

6.3 Model Verification

The approach to model verification that LAQM.TG22 recommends for local authorities when they carry out their LAQM duties is summarised in our assessment methodology. For the verification and adjustment of NO_x/NO₂ concentrations, the guidance recommends that the comparison considers a broad spread of automatic and diffusion-tube monitoring. MCC monitors roadside/kerbside NO₂ concentrations passively using diffusion tubes at three locations and automatically at one location in the vicinity of the Application Site.

The concentrations monitored over recent years are provided in Table 6.3.1.

Table 6.3.1 Measured Annual-mean NO₂ Concentrations (µg.m⁻³)

Monitoring Site	Measured Annual-mean Concentrations (µg.m ⁻³)			
	2017	2018	2019	2020
MAN1	65	62	59	36
MA29ANO	57.7	58.8	55.4	39.0
MA96NO	-	-	46.0	36.4
SA81NO	-	-	46.4	34.8

Monitored results from 2019 were used in this model verification study to avoid the associated decrease in traffic-related pollutant concentrations due the Covid-19 pandemic. The four monitors were selected as they represent Roadside/Kerbside locations, are located within 1.5 km of the Site and have recent monitoring and traffic data from 2019.

The monitored annual-mean NO_x road contributions have been derived from the monitored annual-mean NO₂ concentrations using the LAQM.TG22 calculator. The monitored annual-mean NO_x road contributions have then been compared with the modelled annual-mean NO_x road contributions. This comparison is provided in Table 6.3.2 below.

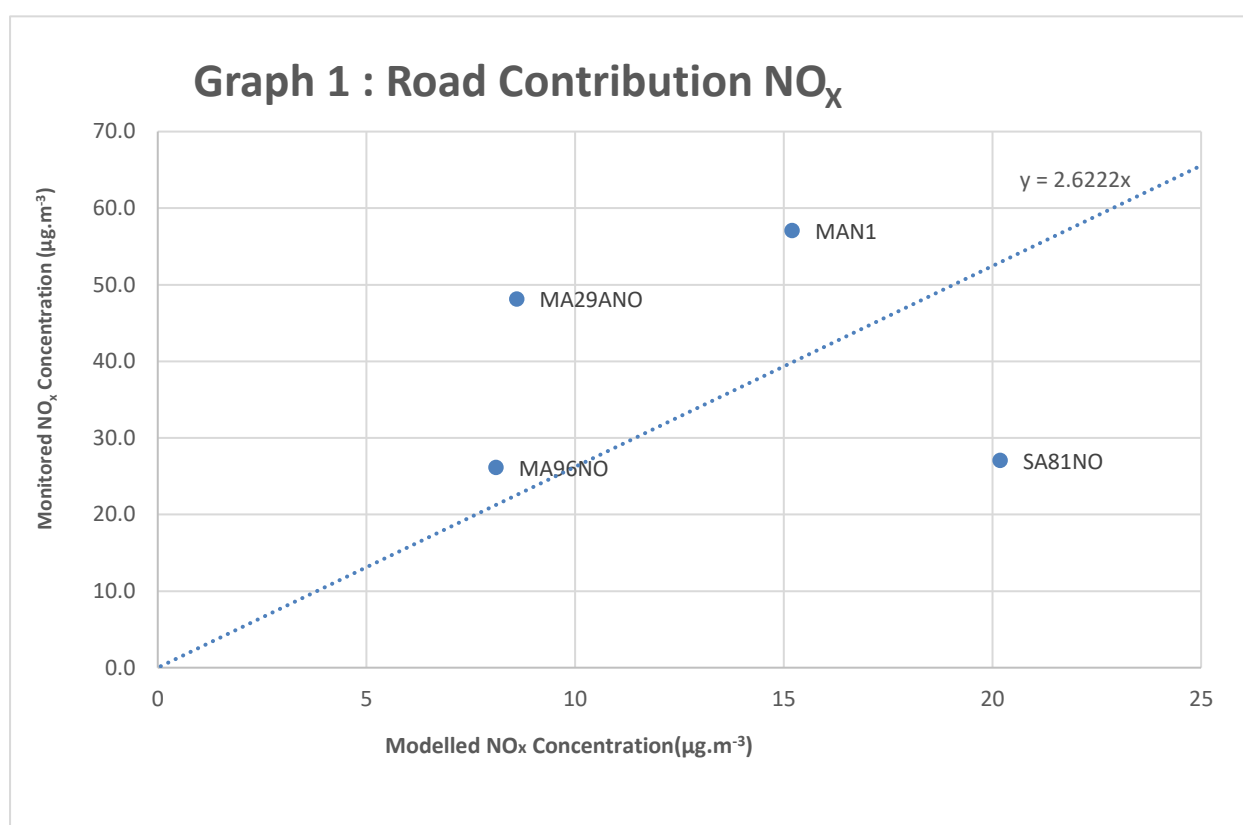
Table 6.3.2 Comparison of Monitored and Modelled Annual-mean Road NO_x Contribution (µg.m⁻³)

Monitoring Site	Annual-mean Road NO _x Contribution (µg.m ⁻³)	
	Monitored	Modelled
MAN1	57.1	15.2
MA29ANO	48.2	8.6
MA96NO	26.2	8.1

SA81NO	27.1	20.2
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It should be borne in mind that the monitored concentrations are themselves only estimates to the true concentrations at each point; the EU Directive on air quality [1] designates passive NO₂ samplers indicative measures with a potential uncertainty of +/-30 %. Ignoring any uncertainty errors in the monitoring results, Table 6.3.2 above indicates that the model is under-predicting at all monitoring sites.

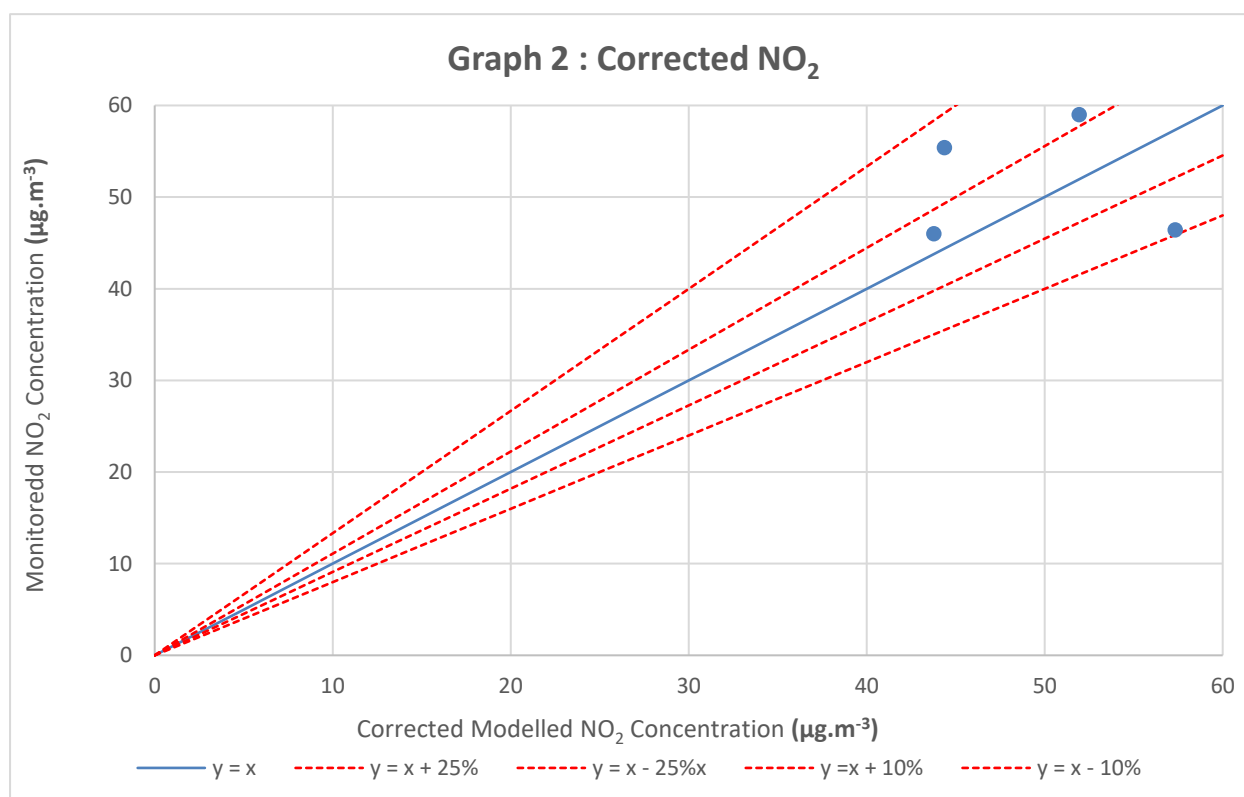
The modelled annual-mean NO_x road contributions have been plotted against the monitored annual-mean NO_x road contributions in Graph 1.



The modelled NO_x contributions have been multiplied by the gradient of the trend line (2.622) to determine the corrected NO_x contributions. Modelled annual-mean NO₂ concentrations have been derived from the corrected modelled annual-mean NO_x road contributions. The

¹ Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe

corrected modelled annual-mean NO₂ concentrations have been plotted against the monitored annual-mean NO₂ concentrations in Graph 2.



The corrected modelled annual-mean NO₂ concentrations are all within 25% of the monitored annual-mean NO₂ concentrations. The correction factor therefore improves the modelled concentrations and has been applied to all predictions used within the assessment.

The fractional bias can also be used to determine whether the corrected model has a tendency to over or under-predict. The fractional bias is calculated as:

$$\frac{(\text{Average Monitored NO}_x \text{ Concentration} - \text{Average Predicted NO}_x \text{ Concentration})}{0.5 \times (\text{Average Monitored NO}_x + \text{Average Predicted NO}_x \text{ Concentration})}$$

Fractional bias values vary between +2 and -2 and has an ideal value of zero. A negative value suggests a model over-prediction and a positive value suggests a model under-prediction.

Table 6.3.3 sets out the average monitored concentration and the average predicted concentration.

Monitoring Site	Annual-mean Road NO _x Contribution (µg.m ⁻³)	
	Monitored	Corrected Modelled
MAN1	57.1	39.9
MA29ANO	48.2	22.6
MA96NO	26.2	21.3
SA81NO	27.1	52.9
Average	39.6	34.2

The fractional bias for this study is therefore $(39.6 - 34.2) / (0.5 \times (39.6 + 34.2)) = 0.15$. As the fractional bias is small, the adjusted model is performing well.