



**ENVIRONMENTAL STATEMENT**  
**VOLUME 2**  
**APPENDIX 7.3 – MODEL INPUTS,**  
**VERIFICATION AND PERFORMANCE**



## Appendix 7.3 – Model Input, Verification and Performance.

### Model Input Summary

The modelling parameters are summarised in Table A3-1.

**Table A3-1: Summary of Modelling Inputs**

Parameter	Description	Input Variable
Surface Roughness	Surface roughness of the modelling domain as a function of land use	A roughness length $z_0$ of 1.5m (large urban areas) was used within the assessment area of the verification year dispersion modelling study and a roughness length $z_0$ of 0.5m (parkland, open suburbia) was used within the assessment area of the future year dispersion modelling study. A roughness length $z_0$ of 0.3 (agricultural areas max) was used within the meteorological measurement site area for both models. These values are considered appropriate for the surface roughness of the dispersion modelling assessment area and meteorological station area.
Road Source Emissions	Source of the emission factors used	EFT v.9.0
Emission Year	Modelling year used to factor the traffic emissions	2018 for both the verification and opening year DM/DS scenarios
NO <sub>x</sub> to NO <sub>2</sub> Conversion	Conversion from NO <sub>x</sub> concentrations to NO <sub>2</sub> concentrations	NO <sub>x</sub> to NO <sub>2</sub> calculator v7.1. Year: 2018 Local Authority: Cherwell District Traffic Mix: All other urban UK traffic / and All non-urban UK traffic
Road Type	Road type within the EFT emission database	Urban (not London), Rural (not London), Motorway (not London)
Elevation of Road	Height of the road link above ground level	Flat – roads are at ground level (0m)
Road Width	Width of the road link	Road width obtained from Google Maps satellite imagery
Road Speed	Road speed in km/h	Average speed limits provided by Motion, the appointed Transport Consultant for the project. Adjustment for road geometry was undertaken in line with LAQM.TG(16). For sections of the road approaching junctions where speeds were reduced to 20kph less than the speed limit provided by Motion and for particularly busy junctions, the speed was reduced to 20kph.
Time Varied Emissions	Annual, daily, weekly or monthly variations in emissions applied to road sources	Not applied
Meteorology	Representative hourly sequential meteorological data	Brize Norton 2018 – 8760 hours with 3% calm conditions
Background	Background pollutant concentration considered during the modelling	Defra 2018 mapped background concentrations for NO <sub>2</sub> , PM <sub>10</sub> and PM <sub>2.5</sub> for all assessment years which assumed no future improvement

Output	Output as gridded or specified points	At specified points as detailed in Table 7.8 in the Air Quality Chapter
Pollutant Output	Pollutants modelled and averaging time	NO <sub>2</sub> , PM <sub>10</sub> and PM <sub>2.5</sub> annual mean

### Traffic Data

Traffic flow data was provided by Motion, the appointed Transport Consultants for the Proposed Development and applied in the assessment as detailed in Tables A3-2 and A3-3 below.

**Table A3-2: Traffic Flow Data for Verification Assessment**

Ref	Description	2018 Base Year		
		AADT	HDV%	Speed (kph)
L1	Kings End	20,316	0.8	48
L2	Kings End Traffic Lights Slow Down	20,316	0.8	28
L3	Kings End	20,316	0.8	48
L4	Kings End Slow Down	20,316	0.8	20
L5	Queens Avenue	20,316	0.8	48
L6	Queens Avenue	20,316	0.8	48
L7	London Road Slow Down	8,790	1.0	28
L8	London Road	8,790	1.0	48
L9	London Road Bicester Crossing Slow Down	8,790	1.0	28
L10	Kings End Slow Down	20,316	0.8	28
L11	Kings End Roundabout	20,316	0.8	28

**Table A3-3: Traffic Flow Data for the Air Quality Impact Assessment**

Ref	Description	2022 DM		2022 DS		Speed (kph)
		AADT	HDV %	AADT	HDV %	
L1	Vendee Drive (north of A4095) Slow Down	9,571	4.1	10,451	3.8	44
L2	Vendee Drive (north of A4095)	9,957	6.0	10,768	5.6	64
L3	Vendee Drive (south of A4095)	9,957	6.0	10,768	5.6	64
L4	Vendee Drive (south of A4095) Slow Down	9,957	6.0	10,768	5.6	44
L5	A41 (Northbound, north of Vendee Drive) Slow Down 1	14,174	6.0	14,184	6.0	44
L6	A41 (Northbound, north of Vendee Drive)	14,174	6.0	14,184	6.0	64
L7	A41 (Northbound, north of Vendee Drive) Slow Down 2	14,174	6.0	14,184	6.0	44
L8	A41 (Northbound, north of Premier Inn)	14,174	6.0	14,184	6.0	64
L9	A41 (Northbound, south of A41 roundabout) Slow Down	14,174	6.0	14,184	6.0	44
L10	Roundabout, north of Vendee Drive (A41 NB to A41 SB)	23,928	6.0	24,470	5.9	44
L11	A41 (Southbound, north of Vendee Drive) Slow Down	14,174	6.0	14,184	6.0	44
L12	A41 (Southbound)	14,174	6.0	14,184	6.0	64

L13	A41 (Southbound, south of A41 roundabout) Slow Down	14,174	6.0	14,184	6.0	44
L14	A41 (Southbound, south of Vendee Drive) Slow Down	16,743	6.0	17,138	5.9	76
L15	Roundabout, south of Vendee Drive (A41 SB to A41 NB)	23,930	6.0	24,470	5.9	44
L16	A41 (Northbound, south of Vendee Drive) Slow Down	16,743	6.0	17,138	5.9	76
L17	A41 (Northbound, south of Vendee Drive)	16,743	6.0	17,138	5.9	96
L18	A41 (Southbound, south of Vendee Drive)	16,743	6.0	17,138	5.9	96
L19	A4095 Slow Down	9,184	2.0	10,133	1.9	39
L20	A4095 (National Speed Limit)	9,184	2.0	10,133	1.9	59
L21	A4095 (30mph)	9,184	2.0	10,133	1.9	59
L22	Unnamed Road Slow Down	1,689	2.0	1,689	2.0	9
L23	Unnamed Road (National Speed Limit)	1,689	2.0	1,689	2.0	48
L24	A4095 (East of Site Access)	3,051	2.0	4,001	1.8	65
L25	A4095 (West of Site Access)	3,038	1.9	4,068	1.7	85
L26	A4095 Slow Down (towards B430 Southbound)	1,521	2.0	2,034	1.7	65
L27	A4095 Slow Down (towards B430 Northbound)	1,521	2.0	2,034	1.7	65
L28	B430 (Southbound)	6,212	4.0	6,646	3.8	69
L29	B430 (Northbound)	7,685	3.9	8,278	3.7	74
L30	M40 (adjacent to Site)	108,993	14.0	108,993	14.0	101

### Model Verification

The model output of road-NO<sub>x</sub> (i.e. the component of total NO<sub>x</sub> coming from road traffic exhaust emissions) has been compared with the 'measured' road-NO<sub>x</sub>. The measured road-NO<sub>x</sub> was calculated from the measured NO<sub>2</sub> concentrations and the predicted background NO<sub>2</sub> concentration using the NO<sub>x</sub> from NO<sub>2</sub> calculator (v7.1) available on the Defra LAQM Support website. All other urban UK traffic was selected.

Monitoring data versus modelling data is shown in Table A3-4 below with the applied primary adjustment factors.

**Table A3-4: Verification Data**

Monitoring Location	Modelled NO <sub>x</sub> Road Contribution (µg/m <sup>3</sup> )	Monitored NO <sub>x</sub> Road Contribution (µg/m <sup>3</sup> )	Adjusted Modelled NO <sub>x</sub> Road Contribution (µg/m <sup>3</sup> )	Monitored Total NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )	Adjusted Modelled Total NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )	Difference (%)
Kings End	26.68	61.71	63.25	41.90	28.92	0.12
Queens Avenue	18.80	45.50	44.58	35.10	21.12	-0.79
London Road	9.40	24.86	22.30	25.70	11.16	-1.44

In accordance with LAQM.TG(16), the ratio of 'Monitored Road Contribution' to 'Modelled Road Contribution NO<sub>x</sub>' has been calculated and reviewed.

As stated in LAQM.TG(16), a graph of modelled versus calculated road NO<sub>x</sub> contributions has been prepared, including a trend line which presents the following requirements:

“The equation of the trend line should be in the format of

$y = mx$  (intercept at 0)

y is monitored road contribution NO<sub>x</sub> and

x is modelled road contribution NO<sub>x</sub>

m is the regression correction factor to apply to the modelled road contribution NO<sub>x</sub>”.

Reference should be made to Figure A3-1 for the relevant graph and trend line.

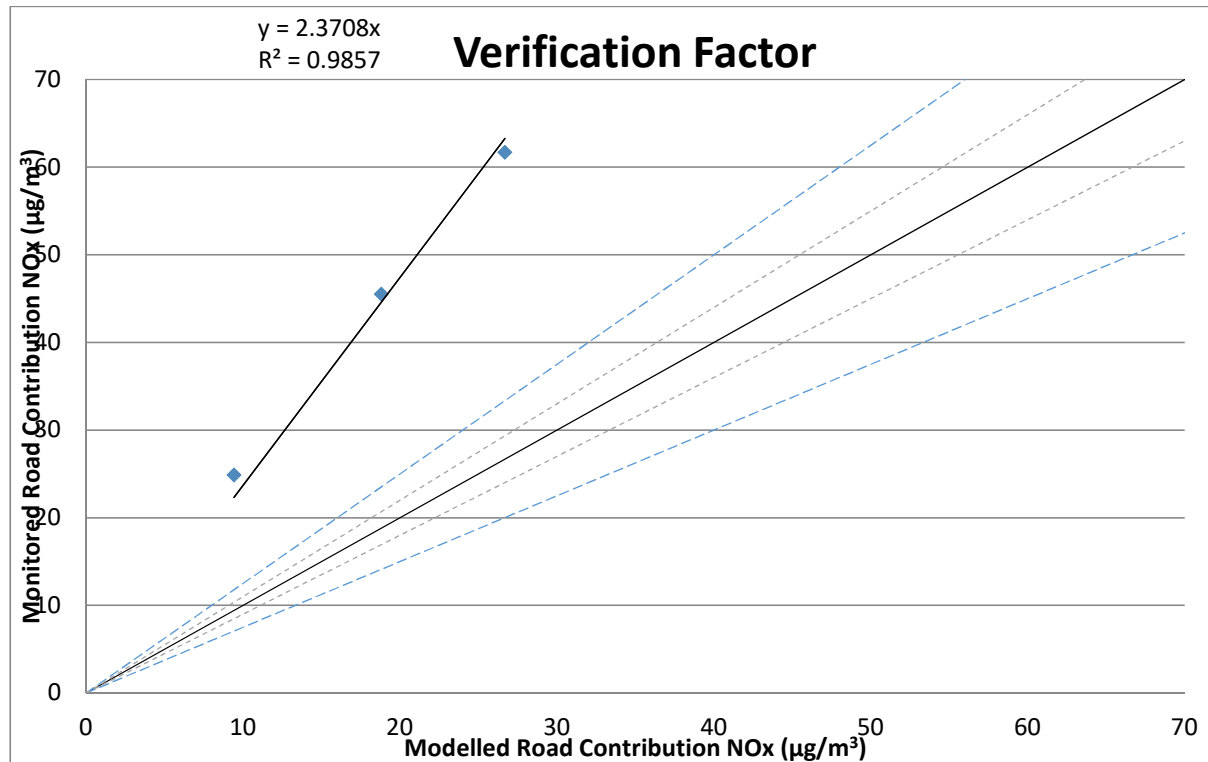


Figure A3-1: Verification Factor Graph – Plot of Monitored vs Modelled NO<sub>x</sub> Concentrations

As presented in Table A3-4 and Figure A3-1, the calculated verification factor is 2.3708. This was applied to concentrations of NO<sub>x</sub> from the model output.

There are no PM<sub>10</sub> or PM<sub>2.5</sub> monitors within the study area; therefore, the model outputs of road PM have been adjusted by applying the adjustment factor calculated for road NO<sub>x</sub>. This is in line with the methodology detailed in LAQM.TG(16).

#### Model Performance

An evaluation of model performance has been undertaken to establish confidence levels in model results. LAQM.TG(16) identifies a number of statistical procedures that are appropriate to evaluate model performance and assess uncertainty. The statistical parameters used in this assessment are:

- Root mean square error (RMSE); and
- Fractional bias (FB).

A brief for explanation of each statistic is provided in Table AIII-5, and further details can be found in LAQM.TG(16).

**Table A3-5: Model Performance**

Parameter	Comments	Value
Root Mean Square Error	<p>RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared</p> <p>If the RMSE values are higher than <math>\pm 25\%</math> of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. For example, if the model predictions are for the annual mean NO<sub>2</sub> objective of 40<math>\mu\text{g}/\text{m}^3</math>, if an RMSE of 10<math>\mu\text{g}/\text{m}^3</math> or above is determined for a model, the local authority would be advised to revisit the model parameters and model verification. Ideally an RMSE within 10% of the air quality objective would be derived, which equates to 4<math>\mu\text{g}/\text{m}^3</math> for the annual average NO<sub>2</sub> AQO.</p>	0.67 $\mu\text{g}/\text{m}^3$
Fractional Bias	<p>It is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.</p>	0.50