

Technical Note

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Subject:	Air Quality Technical Note		
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Air Quality Technical Note

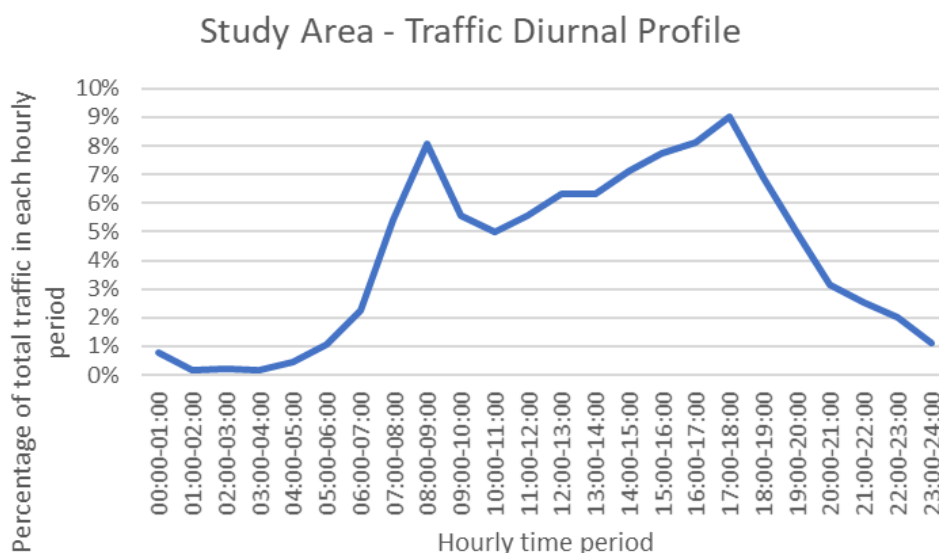
This Technical Note includes additional air quality dispersion modelling information as requested by Coventry City Council.

Air Quality Modelling and Verification

Traffic Profile

The annual average daily traffic flows for each road in the study area, as presented in Table A.14.1: Air Quality: Assessment Traffic Data of document *P16-0905_14_Air_appendix_170219* were adjusted to represent hourly flows across a typical 24-hour period using the diurnal profile shown in Figure A.14.1. This data was provided by the Traffic Consultants, PJA.

Figure A.14.1 -Traffic Diurnal Profile applied to Affected Road Network



ADMS Roads model parameters

The ADMS-Roads model v4.1 was used for the detailed dispersion modelling for the proposed scheme. For the study area, a latitude of 52.46 degrees and a minimum Monin Obukhov length of 30 m were selected. Meteorological data for 2017 from Coventry Airport monitoring site was used, with a surface roughness of 0.3 m

set for the meteorological and modelling sites. All other model parameters were model default settings. Table A.14.1 summarises the modelling parameters.

Table A.14.1 - Summary of dispersion modelling parameters

Model element	Parameter
Pollutant	NO _x , PM ₁₀ , PM _{2.5}
Scenario	2017 Base, 2026 DM, DS1 and DS2
Meteorological data	Coventry Airport 2017
Surface roughness, m	0.3
Minimum Monin-Obukhov (MO), m	30
Model receptors	BS1, KG1, BA1c, R1 – R22
Receptor height, m	Monitoring height, Receptors at 2m
Extent of model	Affected Road Network
Traffic scenario	As detailed in traffic data input Table A.14.1
Diurnal profile used	Diurnal profile provided by traffic consultant, presented in Figure A.14.1
Method to estimate road emissions	DEFRA EFT v8.0.1
Traffic mix used in EFT	England (Not London) Basic split
Average speed or hourly profile?	Based on speed limit as modelled speeds not available
Background values used	2017 and 2026 DEFRA maps for NO _x , PM ₁₀ and PM _{2.5} (without removal of in-square roads component) and NO ₂
Calculation of NO ₂ from NO _x	DEFRA NO _x -NO ₂ calculator (v6.1)

Model Verification

Model verification was undertaken considering passive monitoring sites adjacent to the modelled ARN. Only three diffusion tube (DT) monitoring sites were located within the air quality study area. BA1c was located on the edge of the traffic network without full representation of sources. The comparison is presented but it has not been used in the verification.

Uncertainty in modelled estimates has been considered by calculating root mean square error (RMSE) and fractional bias statistics. An air quality model can be considered to perform reasonably well where modelled concentrations are within 25% of monitored concentrations in accordance with DEFRA's Technical Guidance LAQM.TG(16). The RMSE should ideally be within 10% of the relevant air quality criterion but is acceptable where it is within 25% of the relevant air quality criterion. The Fractional Bias (FB) has an ideal value of 0 but is acceptable in the range between +2 and -2.

Firstly, unadjusted modelled estimates of total annual mean NO₂ concentrations have been compared against monitored annual means. These results indicate that the model underestimates compared to monitored concentrations by between 37 and 46%, which is not uncommon. Unadjusted model statistics are shown in Table A.14.2.

Table A.14.2 – Comparison of Unadjusted Modelled and Measured NO₂ Concentrations (µg/m³)

Site	Background Annual Mean NO ₂	Monitored Annual Mean Total NO ₂	Modelled Annual Mean Total NO ₂	Modelled NO ₂ Minus Monitored NO ₂	% Difference (unadjusted modelled NO ₂ - monitored NO ₂) / monitored NO ₂ × 100
BS1	13.34	24.99	15.62	-9.37	-37%
KG1	13.34	39.49	22.29	-17.20	-44%
BA1c	14.99	29.17	15.61	-13.56	-46%

For unadjusted modelled estimates of NO₂ compared to monitored concentrations, the RMSE is 13.76 µg/m³, which is not within the target value according to DEFRA’s Technical Guidance LAQM.TG(16) i.e. ideally less than 4 µg/m³ in relation to the 40 µg/m³ objective concentration for annual mean NO₂, but as a minimum not more than 25% of the objective i.e. 10 µg/m³. The Fractional Bias (0.55) is above the ideal value of 0, indicating that the model tends to underestimate. The overall performance of the unadjusted model is therefore not acceptable.

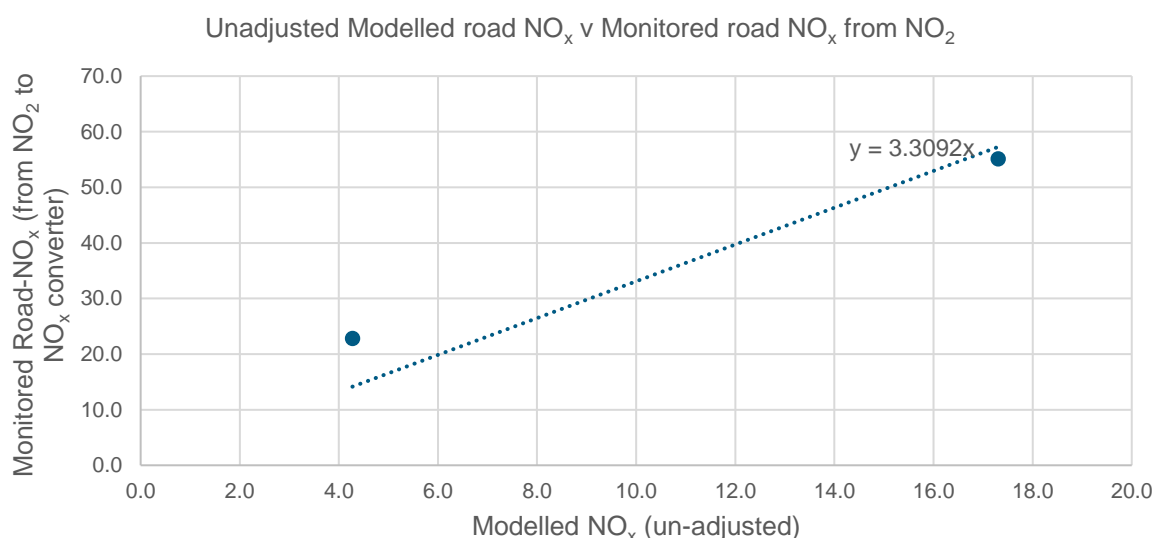
The second comparison of modelled estimates of road contributed annual mean NO_x with the road NO_x component derived from monitoring data is presented in Table A.14.3. This analysis requires the estimation of the monitored road NO_x component. This has been undertaken using DEFRA’s NO₂ to NO_x calculator, version 6.1, October 2017.

Table A.14.3 – Comparison of Unadjusted Modelled and Measured NO_x Concentrations (µg/m³)

Site	Modelled Annual Mean Road NO _x	Monitored Annual Mean Road NO _x	Modelled NO _x Minus Monitored NO _x	Monitored Road NO _x / Modelled Road NO _x	% Difference (unadjusted modelled NO _x - monitored NO _x) / monitored NO _x × 100
BS1	4.27	22.80	-18.53	5.33	-81%
KG1	17.31	55.13	-37.82	3.19	-69%

The results from the comparison above have been used to derive an adjustment factor of 3.309 as shown in Figure A.14.2 below.

Figure A.14.2 - Derivation of the Model Adjustment Factor



The third comparison of the adjusted modelled estimates of total annual mean NO₂ with monitored concentrations is presented in Table A.14.4 to improve model performance. The RMSE for adjusted modelled NO₂ concentration compared to monitored concentration is 3.09 and the fractional bias is 0.05, which are acceptable model performance statistics.

Table A.14.4 – Comparison of Adjusted Modelled and Measured NO₂ Concentrations (µg/m³)

Site	Background Annual Mean NO ₂	Monitored Annual Mean Total NO ₂	Adjusted Modelled Annual Mean Total NO ₂	Modelled NO ₂ Minus Monitored NO ₂	% Difference (adjusted modelled NO ₂ - monitored NO ₂) / monitored NO ₂ × 100
BS1	13.34	24.99	20.71	-4.28	-17%
KG1	13.34	39.49	40.38	0.89	2%