

# **A1 in Northumberland: Morpeth to Ellingham**

**Scheme Number: TR010041**

## **6.8 Environmental Statement – Appendix 5.3 Methodology and Verification**

**Part B**

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed  
Forms and Procedure) Regulations 2009

June 2020

Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning  
(Applications: Prescribed Forms and  
Procedure) Regulations 2009**

The A1 in Northumberland: Morpeth to Ellingham  
Development Consent Order 20[xx]

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**Environmental Statement - Appendix**

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<b>Regulation Reference:</b>	APFP Regulation 5(2)(a)
<b>Planning Inspectorate Scheme Reference</b>	TR010041
<b>Application Document Reference</b>	TR010041/APP/6.8
<b>Author:</b>	A1 in Northumberland: Morpeth to Ellingham Project Team, Highways England

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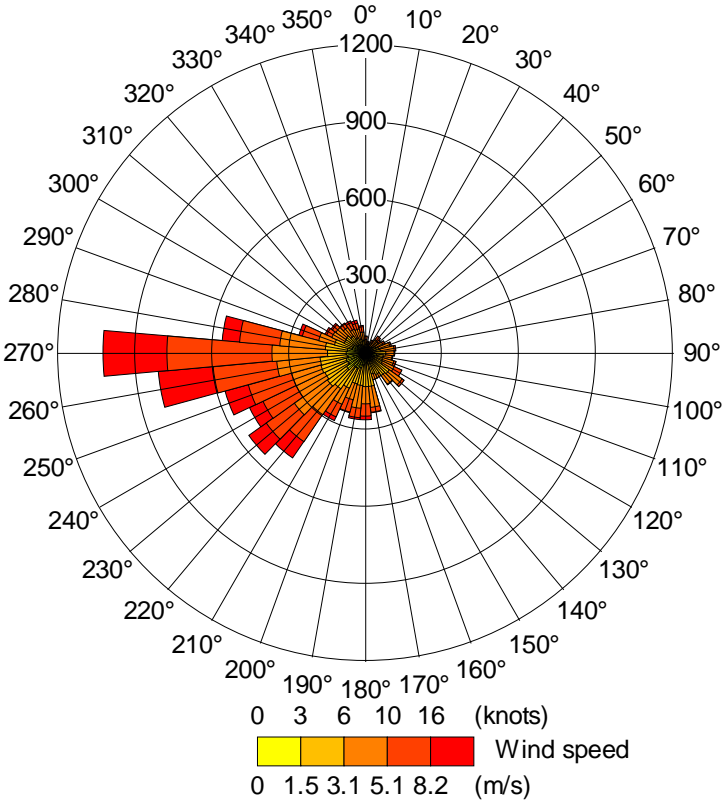
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## METHODOLOGY AND VERIFICATION

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**Table 5-1 - Model Inputs**

Input	Notes
Traffic data and emissions rates	<p>Input to emissions model by period of the day: AM Peak= 07:00 – 10:00; Inter-Peak (IP) = 10:00 – 16:00; PM Peak = 16:00 – 19:00; Off-Peak (OP) = 19:00 to 07:00.</p> <p>Emission Factors from IAN 185/13 Speed Band Emission Factors (v3.1.xlsb).</p> <p>A weekend factor of 0.916 was applied to scale emissions on Saturdays and Sundays.</p>
Road geometry	<p>All roads realigned to centreline, set to true road widths (kerb to kerb / edge of travelled lanes); road heights set to zero.</p>
Meteorological data	<p>Newcastle Airport 2015</p> <p>Newcastle Airport 43 kilometres (km) south of Part B: Alnwick to Ellingham (Part B).</p> <p>Parameters include in hourly sequential format: Julian date, hour, wind speed (metres/second (m/s)), wind direction (degrees from north), cloud cover (oktas), surface temperature (Celcius ( °C)).</p> <p>Roughness length = 0.5 m (parkland / open suburbia)</p> <p>Minimum Monin-Obukhov length = 30 m</p>

Input	Notes
	
Background concentrations	From Defra 1 x 1 kilometre mapped datasets for 2015 and 2023, sector removed NO <sub>x</sub> . Sectors removed are motorways, trunk roads, primary 'A' roads within the 1 kilometre squares.
Receptors	Discrete receptors for human receptors, transects for ecological receptors (refer to <b>Appendix 5.4: Receptors</b> and <b>Chapter 16: Cumulative Effects of the Scheme, Volume 4</b> of this ES ( <b>Application Document Reference: TR010041/APP/6.4</b> )).
Model outputs	Annual mean NO <sub>x</sub> and PM <sub>10</sub> concentrations at receptor points (road source contributions only).
Post-processing	Verification (discussed below) with adjustment of road source contributions of annual mean NO <sub>x</sub> and PM <sub>10</sub> (to address systematic model error).

Input	Notes
	<p>NO<sub>x</sub> to NO<sub>2</sub> conversion using Defra's calculator v6.1 (NO<sub>x</sub>_to_NO2_Calculator_v6.1.xls)</p> <p>Gap Analysis following IAN 170/12 v3 (HA_Long-Term_Gap_Analysis_Calculator_v1-0_LTTE6.xls)</p> <p>Compliance with the 24-hour mean air quality objective for PM<sub>10</sub> has been determined using the following empirical equation given in Design Manual for Roads and Bridges (DMRB) HA 207/07:</p> <ul style="list-style-type: none"> <li>- Number of 24-hour mean exceedances of 50 µg/m<sup>3</sup> = <math>-18.5 + 0.00145 \times (\text{annual mean})^3 + (206 \div \text{annual mean})</math>.</li> <li>- PM<sub>2.5</sub> concentration estimation from PM<sub>10</sub> concentration: PM<sub>10</sub> × 0.7 (national derived ratio PM<sub>2.5</sub>/PM<sub>10</sub>).</li> </ul>

## MODEL VERIFICATION

- 5.1.1. 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 uncertainties in model input data, modelling and monitoring data assumptions. The following are examples of potential causes of such discrepancy:
- a. Estimates of background pollutant concentrations
  - b. Uncertainty in monitored pollutant concentrations
  - c. Meteorological data uncertainties
  - d. Traffic data uncertainties
  - e. Model input parameters, such as 'roughness length'
  - f. Overall limitations of the dispersion model
- 5.1.2. Most NO<sub>2</sub> 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 the NO<sub>x</sub> increment (or contribution) from the road sources that have been explicitly included in the dispersion model. This is in line with Local Air Quality Management (LAQM).TG(16) guidance.
- 5.1.3. The verification process compares the annual mean road NO<sub>x</sub> contribution at roadside monitoring locations, which represent existing receptor locations using Interim Advice Note (IAN) 185 Speed Banded emissions. The model output of road-NO<sub>x</sub> has been compared with the 2015 'measured' road-NO<sub>x</sub>, which was determined from the nitrogen dioxide concentration measured at monitoring sites, utilising the NO<sub>x</sub> from NO<sub>2</sub> calculator provided by the Department for the Environment, Food and Rural Affairs (Defra), and the NO<sub>x</sub>

background concentration (from the Defra 1 x 1 kilometre background mapping). Monitored NO<sub>2</sub> data has been taken from local authority monitoring and the Applicant's project specific monitoring.

5.1.4. The data used in the verification are presented below. Three verification factors were derived to account for local variations:

- a. Morpeth town (Group 1)
- b. Receptors near monitoring site 'A4' (Earsdon Moor) on the A1 to account for road gradient (Group 2)
- c. All other locations (Group 3)

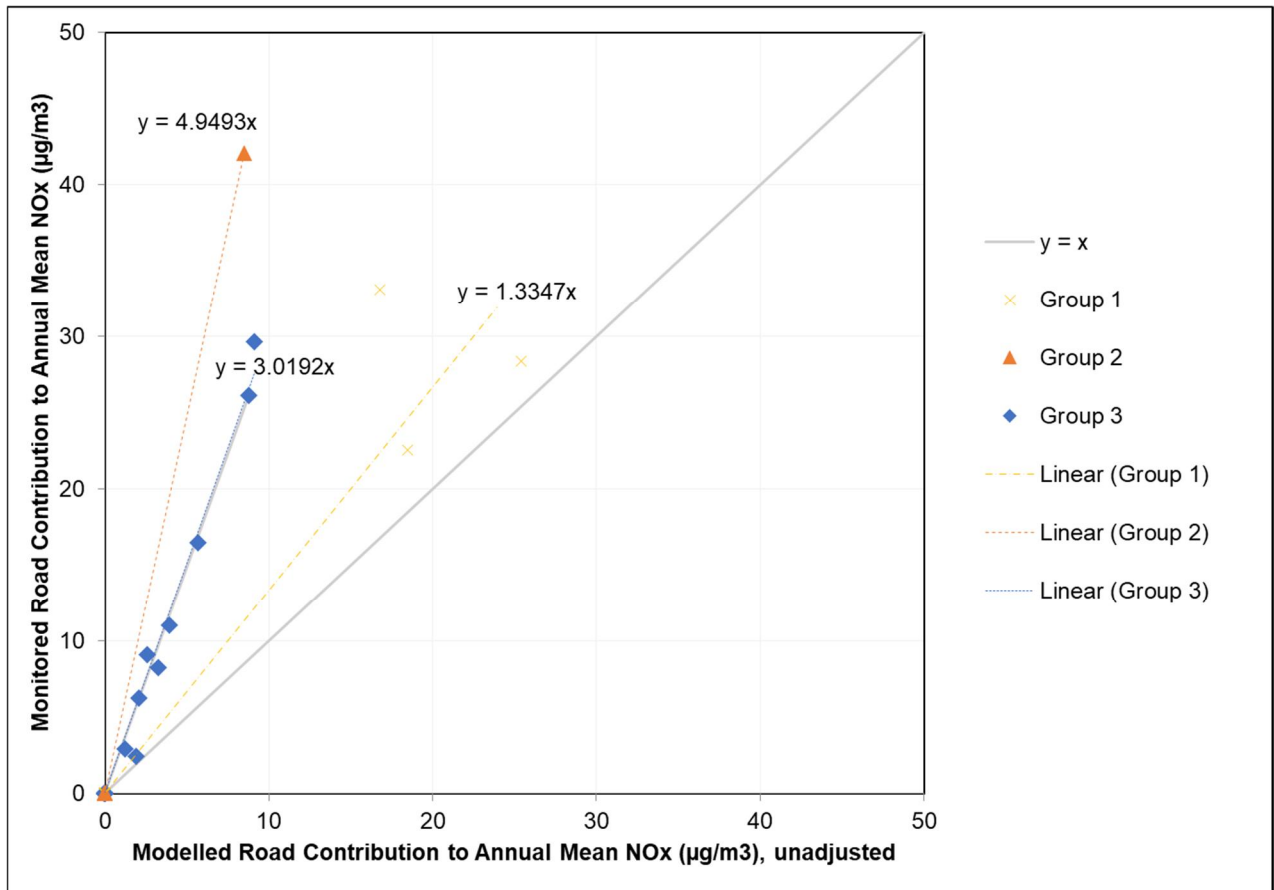
**Table 5-2 - Data Examined in Model Verification**

Monitoring Site	2015 Back-ground NO <sub>x</sub> (µg/m <sup>3</sup> )	2015 Monitored NO <sub>2</sub> (µg/m <sup>3</sup> )	2015 Monitored Road NO <sub>x</sub> (µg/m <sup>3</sup> )	2015 Modelled Road NO <sub>x</sub> (µg/m <sup>3</sup> )	Ratio Monitored / Modelled Road NO <sub>x</sub>	Comment	Group
CM2	9.8	19.0	22.5	18.5	1.2	Centre of Morpeth	1
CM4	10.0	22.0	28.4	25.4	1.1	Centre of Morpeth	1
CM6	11.3	25.0	33.1	16.8	2.0	Centre of Morpeth	1
A4	6.7	26.8	42.1	8.5	4.9	On a hill on A1. Rural	2
A1	7.8	19.7	26.2	8.8	3.0	Rural	3
A3	6.7	14.2	16.5	5.7	2.9	Rural	3
A5	6.6	20.9	29.7	9.1	3.2	Rural	3
A6	6.6	9.8	8.2	3.3	2.5	Rural	3
B1	6.2	8.5	6.2	2.1	3.0	Rural	3
B2	6.2	10.1	9.1	2.6	3.5	Rural	3
B3	6.2	6.4	2.5	1.9	1.3	Rural	3
B4	6.2	11.1	11.0	3.9	2.8	Rural	3
B6	6.3	6.7	2.9	1.2	2.4	Rural	3
A2	7.3	18.3	23.8	4.0	6.0	Speed camera and junction	N

Monitoring Site	2015 Back-ground NO <sub>x</sub> (µg/m <sup>3</sup> )	2015 Monitored NO <sub>2</sub> (µg/m <sup>3</sup> )	2015 Monitored Road NO <sub>x</sub> (µg/m <sup>3</sup> )	2015 Modelled Road NO <sub>x</sub> (µg/m <sup>3</sup> )	Ratio Monitored / Modelled Road NO <sub>x</sub>	Comment	Group
						affecting flows	
A7	6.4	23.7	35.8	21.1	1.7	Very low to the ground (0.9 m)	N
B5	6.2	9.0	7.2	1.8	4.1	Monitored unusually high	N
B7	6.5	6.7	2.7	0.4	6.9	Not near ARN	N
CM5	9.8	21.0	26.6	8.5	3.1	Queuing vehicles	N

- 5.1.5. The verification (adjustment) factor for each group represents the slope of the best fit line through the plotted monitored and modelled road NO<sub>x</sub> data (shown in **Figure 5-1** below), which has been derived by simple linear regression with the line forced through the origin of the graph. Data points in the N group were eliminated as not representative of receptor locations.
- 5.1.6. After verification on the basis of road NO<sub>x</sub>, the monitored and modelled total NO<sub>2</sub> concentration is compared (shown in **Figure 5-2** below). This showed a good fit with the data and no secondary verification factor was required.





**Figure 5-1 - Selected Monitored / Modelled Road Contribution to Annual Mean NO<sub>x</sub>**

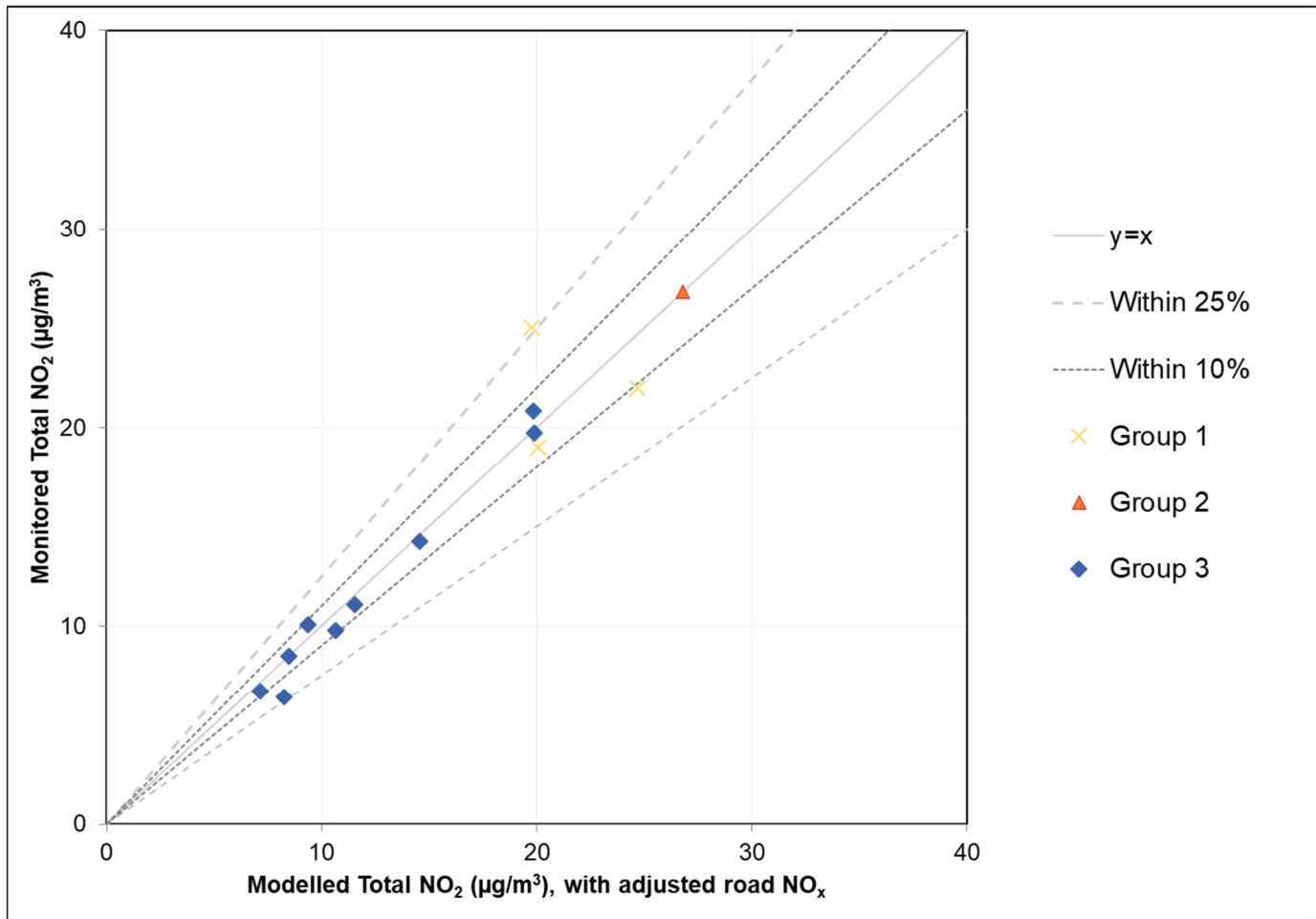


Figure 5-2 - Monitored and Modelled Total NO<sub>2</sub> Concentrations

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