

A1 in Northumberland: Morpeth to Ellingham

Scheme Number: TR010041

6.7 Environmental Statement – Appendix 5.3 Methodology and Verification

Part A

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]**

Environmental Statement - Appendix

Regulation Reference:	APFP Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010041
Application Document Reference	TR010041/APP/6.7
Author:	A1 in Northumberland: Morpeth to Ellingham Project Team, Highways England

Version	Date	Status of Version
Rev 0	June 2020	Application Issue

CONTENTS

TABLES

Table 5-1 - Model Inputs	1
Table 5-2 - Data Examined in Model Verification	4

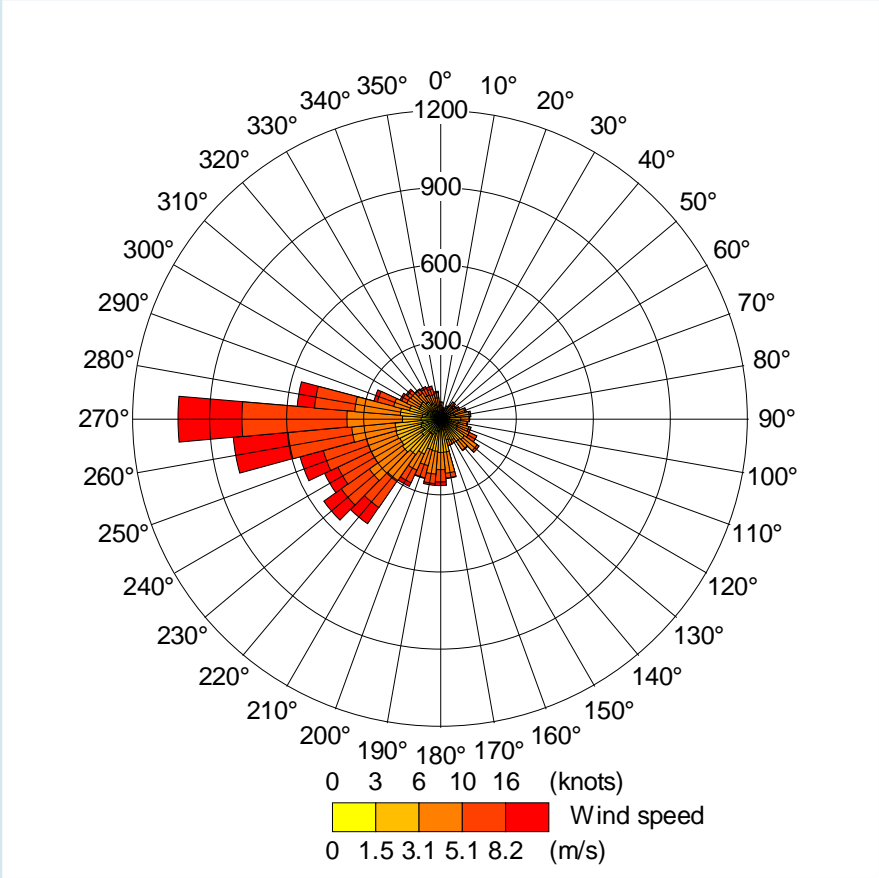
FIGURES

Figure 5-1 – Monitored and Modelled Road Contribution to Annual Mean NO _x	6
Figure 5-2 - Monitored and Modelled Total NO ₂ Concentrations	7

METHODOLOGY AND VERIFICATION

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 17 km south of Part A</p> <p>Parameters include in hourly sequential format: Julian date, hour, wind speed (m/s), wind direction (degrees from north), cloud cover (oktas), surface temperature (Celcius).</p> <p>Roughness length = 0.5 m (parkland/open suburbia)</p> <p>Minimum Monin-Obukhov length = 30 m</p>

	
<p>Background concentrations</p>	<p>From Defra 1 x 1 km mapped datasets for 2015 and 2023, sector removed NO_x. Sectors removed are motorways, trunk roads, primary 'A' roads within the 1 km squares.</p>
<p>Receptors</p>	<p>Discrete receptors for human receptors, transects for ecological receptors (refer to Appendix 5.4: Receptors of Volume 7 (Application Document Reference: TR010041/APP/6.7) of this ES)</p>
<p>Model outputs</p>	<p>Annual mean NO_x and PM₁₀ concentrations at receptor points (road source contributions only).</p>
<p>Post-processing</p>	<p>Verification (discussed below) with adjustment of road source contributions of annual mean NO_x and PM₁₀ (to address systematic model error).</p> <p>NO_x to NO₂ conversion using Defra's calculator v6.1 (NO_x_to_NO₂_Calculator_v6.1.xls)</p>

	Gap Analysis following IAN 170/12 v3 (HA_Long-Term_Gap_Analysis_Calculator_v1-0_LTTE6.xls)
	<p>Compliance with the 24-hour mean air quality objective for PM₁₀ has been determined using the following empirical equation given in DMRB HA 207/07:</p> <p>Number of 24-hour mean exceedances of 50 µg/m³ = -18.5 + 0.00145 × (annual mean)³ + (206 ÷ annual mean)</p> <p>PM_{2.5} concentration estimation from PM₁₀ concentration: PM₁₀ × 0.7 (national derived ratio PM_{2.5}/PM₁₀).</p>

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/or 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 NO₂ 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 the NO_x increment (or contribution) from the road sources that have been explicitly included in the dispersion model. This is in line with LAQM.TG (16) guidance.
- 5.1.3. The verification process compares the annual mean road NO_x contribution at roadside monitoring locations, which represent existing receptor locations using IAN 185 Speed Banded emissions. The model output of road-NO_x has been compared with the 2015 ‘measured’ road-NO_x, which was determined from the nitrogen dioxide concentration measured at monitoring sites, utilising the NO_x from NO₂ calculator provided by Defra, and the NO_x background concentration (from the Defra 1 x 1 km background mapping). Monitored NO₂ data has been taken from local authority monitoring and Highways England project specific monitoring as well as Local Authority 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 _x (µg/m ³)	2015 Monitored NO ₂ (µg/m ³)	2015 Monitored Road NO _x (µg/m ³)	2015 Modelled Road NO _x (µg/m ³)	Ratio Monitored / Modelled Road NO _x	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 affecting flows	N
A7	6.4	23.7	35.8	21.1	1.7	Very low to the ground (0.9 m)	N

Monitoring Site	2015 Back-ground NO _x (µg/m ³)	2015 Monitored NO ₂ (µg/m ³)	2015 Monitored Road NO _x (µg/m ³)	2015 Modelled Road NO _x (µg/m ³)	Ratio Monitored / Modelled Road NO _x	Comment	Group
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_x data (shown in **Figure 5-1**), 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_x, the monitored and modelled total NO₂ concentration was compared (**Figure 5-2**). This showed a good fit with the data and no secondary verification factor was required.

Figure 5-1 – Monitored and Modelled Road Contribution to Annual Mean NO_x

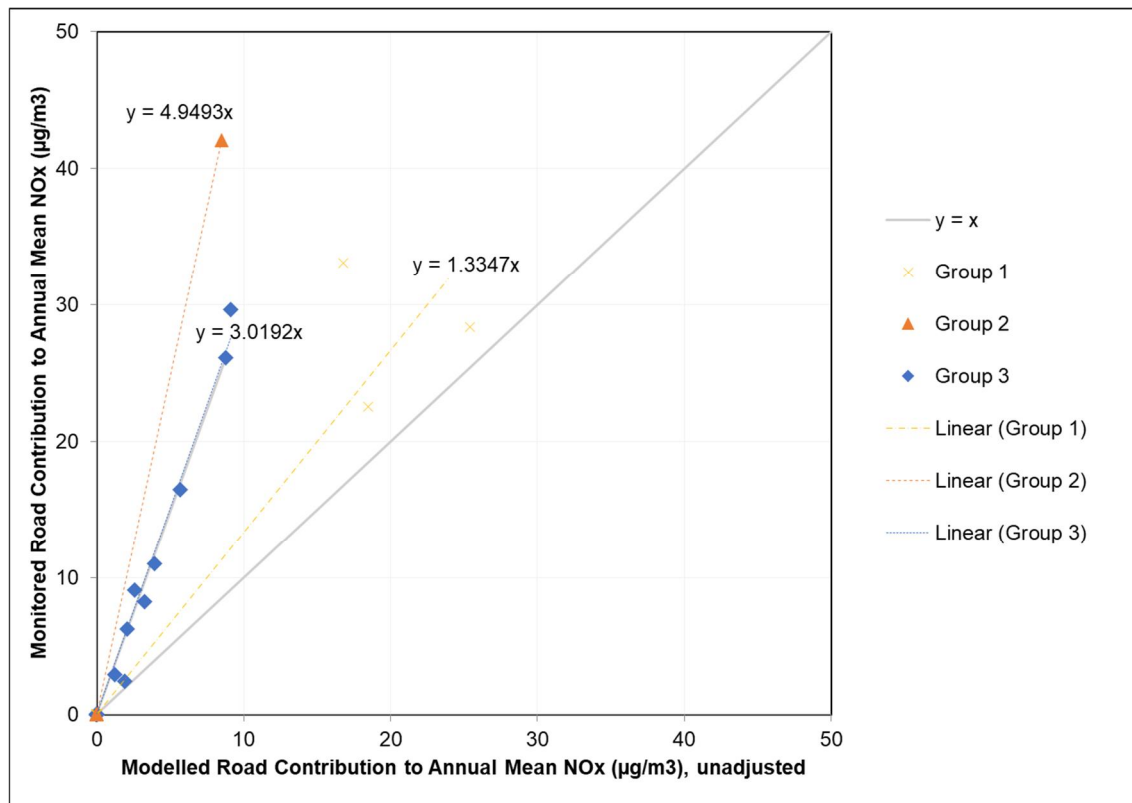
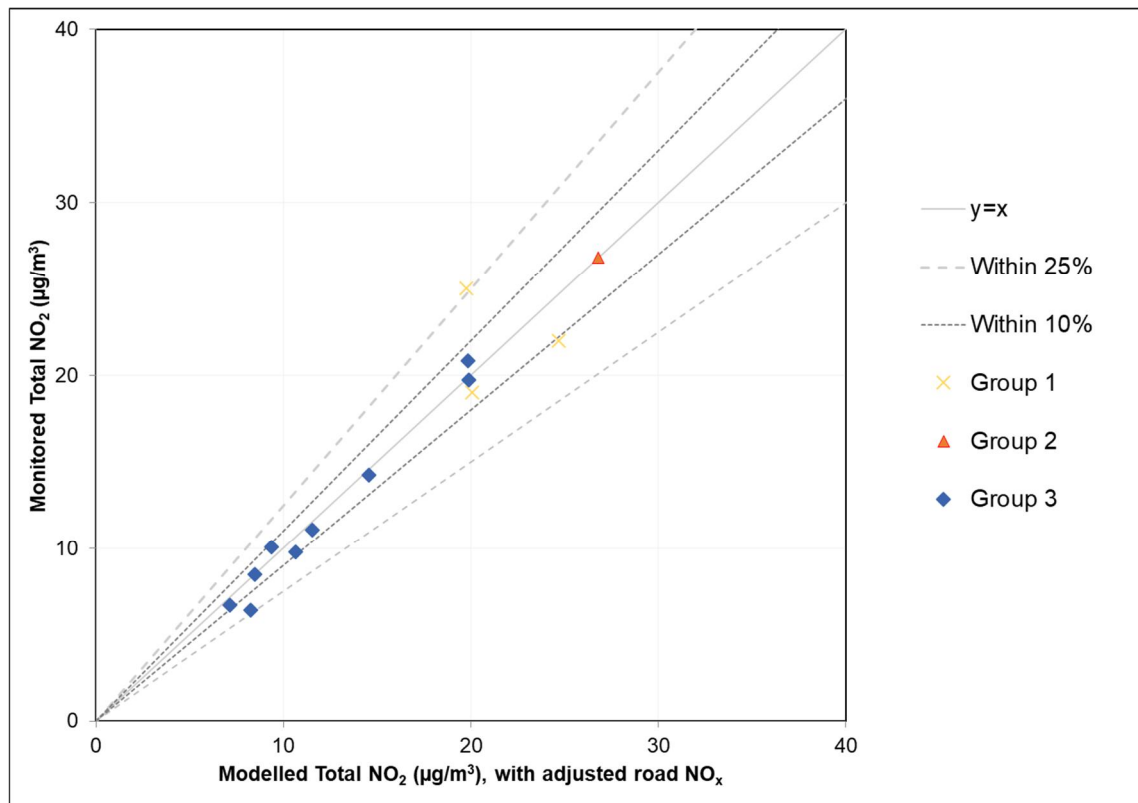


Figure 5-2 - Monitored and Modelled Total NO₂ Concentrations



© Crown copyright 2020.

You may re-use this information (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence. To view this licence:

visit www.nationalarchives.gov.uk/doc/open-government-licence/

write to the **Information Policy Team, The National Archives,**

Kew, London TW9 4DU, or email

psi@nationalarchives.gsi.gov.uk.

This document is also available on our website at www.gov.uk/highways

If you have any enquiries about this document A1inNorthumberland@highwaysengland.co.uk or call **0300 470 4580***.

*Calls to 03 numbers cost no more than a national rate call to an 01 or 02 number and must count towards any inclusive minutes in the same way as 01 and 02 calls.

These rules apply to calls from any type of line including mobile, BT, other fixed line or payphone. Calls may be recorded or monitored.

Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ

Highways England Company Limited registered in England and Wales number 09346363