

### **Appendix 9.3 – Model Verification**

Model verification studies are undertaken in order to check the performance of dispersion models and, where modelled concentrations are significantly different to monitored concentrations, a factor can be established by which the modelled results can be adjusted in order to improve their reliability. The model verification process is detailed in LAQM TG(16).

According to LAQM TG(16), adjustment is not necessary where:

- There is no systematic under or over prediction
- Predictions at sites where monitoring shows concentrations are close to the objective show good comparison; and
- The majority of results lie within 25% (as a minimum – preferably within 10%) of monitored concentrations.

Model verification can only be undertaken where there is sufficient roadside monitoring data in the vicinity of the subject scheme being assessed. LAQM TG(16) recommends that a combination of automatic and diffusion tube monitoring data is used; although this may be limited by data availability.

Background concentrations were based on UK-AIR data for the corresponding year.

Vehicle speeds were estimated based on LAQM TG(16), the outputs of the NTSM2 model and the practitioners driving experience; it was ensured that vehicle speeds used in model verification and the modelling scenarios were directly comparable.

As the assessment for Northampton Gateway covered a number of different study areas, a verification study was undertaken for each area separate area, where appropriate. These are summarised below, in the following format:

- Model verification inputs and summary;
- Table showing comparison of modelled and monitored data;
- Graph with trend line (Modelled vs Monitored NO<sub>x</sub>) and equation (adjustment factor) (unless no adjustment was required); and
- Table showing comparison of adjusted modelled and monitored data

**Northampton AQMA No.1 and NSSUE, Collingtree**

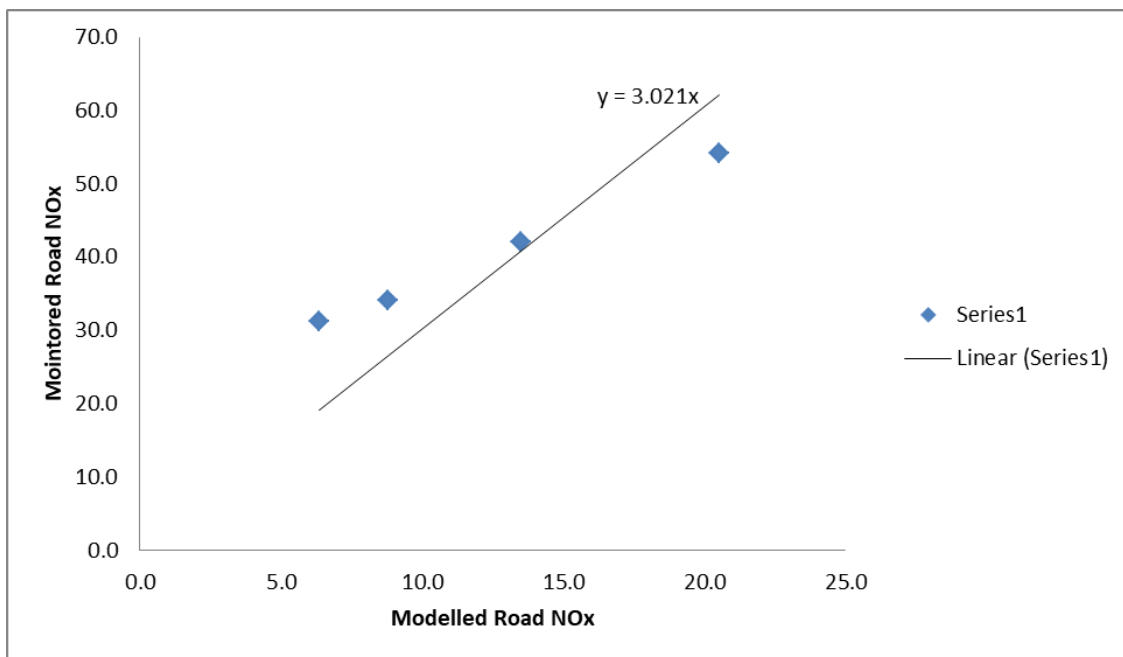
- Year(s) of verification: 2016
- Verification factor(s):
  - 3.02

**Table A9.3.1: Comparison of Monitored and Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations (µg.m <sup>-3</sup> )		Difference (%)
			Monitored	Modelled	
Project Tube 1	58373	DT	32.7	19.1	-41.7%
Project Tube 2	58373	DT	29.1	16.6	-42.9%
Project Tube 3	58373	DT	27.8	15.3	-44.8%
Project Tube 4	58373	DT	38.0	22.6	-40.5%

Note: "DT" = diffusion tube.

**Figure A9.3.1: Monitored vs Modelled NO<sub>x</sub>**



**Table A9.3.2: Comparison of Monitored and Adjusted Modelled Total NO<sub>2</sub>**

Monitor Location	Type	Concentrations (µg.m <sup>-3</sup> )		Difference (%)
		Monitored	Modelled	
Project Tube 1	DT	32.7	32.1	-1.8%
Project Tube 2	DT	29.1	25.5	-12.4%
Project Tube 3	DT	27.8	21.9	-21.2%
Project Tube 4	DT	38.0	41.3	8.6%

**Northampton AQMA No.5, Wootton**

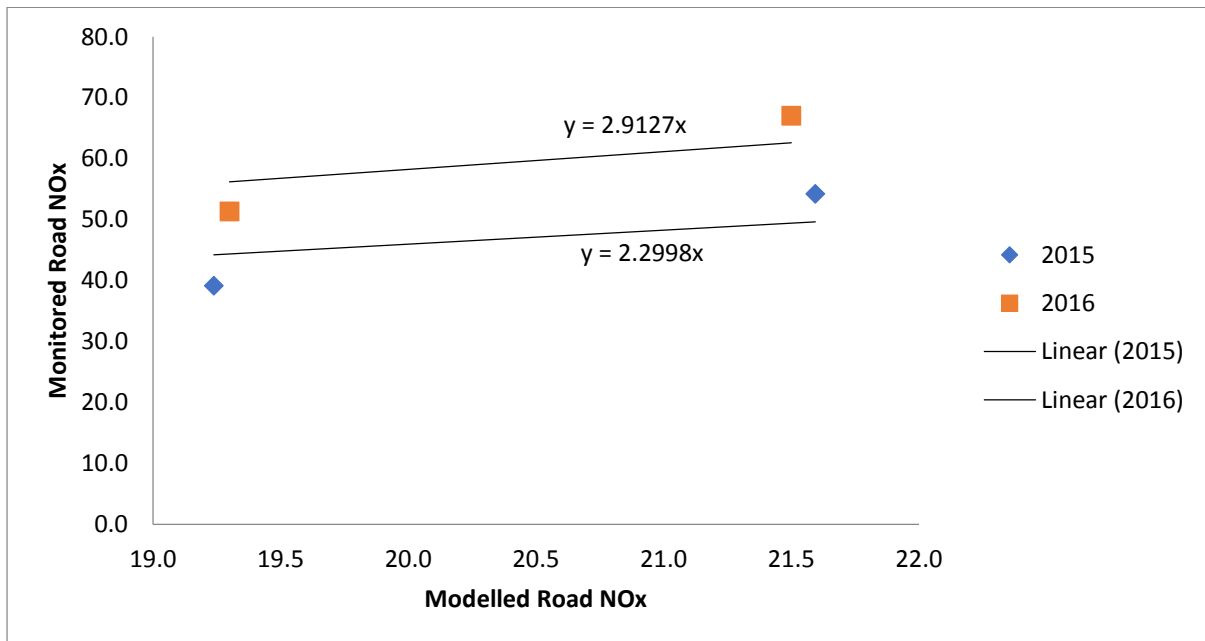
- Year(s) of verification: 2015 & 2016
- Verification factor(s):
  - 2015: 2.30
  - 2016: 2.91

**Table A9.3.3: Comparison of Monitored and Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations (µg.m <sup>-3</sup> )		Difference (%)
			Monitored	Modelled	
2015					
Hermitage Way	77419	DT	38.1	23.4	-38.5%
Chestnut Avenue	77419	DT	31.6	22.3	-29.5%
2016					
Hermitage Way	77419	DT	43.0	23.0	-46.5%
Chestnut Avenue	77419	DT	36.6	21.9	-40.1%

Note: "DT" = diffusion tube.

**Figure A9.3.2: Monitored vs Modelled NO<sub>x</sub>**



**Table A9.3.4: Comparison of Monitored and Adjusted Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations (µg.m <sup>-3</sup> )		Difference (%)
			Monitored	Modelled	
2015					
Hermitage Way	77419	DT	38.1	31.7	-16.9%

Chestnut Avenue	77419	DT	31.6	29.8	-5.9%
2016					
Hermitage Way	77419	DT	43.0	37.2	-13.6%
Chestnut Avenue	77419	DT	36.6	34.9	-4.7%

#### **AQM No.4, Kingsthorpe**

- Year(s) of verification: 2015 & 2016
- Verification factor(s):
  - 2015
    - Leeward: 6.23
    - Windward: 3.94
  - 2016:
    - Leeward: 5.92
    - Windward: 4.82
- Harborough Road scoped out of MV as adjacent to bus stop and suspected limited air flow around DT.

**Table A9.3.5: Comparison of Monitored and Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations (µg.m <sup>-3</sup> )		Difference (%)
			Monitored	Modelled	
2015					
Harborough Road 2	99145	DT	35.9	23.7	-34.0%
Harborough Road 3	99145	DT	36.7	19.4	-47.1%
Harborough Road 5	99145	DT	44.8	19.6	-56.4%
Harborough Road 6	99145	DT	45.1	22.5	-50.2%
Harborough Road 7	46546	DT	40.7	24.5	-39.7%
Harborough Road 11	28261	DT	35.0	20.9	-40.3%
Kingsthorpe Grove 1	26539	DT	37.9	19.0	-49.9%
Harborough Road 8	46546	DT	37.3	21.7	-41.8%
Harborough Road 4	99145	DT	44.1	21.4	-51.4%
Kingsthorpe Grove 2	26539	DT	32.6	20.3	-37.8%
2016					
Harborough Road 2	99145	DT	41.0	23.7	-42.2%
Harborough Road 3	99145	DT	35.1	19.6	-44.2%
Harborough Road 5	99145	DT	45.0	19.7	-56.2%

Harborough Road 6	99145	DT	48.7	22.5	-53.9%
Harborough Road 7	46546	DT	44.4	24.5	-44.9%
Harborough Road 11	28261	DT	46.9	20.8	-55.8%
Kingsthorpe Grove 1	26539	DT	41.1	19.0	-53.8%
Harborough Road 8	46546	DT	41.2	22.2	-46.2%
Harborough Road 4	99145	DT	48.5	21.3	-56.0%
Kingsthorpe Grove 2	26539	DT	38.8	20.1	-48.2%

Note: "DT" = diffusion tube.

Figure A9.3.3: Monitored vs Modelled NO<sub>x</sub>

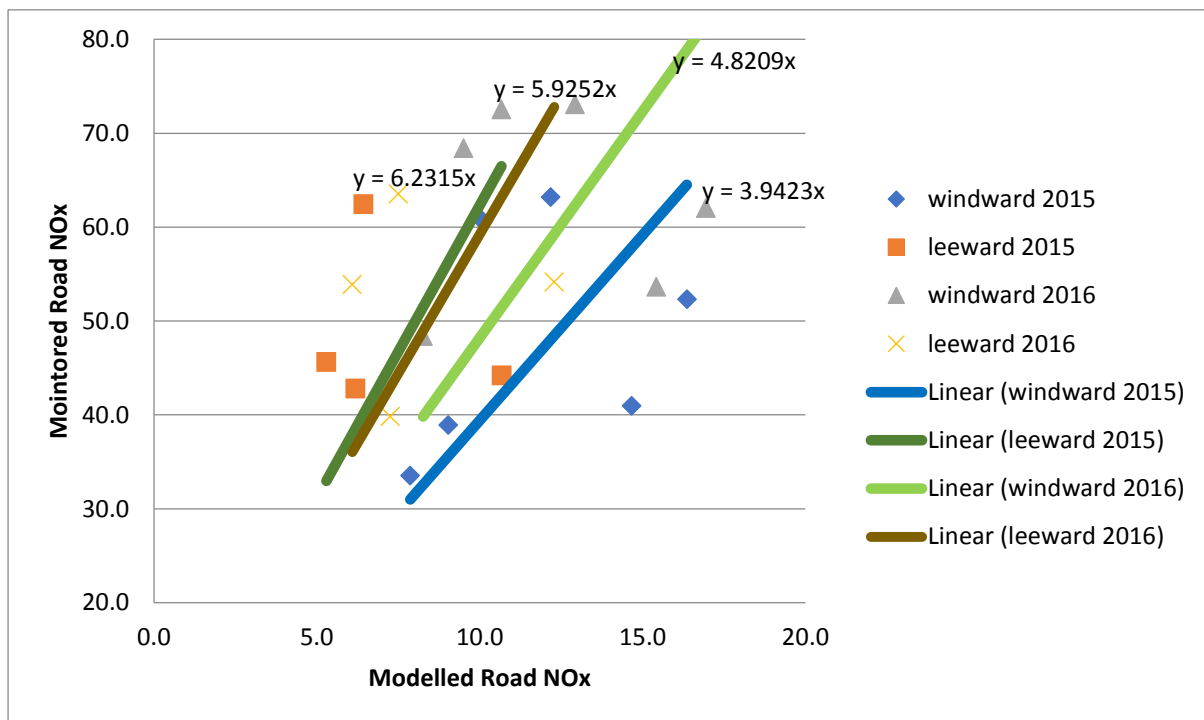


Table A9.3.6: Comparison of Monitored and Adjusted Modelled Total NO<sub>2</sub>

Monitor Location	DfT Count Point	Type	Concentrations (µg.m <sup>-3</sup> )		Difference (%)
			Monitored	Modelled	
2015					
Harborough Road 2	99145	DT	35.9	42.9	19.6%
Harborough Road 3	99145	DT	36.7	34.8	-5.1%

Harborough Road 5	99145	DT	44.8	35.5	-20.8%
Harborough Road 6	99145	DT	45.1	38.9	-13.8%
Harborough Road 7	46546	DT	40.7	45.6	12.0%
Harborough Road 11	28261	DT	35.0	33.5	-4.2%
Kingsthorpe Grove 1	26539	DT	37.9	32.3	-14.7%
Harborough Road 8	46546	DT	37.3	46.4	24.3%
Harborough Road 4	99145	DT	44.1	35.4	-19.8%
Kingsthorpe Grove 2	26539	DT	32.6	31.5	-3.5%
2016					
Harborough Road 2	99145	DT	41.0	49.2	19.9%
Harborough Road 3	99145	DT	35.1	36.5	3.9%
Harborough Road 5	99145	DT	45.0	37.1	-17.6%
Harborough Road 6	99145	DT	48.7	44.5	-8.6%
Harborough Road 7	46546	DT	44.4	51.9	16.9%
Harborough Road 11	28261	DT	46.9	37.7	-19.6%
Kingsthorpe Grove 1	26539	DT	41.1	33.4	-18.7%
Harborough Road 8	46546	DT	41.2	48.6	17.9%
Harborough Road 4	99145	DT	48.5	40.1	-17.4%
Kingsthorpe Grove 2	26539	DT	38.8	35.1	-9.6%

### Northampton AQMA No.2, Victoria Promenade

- Year(s) of verification: 2015 & 2016
- Verification factor(s):
  - 2015: 1.66
  - 2016: 2.85

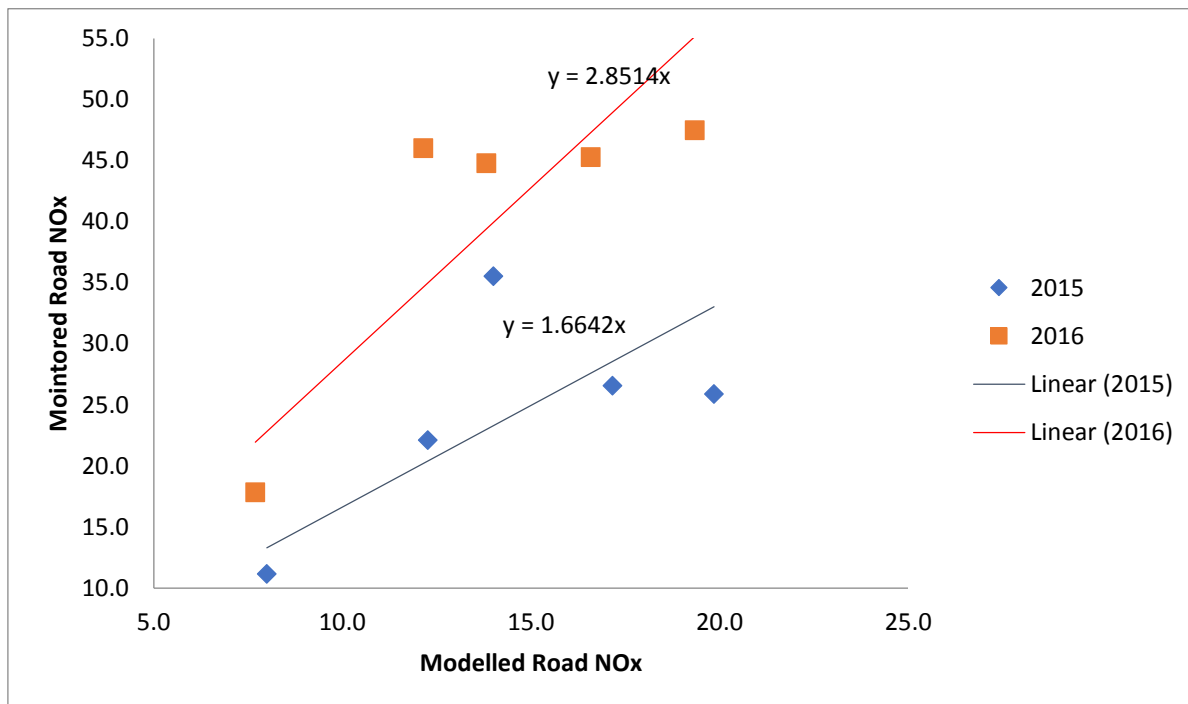
**Table A9.3.7: Comparison of Monitored and Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations (µg.m <sup>-3</sup> )		Difference (%)
			Monitored	Modelled	
2015					
Bridge Street 2	74755	DT	37.1	32.5	-12.3%
Bridge Street 3	74755	DT	43.0	33.3	-22.5%
Plough 1	74752 & 74755	DT	38.8	36.1	-7.1%
Plough 2	74752	DT	39.1	34.8	-10.9%
Victoria Promenade	36486	DT	32.0	30.5	-4.8%
2016					
Bridge Street 2	74755	DT	46.9	31.9	-32.0%
Bridge Street 3	74755	DT	46.4	32.7	-29.5%
Plough 1	74752 & 74755	DT	47.5	35.3	-25.7%
Plough 2	74752	DT	46.6	34.0	-27.0%
Victoria Promenade	36486	DT	34.6	29.7	-14.0%

Note: "DT" = diffusion tube.



**Figure A9.3.4: Monitored vs Modelled NO<sub>x</sub>**



**Table A9.3.8: Comparison of Monitored and Adjusted Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations ( $\mu\text{g}\cdot\text{m}^{-3}$ )		Difference (%)
			Monitored	Adjusted Modelled	
2015					
Bridge Street 2	74755	DT	37.1	36.3	-2.2%
Bridge Street 3	74755	DT	43.0	37.6	-12.5%
Plough 1	74752 & 74755	DT	38.8	41.9	8.0%
Plough 2	74752	DT	39.1	40.0	2.2%
Victoria Promenade	36486	DT	32.0	33.0	3.1%
2016					
Bridge Street 2	74755	DT	46.9	42.1	-10.2%
Bridge Street 3	74755	DT	46.4	44.2	-4.8%
Plough 1	74752 & 74755	DT	47.5	50.6	6.5%
Plough 2	74752	DT	46.6	47.4	1.8%

Victoria Promenade	36486	DT	34.6	36.5	5.4%
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### **Northampton AQMA No.6, Campbell Square**

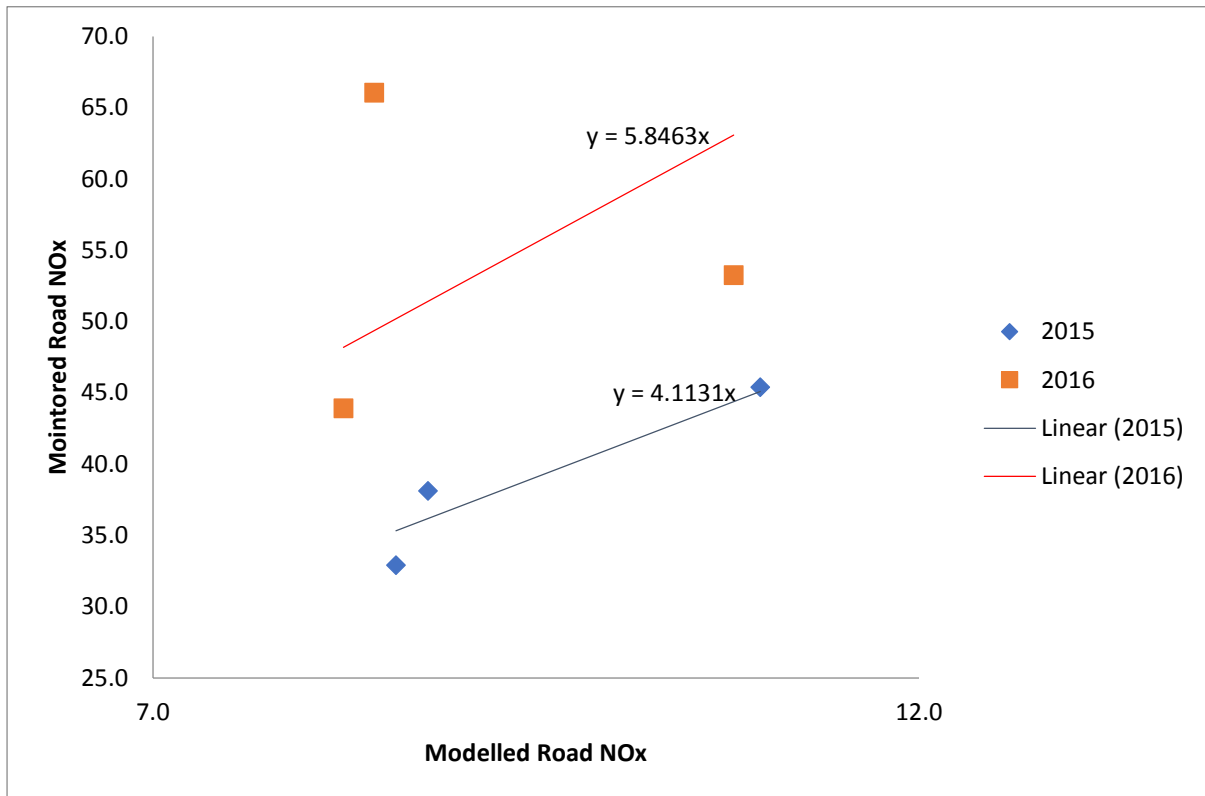
- Year(s) of verification: 2015 & 2016
- Verification factor(s):
  - 2015: 4.11
  - 2016: 5.85

**Table A9.3.9: Comparison of Monitored and Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations ( $\mu\text{g.m}^{-3}$ )		Difference (%)
			Monitored	Modelled	
2015					
Campbell Square 2	7707	DT	37.5	23.8	-36.5%
Campbell Square 4	7707	DT	35.2	23.7	-32.7%
Campbell Square 5	7723	DT	40.6	24.9	-38.7%
2016					
Campbell Square 2	7707	DT	48.6	23.2	-52.4%
Campbell Square 4	7707	DT	39.6	23.0	-41.8%
Campbell Square 5	7723	DT	43.5	24.3	-44.1%

Note: "DT" = diffusion tube.

**Figure A9.3.5: Monitored vs Modelled NO<sub>x</sub>**



**Table A9.3.10: Comparison of Monitored and Adjusted Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations ( $\mu\text{g}\cdot\text{m}^{-3}$ )		Difference (%)
			Monitored	Modelled	
2015					
Campbell Square 2		DT	37.5	36.6	-2.3%
Campbell Square 4		DT	35.2	36.3	3.0%
Campbell Square 5		DT	40.6	40.5	-0.3%
2016					
Campbell Square 2		DT	48.6	41.9	-13.8%
Campbell Square 4		DT	39.6	41.4	4.5%
Campbell Square 5		DT	43.5	47.4	9.0%

### Northampton AQMA No.8, St Michaels Road

- Year(s) of verification: 2015, 2016
- No DfT traffic data available for verification.
- Verification factor(s):
  - 2015: 1
  - 2016: 1

### Roads Bypass and West Lodge Cottages

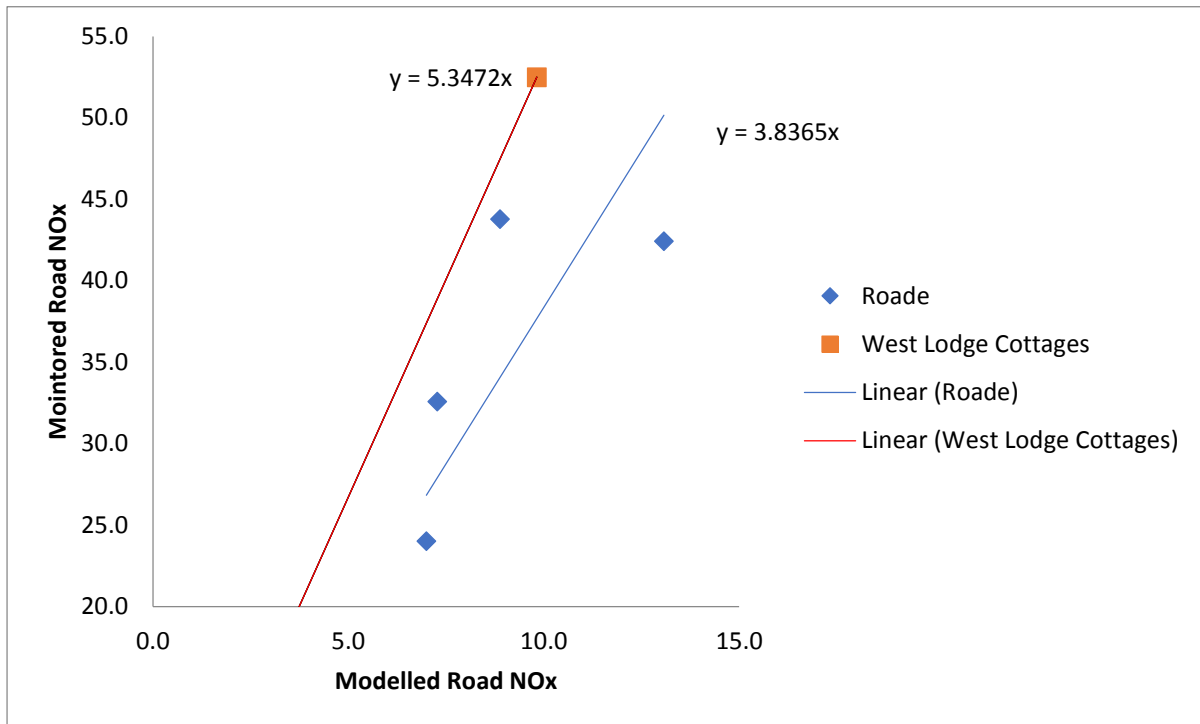
- Year(s) of verification: 2015 (Roads), 2016 (West Lodge Cottages)
- Verification factor(s):
  - Roads: 3.84
  - West Lodge Cottages: 5.35

**Table A9.3.11: Comparison of Monitored and Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations ( $\mu\text{g.m}^{-3}$ )		Difference (%)
			Monitored	Modelled	
Roads					
S Northants Tube_RO2	57251	DT	31.1	17.0	-45.3%
S Northants Tube_RO3	57251	DT	26.6	14.0	-47.4%
S Northants Tube_RO1	7724	DT	22.5	13.9	-38.4%
S Northants Tube_RO6	7724	DT	31.7	14.9	-53.2%
West Lodge Cottages					
Project Tube 6	57251	DT	36.2	16.1	-55.5%

Note: "DT" = diffusion tube.

**Figure A9.3.6: Monitored vs Modelled NO<sub>x</sub>**



**Table A9.3.12: Comparison of Monitored and Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations (µg.m <sup>-3</sup> )		Difference (%)
			Monitored	Modelled	
Roade					
S Northants Tube_RO2	57251	DT	31.1	34.5	10.9%
S Northants Tube_RO3	57251	DT	26.6	24.4	-8.3%
S Northants Tube_RO1	7724	DT	22.5	23.9	6.1%
S Northants Tube_RO6	7724	DT	31.7	27.3	-13.9%
West Lodge Cottages					
Project Tube 6	57251	DT	36.2	36.2	-0.1%

**Bilsworth and Milton Malsor**

- Year(s) of verification: 2015
- No DfT traffic data available for verification; as such, adjustment factor for Roade has been used.
- Verification factor(s):
  - 2015: 3.84 (Roade)

**Towcester**

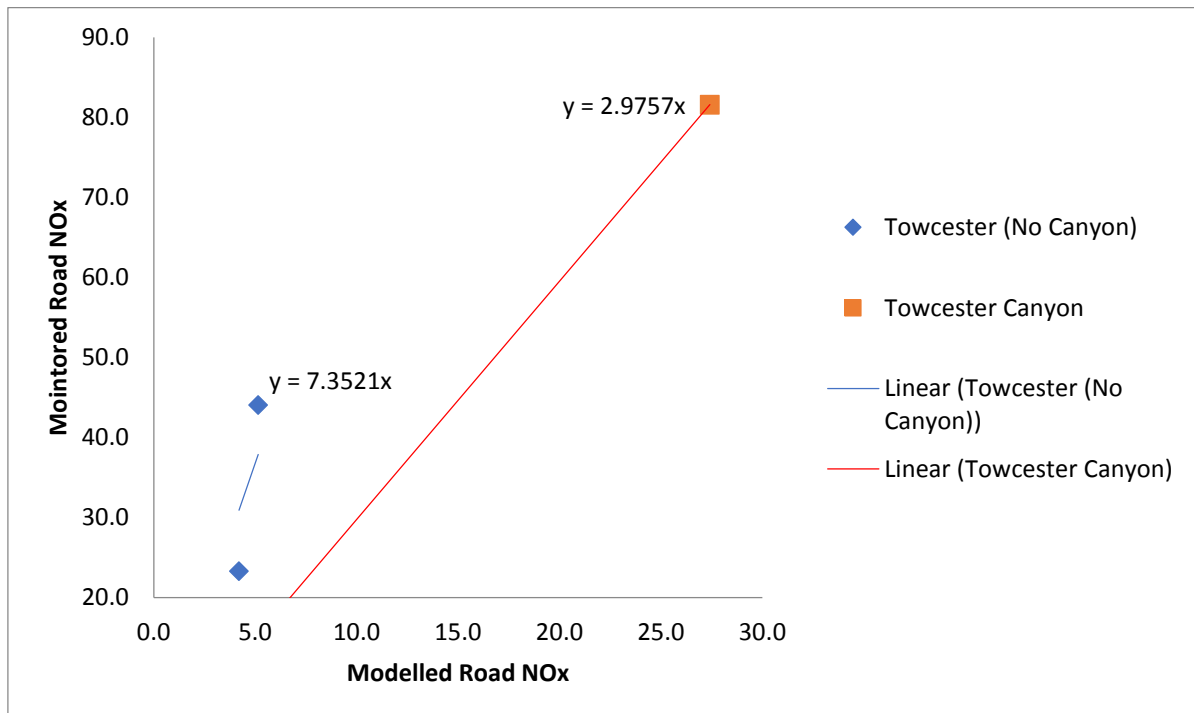
- Year(s) of verification: 2015
- Parts of Towcester modelled as a simple Canyon.
- A number of DT not considered in verification as not considered representative of residential use.
- Verification factor(s):
  - 2015: 2.97 (Canyon), 7.35 (Not Canyon)

**Table A9.3.13: Comparison of Monitored and Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations (µg.m <sup>-3</sup> )		Difference (%)
			Monitored	Modelled	
TK1	49051	DT	47.2	24.1	-49.0%
TK7	49051	DT	22.1	12.3	-44.5%
TK9	49051	DT	31.8	12.8	-59.8%

Note: "DT" = diffusion tube.

**Figure A9.3.7: Monitored vs Modelled NO<sub>x</sub>**



**Table A9.3.14: Comparison of Monitored and Adjusted Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations ( $\mu\text{g.m}^{-3}$ )		Difference (%)
			Monitored	Modelled	
TK1	49051	DT	47.2	47.0	-0.4%
TK7	49051	DT	22.1	25.7	16.4%
TK9	49051	DT	31.8	28.9	-9.0%

**Hartwell**

- Year(s) of verification: 2015
- Verification factor(s): 1
- Modelled results were greater than monitored; to ensure a conservative assessment no adjustment factor was applied to the results.

**Table A9.3.15: Comparison of Monitored and Modelled Total NO<sub>2</sub>**

Monitor Location	DfT Count Point	Type	Concentrations ( $\mu\text{g.m}^{-3}$ )		Difference (%)
			Monitored	Modelled	
H1	73811	DT	21.3	22.9	7.4%

Note: "DT" = diffusion tube.-

**Grafton Regis and Potterspury**

- Year(s) of verification: 2015
- No DfT traffic data available for verification; as such, adjustment factor for Roade has been used.
- Verification factor(s): 3.84 (Roade)