

Hampshire Water Transfer and Water Recycling Project

Environmental Statement – Appendix 6.3 Air dispersion model verification

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Contents

1 ADMS-Roads model verification 1
 1.1 Traffic data 1
 1.2 Model verification 1
References 5

Tables

Table 1-1 Local monitoring data for model verification - review 2
Table 1-2 Local monitoring data for model verification 3
Table 1-3 NOx/NO₂ Model verification (adjustment factor 4.297)..... 3

Graphics

Graphic 1-1 Comparison of unverified modelled vs. monitored road NOx contribution 4

1 ADMS-Roads model verification

1.1 Traffic data

- 1.1.1 Environmental Statement (ES) Appendix 6.2 Air quality assessment traffic data, Volume II (Document reference 6.2, DCO Volume 6) details the traffic data used within the air quality assessment, as presented within ES Chapter 18 Traffic and transport, Volume I (Document reference 6.1, DCO Volume 6).

1.2 Model verification

- 1.2.1 The ADMS-Roads dispersion model has been widely validated for this type of assessment and is specifically listed in the Department for Environment, Food and Rural Affairs (Defra) Local Air Quality Management Technical Guidance (LAQM.TG(22)) [1] as an accepted dispersion model.
- 1.2.2 Model validation undertaken by the software developer (Cambridge Environmental Research Centre) will not have included validation in the vicinity of the study area. It is therefore necessary to perform a comparison of modelled results with local monitoring data at relevant locations. This process of verification attempts to reduce modelling uncertainty and systematic error by correcting modelled results by applying an adjustment factor to gain greater confidence in the final results.
- 1.2.3 Prior to undertaking model verification, model setup parameters and input data were reviewed to maximise the performance of the dispersion model in relation to the real-world conditions.

Verification location selection

- 1.2.4 Monitoring locations within the study area have been reviewed to establish the suitability for use in model verification. Locations have been considered where the assessed road links provided sufficient representation of road traffic sources that would affect monitored concentrations at that point. Monitoring locations that are situated in proximity to several road links which are not considered in the assessment are discounted on the basis that modelled concentrations would be underestimated as a result of emissions from these sources not being accounted for in the model. In addition, verification locations were removed where emission sources believed to be influencing monitored concentrations were present such as petrol station entry/exits and bus stops. Table 1-1 provides a list of monitoring locations within the air quality study area that were considered for use in model verification along with reasons as to why they were or were not included.

Table 1-1 Local monitoring data for model verification - review

Site ID	Local Planning Authority	Site Type	Included or Excluded	Reasoning for Exclusion
135	Portsmouth City Council (PCC)	Kerbside	Excluded	Kerbside monitor
153	PCC	Kerbside	Excluded	Kerbside monitor
BR	Eastleigh Borough Council (EBC)	Roadside	Excluded	No road traffic flows for Riverside, located 35m to the east of diffusion tube.
BR2	EBC	Roadside	Excluded	Located directly adjacent to a petrol station forecourt exit.
FOR	EBC	Roadside	Excluded	Bus stop within 5m of diffusion tube
FORSL	EBC	Roadside	Excluded	Within close proximity to a bus stop. No flows on Sandy Lane, directly adjacent to the diffusion tube.
22	Havant Borough Council (HBC)	Roadside	Included	-
28	HBC	Roadside	Included	-
136	PCC	Roadside	Excluded	Directly adjacent to a bus stop.
148	PCC	Roadside	Excluded	Directly adjacent to a bus stop
149	PCC	Roadside	Included	-
150	PCC	Roadside	Excluded	Directly adjacent to a bus stop.
151	PCC	Roadside	Included	-
152	PCC	Roadside	Included	-
154	PCC	Roadside	Included	-
155	PCC	Roadside	Included	-

NO_x/NO₂ verification

- 1.2.5 NO_x/NO₂ verification relates to the comparison and adjustment of modelled road-NO_x (as output from the ADMS-Roads dispersion model), relative to monitored road-NO_x.
- 1.2.6 For NO_x/NO₂ model verification, 2023 monitoring data has been used for those roadside locations situated adjacent to a modelled road link i.e. where traffic data exists. Table 1-2 presents all local monitoring data available for model verification.

Table 1-2 Local monitoring data for model verification

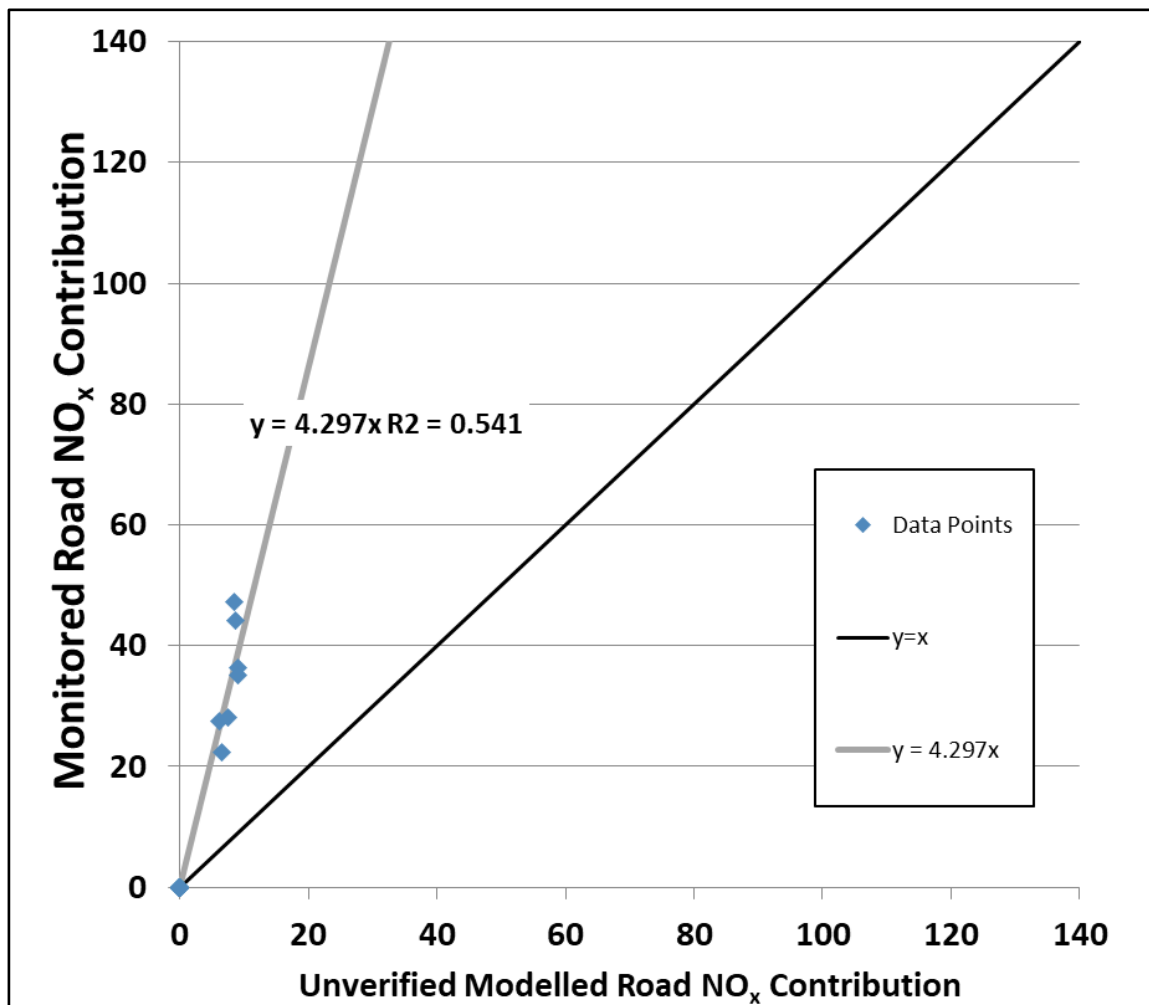
Site ID	Local Planning Authority	NGR X (m)	NGR Y (m)	2023 Monitored Annual Mean NO ₂ (µg/m ³)	2023 Data Capture (%)
22	HBC	471573	106199	25.4	91.8
28	HBC	471577	106280	28.0	99.7
149	PCC	464665	105737	27.7	100.0
151	PCC	464806	105751	25.7	91.7
152	PCC	465169	105763	34.8	100.0
154	PCC	465337	105726	33.7	100.0
155	PCC	465350	105748	31.1	100.0

- 1.2.7 NO_x was back calculated using the version 9.1 of Defra’s NO_x to NO₂ Calculator for all monitored data. The NO_x to NO₂ Calculator was also used to convert modelled road-NO_x (as output by the ADMS-Roads dispersion model) into road-NO₂.
- 1.2.8 Verification was completed using the 2023 Defra background mapped concentrations (2021 base year) for the relevant 1km grid squares (i.e. those within which the model verification locations are located), as discussed in section 6.6 of ES Chapter 6 Air quality and odour, Volume (Document reference 6.1, DCO Volume 6).
- 1.2.9 Comparison of the modelled vs. monitored road NO_x contribution at the verification locations detailed in Table 1-2 is provided in Table 1-3. An adjustment factor of **4.297** has been derived, based on a linear regression forced through zero as shown in Graphic 1-1.

Table 1-3 NO_x/NO₂ Model verification (adjustment factor 4.297)

Site ID	Monitored Road NO _x (µg/m ³)	Modelled Road NO _x (µg/m ³)	Ratio (Monitored vs. Modelled Road NO _x)	Adjustment Factor	Adjusted Modelled Total NO ₂ (µg/m ³)	Monitored Total NO ₂ (µg/m ³)	% Difference (Adjusted Modelled NO ₂ vs Monitored NO ₂)
22	28.2	7.6	3.7	4.297	27.1	25.4	6.8
28	35.1	9.1	3.9		29.4	28.0	5.1
149	27.6	6.2	4.4		27.4	27.7	-1.2
151	22.4	6.6	3.4		28.0	25.7	8.9
152	47.3	8.4	5.6		31.0	34.8	-10.9
154	44.1	8.7	5.0		31.5	33.7	-6.7
155	36.4	9.0	4.0		31.9	31.1	2.7

Graphic 1-1 Comparison of unverified modelled vs. monitored road NO_x contribution



1.2.10 LAQM.TG(22) states that:

“In order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within 25% of the monitored concentrations as a minimum, preferably within 10%”.

1.2.11 As shown in Table 1-3, the difference between the adjusted modelled NO₂ and monitored NO₂ is within ±25% at all verification locations, and within ±10% at six of the seven verification locations. Therefore, results are within the LAQM.TG(22) prescribed limits. In addition, a verification factor of 4.297 reduces the Root Mean Square Error (RMSE) from a value of 10.858µg/m³ to 2.087µg/m³ – within the LAQM.TG(22) ideal limit (i.e. 10% of the annual mean Air Quality Assessment Level (AQAL), in this case the AQAL is the annual mean NO₂ standard of 40µg/m³). Following further review, no further improvement could be made to the verification exercise.

1.2.12 On this basis, the derived verification factor (4.297) was considered acceptable and was subsequently applied to all road-NO_x concentrations predicted (as output by the ADMS-Roads dispersion model).

References

- [1] Department for Environment Food and Rural Affairs, “Local Air Quality Management Technical Guidance (LAQM.TG) 2022,” Defra, 2022.



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