

Appendix 7.2 – Model Inputs and Verification

An important stage in the modelling process is model verification of the road traffic model, which involves comparing the model output with measured concentrations in order to increase confidence in modelled predictions. According to LAQM.TG (16), the difference between modelled results and monitored concentrations is acceptable where it is within 25% (10% is preferable).

It is most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides ($\text{NO}_x = \text{NO} + \text{NO}_2$). The model output of road- NO_x (i.e., the component of total NO_x coming from road traffic) has been compared with the 'measured' road- NO_x . Measured road- NO_x has been calculated from the measured NO_2 concentrations using the NO_x from NO_2 calculator (Version 8.1) available on the Defra LAQM Support website¹.

The study area has been split into two and two different adjustment factors have been applied as the majority of the model was overpredicting, however there was one section which was underpredicting. One adjustment factor of 1.8 has been applied to a section of Bishopstoke Road between Sayers Road and Station Hill where the model was underpredicting. A second adjustment factor of 0.62 has been applied to the rest of the study area which was overpredicting. The verification process for each of the two model verification areas are outlined below.

Main study area

The pre-adjusted modelled and monitored verification results are given in Table 7.3.1.

Table 7.3.1 - 2019 Modelled and monitored diffusion results

Diffusion Tube	Modelled Road NO _x	Monitored Road NO _x	Ratio Modelled/Monitored	Modelled NO ₂	Monitored NO ₂	%Difference NO ₂
	µg/m ³	µg/m ³		µg/m ³	µg/m ³	
BOT	50.8	29.2	1.74	41.7	31.9	30.6
FORSL	32.4	21.2	1.53	33.4	28.0	19.3
WYV	20.6	13.4	1.54	27.7	24.1	15.1
FOR	16.6	5.6	2.96	25.8	20.1	28.2
SWA	31.6	22.4	1.41	33.0	28.6	15.4
MS	24.3	17.9	1.36	29.5	26.4	11.9

¹ Defra, "NO_x to NO₂ Calculator" (Defra, 2019), <http://laqm.defra.gov.uk/documents/NOx-NO2-Calculator-v7.1.xls>.

As shown, modelled concentrations of NO_x and NO₂ were overpredicted by the model at all locations, and results were outside the ideal 25% threshold at 2 sites. As such, an adjustment factor of **0.6221** has been determined as the equation of the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution of NO_x, as shown below:

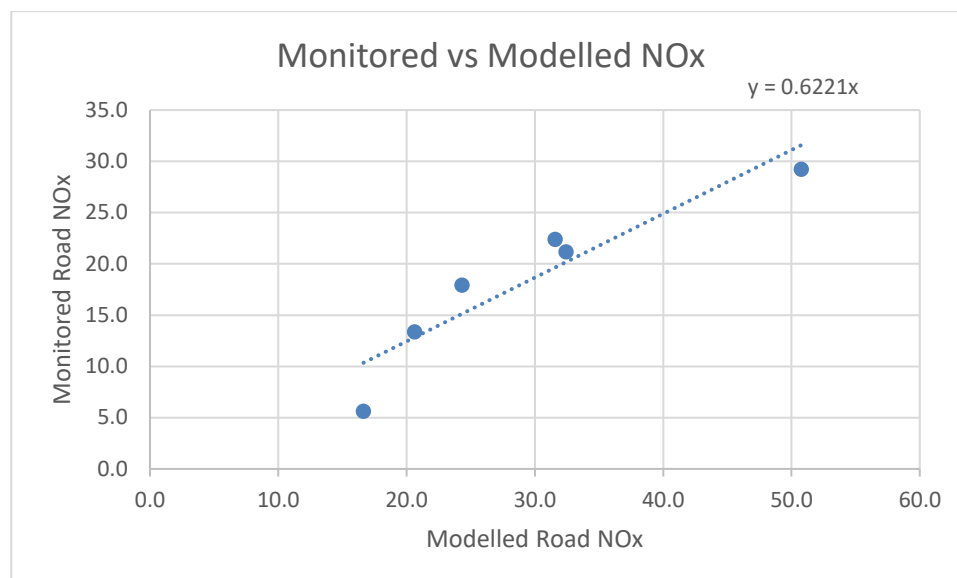


Table 7.3.2 shows total monitored versus modelled NO₂ following the adjustment of the road contribution of NO_x by this factor. The total nitrogen dioxide concentration was determined by adding the background NO₂ concentration to the modelled road contribution.

Table 7.3.2 – Post-adjusted 2019 Modelled and monitored results

Diffusion Tube	Adjusted Modelled NO ₂	Monitored NO ₂	%Difference NO ₂
	µg/m ³	µg/m ³	
BOT	33.0	31.9	3
FORSL	27.5	28.0	-2
WYV	23.8	24.1	-1
FOR	22.5	20.1	12
SWA	27.2	28.6	-5
MS	25.0	26.4	-5

Following adjustment of NO_x by a factor of **0.6221** all modelled concentrations of NO₂ were within the ideal 10% range.

As there is no suitable PM₁₀ or PM_{2.5} monitoring data in the study area, it was not possible to perform model verification for these pollutants. As such, the NO₂ adjustment factor has also been applied to PM₁₀ and PM_{2.5} model results, in accordance with LAQM.TG (16).

Bishopstoke Road

The pre-adjusted modelled and monitored verification results are given in Table 7.3.3.

Table 7.3.3 - 2019 Modelled and monitored results

Diffusion Tube	Modelled Road NO _x	Monitored Road NO _x	Ratio Modelled/Monitored	Modelled NO ₂	Monitored NO ₂	%Difference NO ₂
	µg/m ³	µg/m ³		µg/m ³	µg/m ³	
BR	18.2	33.3	0.55	26.6	33.8	-21.4
BR2	15.5	28.0	0.55	25.2	31.3	-19.6

As shown, modelled concentrations of NO_x and NO₂ were underpredicted by the model at both locations, and whilst the results were within the 25% threshold at both sites, they were outside the ideal 10% threshold. As such, an adjustment factor of **1.8189** has been determined as the equation of the slope of the best-fit line between the ‘measured’ road contribution and the model derived road contribution of NO_x, as shown below:

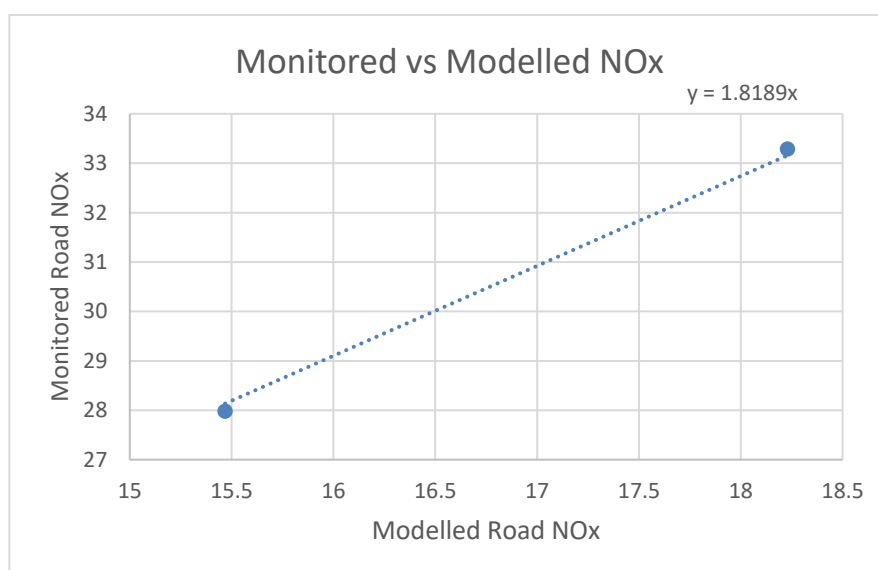


Table 7.3.4 shows total monitored versus modelled NO₂ following the adjustment of the road contribution of NO_x by this factor. The total nitrogen dioxide concentration was determined by adding the background NO₂ concentration to the modelled road contribution.

Table 7.3.4 – Post-adjusted 2019 Modelled and monitored results

Diffusion Tube	Adjusted Modelled NO ₂	Monitored NO ₂	%Difference NO ₂
	µg/m ³	µg/m ³	
BR	33.6	33.8	-1
BR2	31.2	31.3	0

Following adjustment of NO_x by a factor of **1.8189**, all modelled concentrations of NO₂ were within 10% of monitored concentrations.

As there is no suitable PM₁₀ or PM_{2.5} monitoring data in the study area, it was not possible to perform model verification for these pollutants. As such, the NO₂ adjustment factor has also been applied to PM₁₀ and PM_{2.5} model results, in accordance with LAQM.TG (16).