*	5.00*
Swansea Road	5,330*	5.00*
Ross Road	5,330*	5.00*
York Road	5,330*	5.00*

HDV% traffic flows includes buses

* Traffic data calculated from the model verification factor

Appendix E Figures



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1:2,500 @ A4

18/11/2015

Drawn: SL

Checked: GH

EP Collier Primary School

Monitoring Locations and Receptors

Figure 1

Rev A