

PORTISHEAD BRANCH LINE PRELIMINARY
ENVIRONMENTAL INFORMATION REPORT
VOLUME 4

APPENDIX 7.3

Air Quality Model Verification



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SECTION 1

Air Quality Model Verification

1.1 Introduction

- 1.1.1 Prior to performing a rigorous assessment of air quality impacts at all identified sensitive receptors, it is necessary to verify modelling predictions against monitoring data within the study area. This process involves a comparison between predicted and measured road-traffic contributions to pollutant concentrations.
- 1.1.2 As outlined in Chapter 7, Section 7.4 of the Preliminary Environmental Information Report (PEI Report), North Somerset District Council (“NSDC”) and Bristol City Council (“BCC”) monitor NO₂ concentrations using automatic and diffusion tube monitoring. The ADMS-Roads model (v4.0) was used to predict Base Year (2013) total NO₂ concentrations at NSDC and BCC monitoring locations alongside or close to the defined study area.
- 1.1.3 Two separate verification factors have been derived for NSDC and BCC to account for the differences in baseline NO₂ levels.

1.2 NSDC Model Verification

- 1.2.1 Two diffusion tube monitoring sites were used for the NSDC verification. Both these sites had data capture greater than 90% in 2013. The locations of all NSDC air quality monitoring sites within 500 m of the study area are shown in Figure 7.2 Volume 3 of the PEI Report. The initial modelled versus monitored results for total NO₂ concentrations within NSDC are presented in Table 1.1.

Table 1.1: Unadjusted Annual Mean Modelled and Monitored Total NO₂ Concentrations (µg m⁻³) at Monitoring Sites in NSDC

Site Id	Location	Measured NO ₂	Unadjusted Modelled NO ₂	% Difference Model vs Measured
DT13	Portbury (Priory Road)	24.9	17.1	-31.4%
DT14	Pill (Railway Line)	19.4	17.3	-10.7%

- 1.2.2 Table 1.1 shows predicted total annual mean NO₂ concentrations in NSDC are under predicted at all monitoring sites. Modelled and measured road traffic concentrations were compared to derive a verification factor to apply to the modelled results. Following Defra TG(16) Box A7.15 (Defra, 2014), verification has been undertaken based on road-traffic NO_x.
- 1.2.3 As diffusion tubes only measure total NO₂, it is necessary to estimate the road-traffic total NO_x concentration before adding the modelled contribution. NO_x was estimated following the methodology outlined Defra TG(16) (Defra, 2014). Defra background NO₂ was subtracted from the total NO₂ concentration measured, and the road-traffic NO₂ component was converted to NO_x using Version 4.1 of the NO_x to NO₂ calculator.
- 1.2.4 Modelled versus measured road NO_x concentrations, shown in Figure 1.1, have been used to derive a model verification factor. A verification factor of 2.71 was calculated based on the ratio of the monitored to the modelled concentration. This verification factor has been applied to the modelled road traffic NO_x concentrations (Figure 1.1).

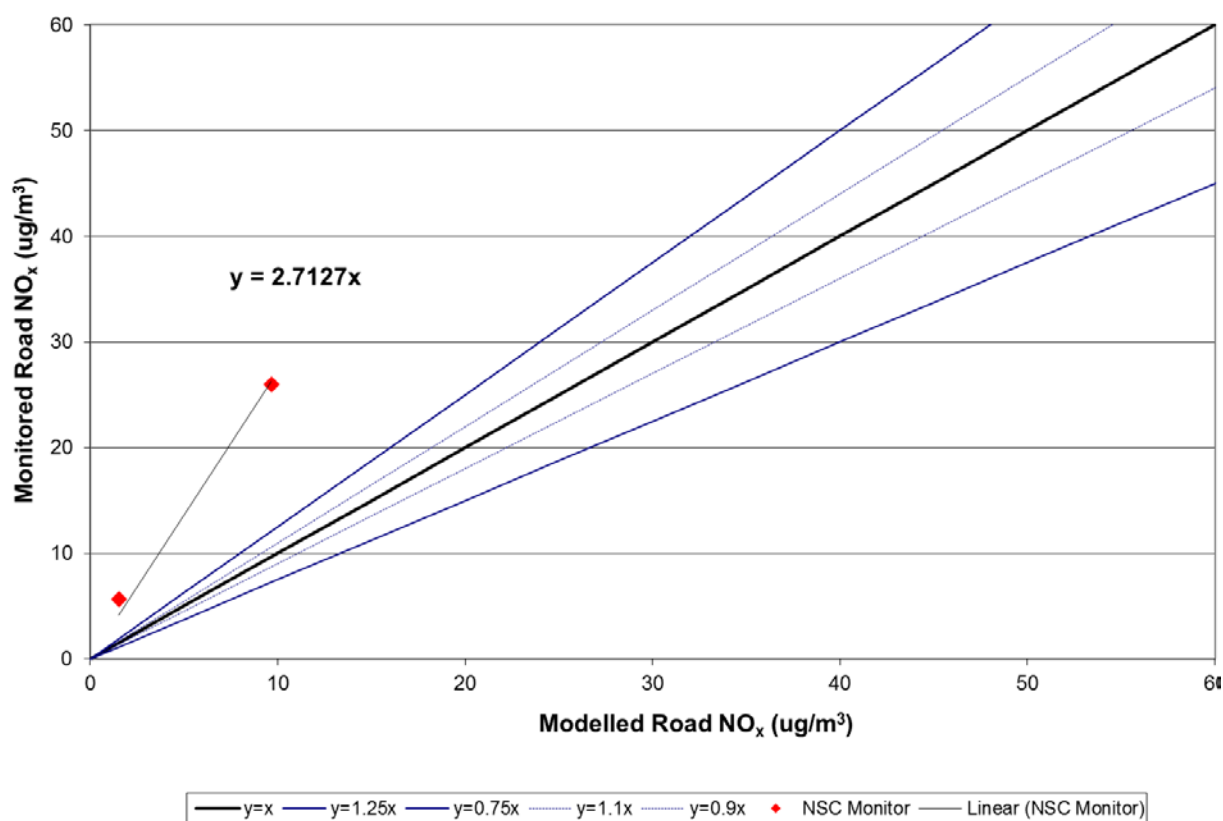


Figure 1-1: Modelled versus Monitored Road NO_x Concentrations (µg m⁻³) in NSDC

1.2.5 This verification factor has been applied to modelled road NO_x at all receptors located within NSDC. The adjusted modelled versus monitored total NO₂ concentrations for the verification diffusion tube monitoring sites are shown in Table 1.2.

Table 1.2: Adjusted Annual Mean Modelled and Monitored Total NO₂ Concentrations (µg m⁻³) at Monitoring Sites in Study Area

Site Id	Location	Measured NO ₂	Adjusted Modelled NO ₂	% Difference Model vs Measured
DT13	Portbury (Priory Road)	24.9	25.0	0.4%
DT14	Pill (Railway Line)	19.4	18.6	-3.9%

1.2.6 The adjusted modelled results are well within 5% of the monitored concentrations at both DT13 and DT14, showing a good correlation between the two sets of data.

1.2.7 Following Defra TG(16) guidance, the verification factor for road traffic NO_x was also applied to road traffic PM₁₀ concentrations as there were no monitoring sites to verify road traffic PM₁₀ concentrations in the study area. This is considered to be a worst-case approach.

1.3 BCC Model Verification

- 1.3.1 Five monitoring sites were used for the BCC verification, one automatic monitoring station and four diffusion tube sites. The locations of all BCC air quality monitoring within 500 m of the study area are shown in Figure 7.2 in Volume 3 of the PEI Report. All these sites had data capture greater than 90% in 2013.
- 1.3.2 The initial modelled versus monitored results for total NO₂ concentrations within BCC are presented in Table 1.3.

Table 1.3: Unadjusted Annual Mean Modelled and Monitored Total NO₂ Concentrations (µg m⁻³) at Monitoring Sites in BCC

Site Id	Location	Measured NO ₂	Unadjusted Modelled NO ₂	% Difference Model vs Measured
DT1	Parson Street School (Automatic)	50.8	29.8	-41.4%
DT5	Parson Street	53.6	41.8	-22.0%
DT7	B&G Snax West St	43.5	27.0	-37.9%
DT8	Martial Arts West Street	39.1	27.1	-30.7%
DT11	Greville Smyth Park	33.1	24.8	-25.2%

- 1.3.3 Table 1.3 shows predicted total annual mean NO₂ concentrations in BCC are under predicted at all monitoring sites.
- 1.3.4 Following the same approach described for NSDC, modelled and measured road traffic concentrations were compared to derive a verification factor to apply to the modelled results. Following Defra TG(16) verification has been undertaken based on road-traffic NO_x. This is shown in Figure 1.2 that shows this relationship for the five monitoring sites considered in the BCC model verification.

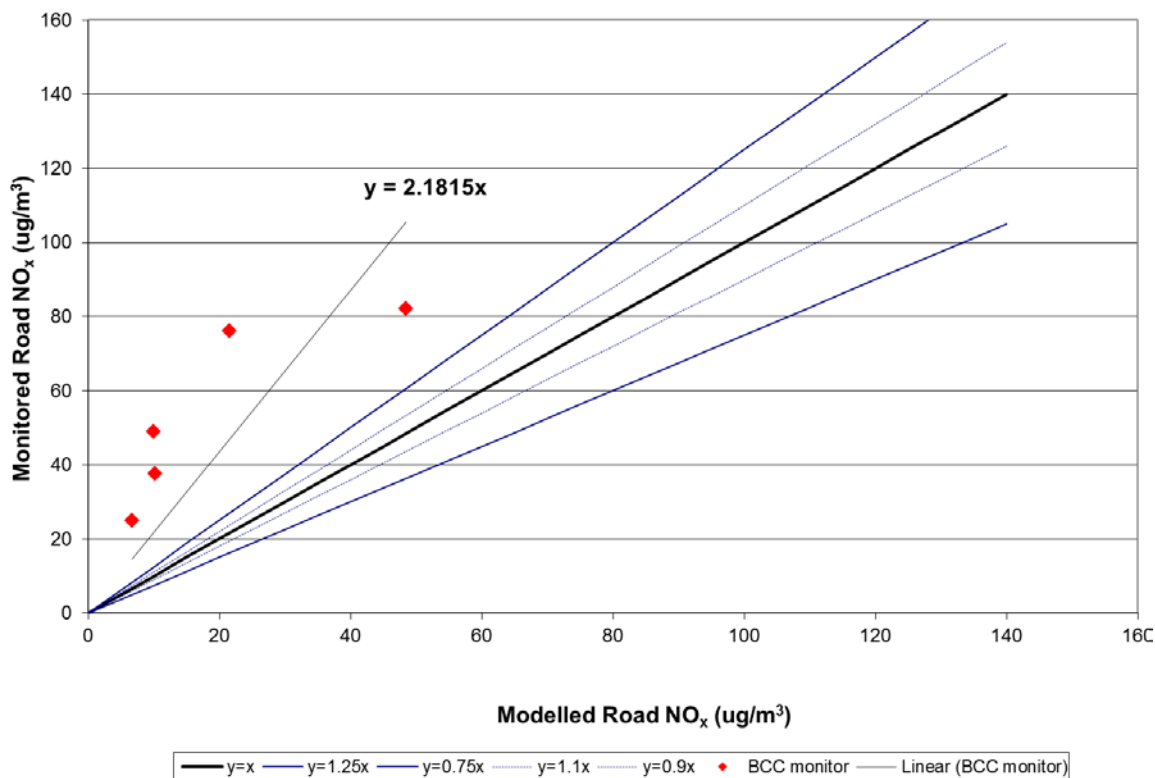


Figure 1.2: Modelled versus Monitored Road NO_x Concentrations (µg m⁻³) in BCC

1.3.5 A verification factor of 2.18 was obtained and applied to the modelled road traffic NO_x concentrations within BCC (Figure 1.2).

1.3.6 The adjusted modelled versus monitored total NO₂ concentrations are shown in Table 1.4.

Table 1.4: Adjusted Annual Mean Modelled and Monitored Total NO₂ Concentrations (µg m⁻³) at Monitoring Sites in the Study Area

Site Id	Location	Measured NO ₂	Adjusted Modelled NO ₂	% Difference Model vs Measured
DT1	Parson Street School (Automatic)	50.8	40.3	-20.7%
DT5	Parson Street	53.6	60.8	13.3%
DT7	B&G Snax West St	43.5	32.3	-25.7%
DT8	Martial Arts West Street	39.1	32.5	-16.8%
DT11	Greville Smyth Park	33.1	28.5	-14.0%

1.3.7 All adjusted total NO₂ concentrations are predicted within 26% of the monitored sites, showing a reasonable correlation between the two sets of data. The largest model underprediction in NO₂ occurs at DT7 where total NO₂ concentrations are underestimated by almost 26%.

1.3.8 Following Defra TG(16) guidance, the verification factor for road traffic NO_x was also applied to road traffic PM₁₀ concentrations as there were no monitoring sites to verify

road traffic PM₁₀ concentrations in the study area. This is considered to be a worst-case approach.

1.4 References

Defra, April 2016. Technical Guidance for Local Air Quality Management. TG16.