LAND NORTH-WEST OF SOUTHWATER, HORSHAM

ENVIRONMENTAL STATEMENT

VOLUME II, APPENDIX 6.3: DISPERSION MODELLING METHODOLOGY

FEBRUARY 2026

CONTENTS

6.3 DISPERSION MODELLING METHODOLOGY

6.1.1. MODEL INPUTS

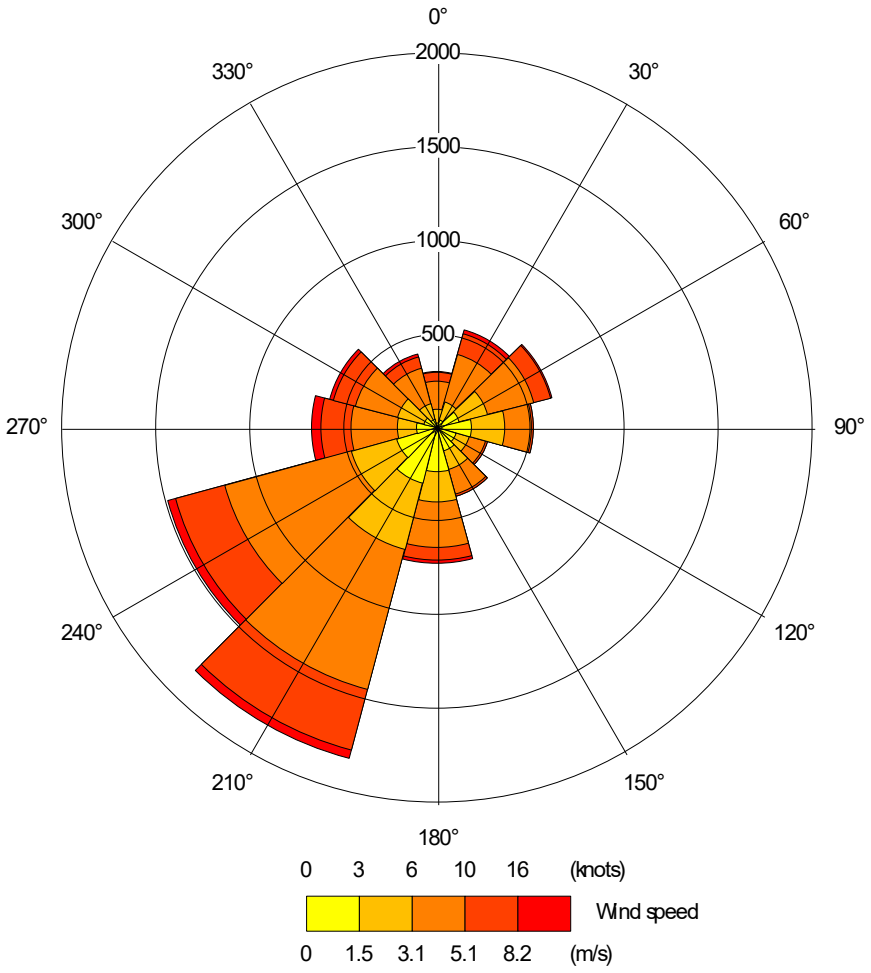
The ADMS-Roads (version 5.0.1.3)[1] model inputs are given in the table below.

Table 6-3-1: Model Inputs

Inputs	Notes
Traffic data	The traffic data were provided by WSP's Transport Modelling team.
Vehicle Emissions Factors	NOx, PM_{10} and $PM_{2.5}$ emissions data for 2024 and 2036 were obtained from Defra's Emissions Factors Toolkit (version 13.1)[2]. For the predictions of future year emissions, the toolkit considers factors such as anticipated advances in vehicle technology and changes in vehicle fleet composition. Vehicle emissions are assumed to reduce over time. Consequently, emissions data for 2024 (baseline) and 2036 (opening year) have been used. EFT settings: ▪ Area = England (not London) ▪ Traffic format = Basic Split ▪ Road type = Urban (not London) and Rural (not London) ▪ Output: Air Quality Modelling (g/km/s)
Road source geometry	All model links aligned to the carriageway centreline, set to true road width (kerb to kerb/edge of travelled lanes), road heights set to zero.
Meteorological data	Gatwick Airport meteorological station 2024. Parameters include hourly sequential format: Julian date, hour, wind speed (m/s), wind direction (degrees from north), cloud cover (oktas), surface temperature (Celsius). Meteorological site roughness length = 0.2m Meteorological site minimum Monin-Obukhov length = 10m Dispersion site latitude = 51˚ Dispersion site roughness length = 0.5m Dispersion site minimum Monin-Obukhov length = 30m

[1] Cambridge Environmental Research Consultants, (2025). ADMS-Roads. [Online] accessed via: https://www.cerc.co.uk/environmental-software/ADMS-Roads-model.html

[2] Department for Environment, Food and Rural Affairs, (2025). Emissions Factors Toolkit. [Online] accessed via: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/

Inputs	Notes
	
Background concentrations	From Defra 1 x 1km mapped datasets for 2024 and 2036. (2021-based background maps for NOx, PM_{10} and $PM_{2.5}$)[3]
Receptors	Specified points: discrete existing and future receptors.
Model outputs	Annual mean (long-term) NOx, PM_{10} and $PM_{2.5}$ concentrations at discrete receptor points.
Post-processing	Verification (discussed below) to address systematic model error of road source contributions of annual mean NO_x, PM_{10} and $PM_{2.5}$.
	NO_x to NO_2 conversion using Defra's calculator (version 9.1)[4].

[3] Department for Environment, Food and Rural Affairs (2024) Background Mapping Data for Local Authorities. [Online] accessed via: https://uk-air.defra.gov.uk/data/laqm-background-home

[4] Department for Environment, Food and Rural Affairs (2024) NOx to NO_2 Calculator. [Online] accessed via: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/

Inputs	Notes
	To indicate compliance with the 24-hour mean air quality standard for PM_{10} LAQM.TG(22)[5] gives the following empirical equation that relates the annual mean concentration to the number of exceedances of the 50µg/m^3 threshold, where up to 35 exceedances are allowed: Number of 24-hour mean exceedances of 50µg/m^3 = -18.5 + 0.00145 × (annual mean)^3 + (206 ÷ annual mean) *Note: where the annual mean PM_{10} concentration is less than 16.5µg/m^3 then the number of exceedances of the 24-hour mean objective can be assumed to be zero.* To indicate compliance with the 1-hour mean NO_2 standard, LAQM.TG(22) (Ref E) advises that compliance is likely if the annual mean concentration is less than 60µg/m^3.

6.1.2. MODEL VERIFICATION

The ADMS-Roads[1] dispersion model has been widely validated for this type of assessment and is fit for purpose. Model validation undertaken by the software developer would not have included validation in the vicinity of the Proposed Development.

To determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out by the HDC was undertaken. This process of verification aims to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment or verification factor to gain greater confidence in the final results. This was carried out following the methodology specified in the LAQM.TG(22)[5].

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. The following are examples of potential causes of such discrepancy:

- Estimates of background pollutant concentrations;
- Meteorological data uncertainties;
- Traffic data uncertainties;
- Model input parameters, such as 'roughness length'; and
- Overall limitations of the dispersion model.

In line with the guidance provided within LAQM.TG(22)[5], the ADMS-Roads[1] model output has been verified in terms of the primary emissions of NOx produced by road traffic.

[5] Department for Environment, Food and Rural Affairs (2025) Local Air Quality Management Technical Guidance (TG22). [Online] accessed via: https://laqm.defra.gov.uk/wp-content/uploads/2021/03/LAQM-TG22-May-25-v2.1.pdf

The model was run to predict the 2024 annual mean road-NOx contribution at two roadside diffusion tubes within the modelled road network. The model outputs of road-NOx have been compared with the 'measured' road-NOx, which was determined from the NO_2 concentrations measured using diffusion tubes at the monitoring locations, utilising Defra's NOx from NO_2 calculator[4] and NO_2 background concentrations[3]. As discussed in the methodology section, the most recent suitable data available for model verification purposes is 2024 data. The data examined in the verification process are presented in table below.

Table 6-3-2: Comparison of monitored and modelled total annual mean NO_2 concentrations ($\mu g/m^3$) before any adjustment

Monitoring Location	Background annual mean NO_2 ($\mu g/m^3$)	Total monitored annual mean NO_2 (A)	Total modelled annual mean NO_2 (B)	B-A (C)	Ratio (C/A)/%
Southwater 1.1	7.9	10.2	12.16	2.0	19%
Southwater 2	7.6	13.5	10.34	-3.2	-23%
Note: HDC monitoring location A281_A24 has been excluded as it is not classified as roadside					

Comparison of unadjusted modelled total annual mean NO_2 concentrations with monitored concentrations, as illustrated in **Figure 6-3-1**.

Figure 6-3-1: Comparison of measured total NO_2 with modelled total NO_2 (before adjustment of road-NO_x)

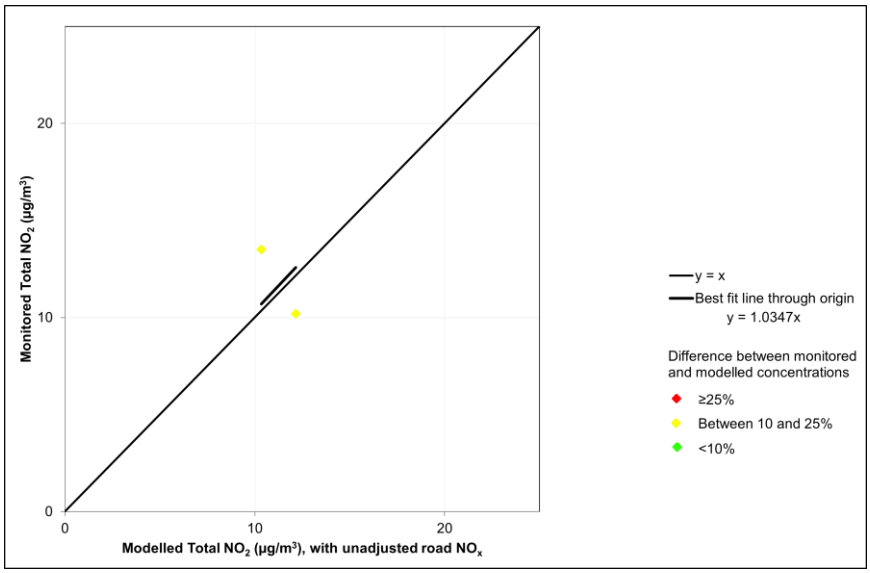


Table 6-3-3: Differences between monitored and modelled concentrations before adjustment

Differences between monitored and modelled concentrations	Number
Within +10%	0
Within -10%	0
Within ±10%	0
Within +10 to +25%	1
Within -10 to -25%	1
Within ±10 to ±25%	2
Over +25%	0
Under -25%	0
Greater ±25%	0
Within ±25%	**2**

Table 6-3-4: Uncertainty statistics without adjustment

Uncertainty statistics	Value
Root mean square error (RMSE)	2.6µg/m^3 (0µg/m^3 is ideal, <4µg/m^3 indicates good model performance)
Fractional bias (FB)	0.052 (values between -2 and +2, where 0 is ideal and positive value indicates model tendency to underpredict)

Caution: the above statistics are based on only two points of comparison

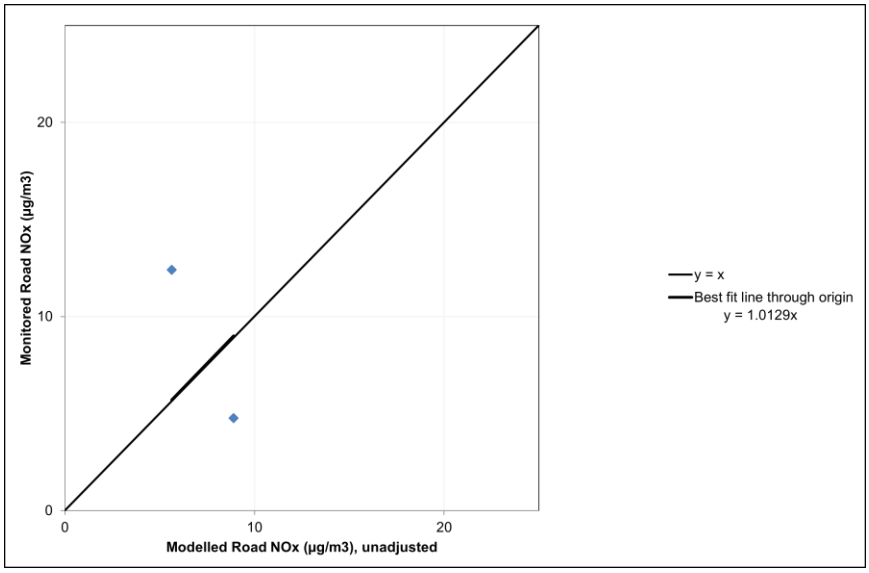
Verification of the unadjusted model predictions shows that the model performs reasonably well with the predictions within 25% of monitored concentrations.

Table 6-3-5: Comparison of monitored and modelled road contributed annual mean NOx concentrations (µg/m^3)

Monitoring site	Monitored road NOx (B)	Modelled road NOx (C) – without adjustment	B/C	Adjusted modelled road NOx
Southwater 1.1	4.8	8.9	0.5	9.01
Southwater 2	12.4	5.6	2.2	5.71

Considering the modelled and monitored road-NOx components with a view to adjustment to bring the model more into line with the monitoring, the slope of the best fit line through the origin was determined (illustrated in **Figure 6-3-2** below). The value of the slope is 1.0129. Multiplying the unadjusted modelled road-NOx concentrations by this value provides a very small uplift – as can be seen in **Table 6-3-5**. As the unadjusted total NO_2 concentrations are within 25% of the monitored and given the adjustment factor being very close to 1, no adjustment to modelled concentrations was considered necessary.

Figure 6-3-2: Comparison of measured road-NOx with unadjusted modelled road-NOx



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