

Air Quality Dispersion Model Verification

Predicted NO₂ and PM₁₀ concentrations based on ADMS-ROADS (v2.2 v3) were verified by comparison against available monitoring data and an adjustment (or correction) factor was calculated. All predicted results (at sensitive receptors) were then adjusted based on this factor.

NO_x / NO₂ model verification

NO_x modelled results have been verified against monitoring data and adjusted accordingly. NO₂ predicted results have then been derived based on the latest equations representing the conversion of NO_x to NO₂ (REF 30). Kerbside sites from the Project diffusion tube survey and from the Council diffusion tube network have been excluded from the model verification as these sites are not suitable for adjustment of dispersion modelling predictions.

The model verification for NO₂ in Halton is presented in further details below:

- a. Both monitored (from continuous analysers and diffusion tubes) and predicted road-NO_x concentrations (i.e. the contribution of traffic road sources to the total NO_x) were calculated by subtracting the background NO_x concentration (see Table A19.1). NO_x concentrations at diffusion tubes were estimated based on the latest NO_x / NO₂ relationship. The average ratio between monitored road-NO_x and modelled road-NO_x was calculated (0.843).

ID	Modelled NO _x 2006 - µg/m ³	Estimated monitored NO _x - µg/m ³ (derived from NO ₂)	Background NO _x - µg/m ³	Modelled Road-NO _x - µg/m ³	Monitored Road-NO _x - µg/m ³	Ratio Road-NO _x monitored / modelled
HBC6	88.3	78.5	23.7	64.6	54.8	0.85
HBC1	75	68.3		51.3	44.6	0.87
HBC2	80.7	89.6		57.0	65.9	1.16
HBC3	59.2	53.2		35.5	29.5	0.83
HBC4	69.2	68.3		45.5	44.6	0.98
HBC5	94.4	82.1		70.7	58.4	0.83
HBC9	90.8	68.3		67.1	44.6	0.67
HBC10	62.2	47.7		38.5	24.0	0.62
HBC13	70.1	85.8		46.4	62.1	1.34
HBC14	76.6	53.2		52.9	29.5	0.56
HBC15	88.2	146.1		64.5	122.4	1.90
HBC18	94	94.8		70.3	71.1	1.01
MG1	77.5	65.8		53.8	42.1	0.78
MG4	105.5	86.2		81.8	62.5	0.76
MG5	91.8	71.0		68.1	47.3	0.69
MG6	70.5	61.4		46.8	37.7	0.81
MG7	84	57.3		60.3	33.6	0.56
MG8	91.7	58.7		68.0	35.0	0.51
MG9	65.6	52.7		41.9	29.0	0.69
MG10	67.5	67.0		43.8	43.3	0.99
MG11	57.7	57.0	34.0	33.3	0.98	
HBC0	66.7	47.4	43.0	23.7	0.55	
MG15	127.2	116.3	103.5	92.6	0.89	
MG16	84.4	76.1	60.7	52.4	0.86	
MG17	52.4	36.7	28.7	13.0	0.45	
MG18	53.4	36.9	29.7	13.2	0.44	
MG19	58.6	37.7	34.9	14.0	0.40	

ID	Modelled NO _x 2006 - µg/m ³	Estimated monitored NO _x - µg/m ³ (derived from NO ₂)	Background NO _x - µg/m ³	Modelled Road-NO _x - µg/m ³	Monitored Road-NO _x - µg/m ³	Ratio Road-NO _x monitored / modelled
MG20	57.4	33.3		33.7	9.6	0.28
MG22	65.7	56.1		42.0	32.4	0.77
MG23	62.8	59.6		39.1	35.9	0.92
					Average	0.843

Table A19.1 – Calculation of Road-NO_x concentrations (2006 - µg/m³)

- b. The predicted road-NO_x was then adjusted based on this average ratio, and the total predicted NO_x was obtained by adding the background NO_x concentration. Predicted road-NO₂ was then calculated using the Defra NO_x to NO₂ Conversion Spreadsheet the following updated empirical NO_x / NO₂ relationship:

$$\text{Road-NO}_2 = (-0.0719 \times \ln(\text{total NO}_x) + 0.6248) \times \text{road-NO}_x$$

(Equation for areas outside London)

- c. The total predicted NO₂ was then calculated by adding the local background NO₂ concentration (18.9 18.1 µg/m³ in 2006 for Runcorn/Widnes area). The results are shown in Table A19.2.

ID	Corrected Modelled Road-NO _x - µg/m ³	Corrected Modelled Total NO _x - µg/m ³	Predicted NO ₂ - µg/m ³
HBC6	54.4	78.1	38.7
HBC1	43.3	67.0	35.2
HBC2	48.1	71.8	36.7
HBC3	30.0	53.7	30.6
HBC4	38.4	62.1	33.5
HBC5	59.6	83.3	40.2
HBC9	56.6	80.3	39.4
HBC10	32.5	56.2	31.5
HBC13	39.1	62.8	33.8
HBC14	44.6	68.3	35.6
HBC15	54.4	78.1	38.7
HBC18	59.3	83.0	40.1
MG1	45.3	69.0	35.9
MG4	69.0	92.7	42.9
MG5	57.4	81.1	39.6
MG6	39.5	63.2	33.9
MG7	50.9	74.6	37.6
MG8	57.3	81.0	39.6
MG9	35.3	59.0	32.5
MG10	36.9	60.6	33.0
MG11	28.7	52.4	30.1
HBC0	36.3	60.0	32.8
MG15	87.3	111.0	47.5
MG16	51.2	74.9	37.7
MG17	24.2	47.9	28.4
MG18	25.1	48.8	28.7
MG19	29.5	53.2	30.4

ID	Corrected Modelled Road-NO _x - µg/m ³	Corrected Modelled Total NO _x - µg/m ³	Predicted NO ₂ - µg/m ³
MG20	28.4	52.1	30.0
MG22	35.4	59.1	32.5
MG23	33.0	56.7	31.7

Table A19.2 – Predicted NO₂ (µg/m³)

- d. The final NO₂ results were then compared to the monitoring data to check if an additional adjustment was required. In this case, as shown in Table A3, results are in good agreement with monitoring data, and it was not necessary to proceed to a further adjustment.

ID	Location	Monitored NO ₂ 2006 - µg/m ³	Modelled NO ₂ 2006 (verified) - µg/m ³	Difference (Modelled-Monitored) NO ₂ - µg/m ³	Difference (Modelled-Monitored) NO ₂ - (%)
HBC6	Deacon Road 3	38.0	38.7	0.7	1.9%
HBC1	Saxon Road 1	35.0	35.2	0.2	0.5%
HBC2	Deacon Road 1	41.0	36.7	-4.3	-10.4%
HBC3	Carey Street	30.0	30.6	0.6	1.8%
HBC4	Shopping Centre exit	35.0	33.5	-1.5	-4.2%
HBC5	Deacon Road 2	39.0	40.2	1.2	3.2%
HBC9	Saxon Terrace 2	35.0	39.4	4.4	12.4%
HBC10	Lower House Lane 1	28.0	31.5	3.5	12.4%
HBC13	Peel House Lane 1	40.0	33.8	-6.2	-15.6%
HBC14	Peel House Lane 2	30.0	35.6	5.6	18.7%
HBC15	Peel House Lane 3	53.0	38.7	-14.3	-27.0%
HBC18	Greenway Road	42.3	40.1	-2.2	-5.1%
MG1	48 Cholmondeley Street, West Bank, Widnes	34.2	35.9	1.7	4.9%
MG4	25 Wilkinson Close, West Bank, Widnes	40.1	42.9	2.8	6.9%
MG5	31 Wright Crescent, West Bank, Widnes	35.8	39.6	3.8	10.6%
MG6	West Bank Primary School (2nd Floor), Widnes	32.8	33.9	1.1	3.4%
MG7	13 Waterloo Road, Runcorn	31.4	37.6	6.2	19.8%
MG8	28 Egerton Street, Runcorn	31.9	39.6	7.7	24.1%
MG9	Opposite 23 Ashridge Street, Runcorn	29.8	32.5	2.7	9.0%
MG10	42 Rutland Street, Runcorn	34.6	33.0	-1.6	-4.5%
MG11	Castner Avenue 'Weston Point	31.3	30.1	-1.2	-3.9%
HBC0	Lower House Lane CM	27.9	32.8	4.9	17.6%
MG15	Ditton Roundabout, Widnes	47.2	47.5	0.3	0.7%
MG16	Catherine Street, Widnes	37.3	37.7	0.4	1.1%
MG17	69 Brookfield Avenue, Runcorn	23.7	28.4	4.7	19.7%
MG18	36 Fenwick Lane, Runcorn	23.8	28.7	4.9	20.6%
MG19	30 Millersdale Grove, Runcorn	24.1	30.4	6.3	26.0%
MG20	26 Steventon, Runcorn	22.3	30.0	7.7	34.5%
MG22	Traffic Sign (at top of steps), Bridgewater Expressway	31.0	32.5	1.5	4.9%
MG23	Traffic Sign (on bridge over canal), Bridgewater	32.2	31.7	-0.6	-1.7%

ID	Location	Monitored NO ₂ 2006 - µg/m ³	Modelled NO ₂ 2006 (verified) - µg/m ³	Difference (Modelled-Monitored) NO ₂ - µg/m ³	Difference (Modelled-Monitored) NO ₂ - (%)
	Expressway				
Summary					
Number of sites	Within ±10%			48	16
	Between ± 10-25%			40	11
	Exceeds ±25%			2	3
	Total			30	

Table A19.3 – Comparison with NO₂ monitoring results

PM₁₀ model verification

Similarly, PM₁₀ results have been verified and adjusted based on available monitoring data. The only monitoring site within the modelled area is the continuous monitoring station in Lower House Lane; therefore, all predicted PM₁₀ results have been adjusted based on this station only. Details of the model verification for PM₁₀ are described below:

- a. The predicted PM₁₀ road contribution at Lower House Lane was modelled as 2.3µg/m³ (19.7 µg/m³) was calculated by subtracting the PM₁₀ background (18.5µg/m³ in 2006):

$$\text{Predicted Road-PM}_{10} = 19.7 - 18.5 = 1.15 \mu\text{g}/\text{m}^3$$

- b. The monitored PM₁₀ road contribution was calculated in a similar way:

$$\begin{aligned} \text{Monitored Road-PM}_{10} &= \text{Total Monitored PM}_{10} - \text{Background PM}_{10} \\ &= 24.2 - 18.5 = 5.7 \mu\text{g}/\text{m}^3 \end{aligned}$$

- c. The ratio Monitored Road-PM₁₀ / Predicted Road-PM₁₀ was then calculated:

$$\text{Ratio Monitored/Predicted Road-PM}_{10} = 5.7 / 1.15 = 2.36 = 4.91 - 2.41$$

The PM₁₀ road contribution at all modelled receptors was adjusted based on this factor.