THE LANES

PENWORTHAM

Appendix 13.2 ADMS Inputs

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Taylor Wimpey

Homes England

APPENDIX 13.2 ADMS INPUTS

The Proposed Development has the potential to introduce future site users to poor air quality. Dispersion modelling using ADMS Roads was therefore undertaken to predict NO_2,PM_{10} and $PM_{2.5}$ concentrations across the site to consider site suitability for the proposed end-use.

The assessment was undertaken in accordance with the guidance contained within the DEFRA document LAQM.TG(16) and the EPUK and IAQM guidance.

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 5.0). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

The model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length; and
- Monin-Obukhov length.

Assessment Area

Ambient concentrations were predicted over the Proposed Development site and surrounding highway network. One Cartesian grid was included in the model over the area at approximately NGR: 352540, 425320 to 353920, 426700 at height of 1.5m to represent the proposed ground floor level for the 2031 opening year scenario.

Results were subsequently used to produce contour plots within the Surfer software package. Reference should be made to Figure 13.7 to 13.9 within Appendix 13.1 for a graphical representation of the verification inputs and operation phase DS extents, respectively.

Traffic Flow Data

Development flow traffic data and associated network distribution was provided by Vectos, the appointed Transport Consultants for the scheme, and indicated that a total flow generation of 4,760 AADT is anticipated as a result of the Purposed Development.

Vectos also provided baseline traffic data for most road links considered within the assessment. This dataset fully accounts for planned growth in line with relevant committed developments and is considered to be a robust.

Additional baseline traffic data for the following road links were obtained from the Department for Transport (DfT), which include:

- A6 London Way
- Liverpool Road/Penwortham Brow

The Dft Matrix web tool enables the user to view and download traffic flows on every link of the A-road and motorway network in Great Britain for the years 1999 to 2019. The DfT matrix is referenced in DEFRA guidance LAQM.TG(16) as being a suitable source of data for air quality assessments and is therefore considered to provide a reasonable representation of traffic flows in the vicinity of the site.

Additionally, baseline traffic data from the previously agreed model provided by Eddisons was used for the following roads:

- Millbrook Way;
- Croston Road; and
- Jubilee Road

Growth factors provided by the Trip End Model Presentation Program (TEMPRO) software package were used to allow for conversion from the obtained DfT and Eddisons dataset to 2031, which was used to represent the opening year scenario.

Vehicle speeds have also been provided by Vectos for the same road links that the traffic data was provided for. Vehicle speeds for the remaining road links were estimated based on the free flow potential of each link and local speed limits. Road widths were estimated from aerial photography and UK highway design standards.

A summary of the traffic data used in the verification scenario is provided in Table 13.2.1.

Table 13.2.1: 2019 Verification Traffic Data

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L1	B5254 - Watkin Lane Slowdown to Roundabout	9.3	15,302	6.54	15	Vectos
L2	B5254 - Watkin Lane	8.0	15,302	6.54	20	Vectos
L3	B5254 - Watkin Lane	8.8	15,302	6.54	20	Vectos
L4	B5254 - Watkin Lane	8.0	16,324	4.60	12	Vectos
L5	B5254 - Watkin Lane	8.3	16,324	4.60	12	Vectos
L6	B5254 - Watkin Lane - between Jubilee Road and Brownedge Road	10.5	16,324	4.60	12	Vectos
L7	B5254 - Watkin Lane - between Coote Lane and Brownedge Road	10.8	16,324	4.60	12	Vectos
L8	B5254 - Watkin Lane - North of Coote Lane	8.8	15,961	4.58	16	Vectos
L9	B5254 - Watkin Lane - South of Flag Lane	7.6	15,961	4.58	16	Vectos
L10	B5254 - Watkin Lane - north of Flag Lane	7.6	15,993	4.38	22	Vectos
L11	B5254 - Watkin Lane - north of Flag Lane Slow Down	7.0	15,993	4.38	17	Vectos
L12	Roundabout - The Cawsey/ B5254	6.7	10,874	4.60	15	Calculated
L13	B5254 (North of roundabout) SLOW DOWN	9.4	19,108	4.55	11	Vectos
L14	B5254 (North of roundabout)	19.0	19,108	4.55	11	Vectos
L15	B5254 (North of roundabout) - from site access	19.0	19,108	4.55	11	Vectos
L16	B5254 Slow Down	8.0	19,108	4.55	11	Vectos
L17	B5253 continued	7.5	16,846	4.93	21	Vectos
L18	Leyland Road, north of Factory Lane	7.5	16,846	4.93	21	Vectos
L19	B5253 Leyland Road, north of Factory Lane Slow Down	7.5	16,846	4.93	21	Vectos
L20	The Cawsey Slow Down	10.6	7,741	5.25	26	Vectos
L21	The Cawsey	7.7	7,741	5.25	26	Vectos
L22	Brownedge Road Slow Down - from Leyland Road	8.5	6,799	4.61	5	Vectos

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L23	Brownedge Road	7.0	6,799	4.61	13	Vectos
L24	Brownedge Road Slow Down	8.0	6,799	4.61	5	Vectos
L25	Brownedge Road	8.2	6,799	4.61	13	Vectos
L26	Brownedge Road Slow Down	8.2	6,799	4.61	5	Vectos
L27	Brownedge Road Slow Down	7.3	6,799	4.61	5	Vectos
L28	London Way	19.8	29,981	1.76	65	DfT
L29	Roundabout - A6 London Way/ Carrwood Road	11.1	18,725	2.15	15	Calculated
L30	A6 London Way North of Roundabout	21.0	29,981	1.76	45	DfT
L31	A6 London Way North of Mean High Water	21.0	29,981	1.76	25	DfT
L32	Jubilee Road Slowdown	9.7	8,117	9.49	15	Eddisons
L33	Carrwood Road	7.2	7,741	5.25	26	Vectos
L34	Carrwood Road	10.0	7,741	5.25	26	Vectos
L35	Carrwood Road	7.4	7,741	5.25	26	Vectos
L36	Carrwood Road (Eastbound) Slow Down	6.1	3,871	5.25	15	Vectos
L37	Carrwood (Westbound) Slow Down	7.4	3,871	5.25	15	Vectos
L38	Roundabout - Carrwood	10.0	3,871	5.25	15	Calculated
L39	Carrwood Road - Slow Down (Eastbound)	4.3	3,871	5.25	15	Vectos
L40	Carrwood Road - Slow Down (Westbound)	5.9	3,871	5.25	15	Vectos
L41	Carwood Road	7.0	7,741	5.25	26	Vectos
L42	Proposed Crossborough Link Road	7.0	7,741	5.25	26	Vectos
L43	Flensburg Way	7.5	15,983	6.51	29	Vectos
L44	Marshall's Brow Slowdown	7.3	8,234	4.98	15	Vectos
L45	Marshall's Brow	7.5	8,234	4.98	29	Vectos
L46	Cop Lane (North of Pope Lane)	7.2	7,761	1.87	25	Vectos
L47	Cop Lane Junction Slow Down	12.6	7,761	1.87	10	Vectos
L48	Cop Lane (North of Golden Way)	6.2	7,761	1.87	31	Vectos
L49	Cop Lane Slow Down	7.7	7,761	1.87	10	Vectos
L50	Liverpool Road South of Cop Lane Slow Down	11.9	21,369	3.66	10	DfT
L51	Liverpool Road South of Cop Lane	9.1	21,369	3.66	35	DfT
L52	Penwortham Brow Slow Down	11.9	21,369	3.66	10	DfT
L53	Penwortham Brow	16.7	21,369	3.66	35	DfT
L54	Leyland Road Slowdown	7.5	17,004	3.41	15	Vectos
L55	Leyland Road	8.6	17,004	3.41	28	Vectos
L56	Golden Way	19.3	31,056	5.14	29	Vectos
L57	A582 Roundabout	5.5	23,507	5.21	15	Calculated

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L58	A582 Roundabout Southbound Approach	6.5	14,480	4.80	29	Vectos
L59	A582 Roundabout Northbound Exit	6.3	16,576	5.44	14	Vectos
L60	Millbrook Way	7.7	5,233	3.74	25	Eddisons
L61	A582 Roundabout to Millbrook Way	7.3	2,616	3.74	20	Eddisons
L62	Millbrook Way Slowdown to A582 Roundabout	7.9	2,616	3.74	15	Eddisons
L63	Golden Way to Roundabout Northbound	7.3	10,325	5.77	29	Vectos
L64	Roundabout Exit onto Golden Way	6.6	9,558	6.95	6	Vectos
L65	Golden Way Between Roundabouts	11.4	19,884	6.34	29	Vectos
L66	Golden Way to Penwortham Way Slowdown	18.4	9,558	6.95	6	Vectos
L67	Junction to Penwortham Way Slowdown	12.9	10,325	5.77	29	Vectos
L68	Penwortham Way North of Site Access	16.6	20,569	6.59	15	Vectos
L69	Penwortham Way South of Site Access	16.6	20,609	6.59	15	Vectos
L70	Penwortham Way North of Site to Golden Way Slow Down	16.5	10,386	6.58	8	Vectos
L71	Golden Way to Penwortham Way	12.1	10,183	6.60	22	Vectos
L72	Pope Lane North of Junction	7.3	5,996	6.88	29	Vectos
L73	Pope Lane (North of Junction) to Golden Way Slow Down	8.5	2,998	6.88	15	Vectos
L74	Golden Way to Pope Lane (North of Junction) Speed Up	5.5	2,998	6.88	20	Vectos
L75	Pope Lane South of Junction	6.3	6,130	4.04	20	Vectos
L76	Golden Way to Pope Lane South	3.0	3,065	4.04	12	Vectos
L77	Pope Lane South to Golden Way	5.8	3,065	4.04	12	Vectos
L78	A6 London Way continued	12.0	32,495	2.85	25	DfT
L79	A6 London Way continued	12.8	32,495	2.85	25	DfT
L80	Penwortham Way North of Junction Slowdown	18.8	20,609	6.59	14	Vectos
L81	Penwortham Way South of Junction Slowdown	19.3	26,623	7.23	15	Vectos
L82	Coote Lane Slowdown to Penwortham Way	12.4	4,049	3.58	19	Vectos
L83	Chain House Lane East of Junction	6.4	4,049	3.58	19	Vectos
L84	Coote Lane	6.4	3,028	5.66	20	Vectos
L85	Coote Lane Slowdown to Leyland Road	7.0	3,028	5.66	10	Vectos
L86	Chain House Lane Slowdown West of Junction	11.5	9,267	7.04	18	Vectos
L87	Chain House Lane West of Junction	6.7	9,267	7.04	18	Vectos
L88	A582 Roundabout	10.5	23,955	6.92	15	Calculated
L89	Penwortham Way South of Junction	7.6	26,623	7.23	64	Vectos
L90	Flensburg Way	7.9	29,258	6.85	36	Vectos
L91	Flensburg Way Roundabout	9.8	21,736	6.71	15	Calculated

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L92	Farington Road Roundabout	9.1	22,211	7.18	15	Calculated
L93	A582 Between Roundabouts	12.2	29,258	6.85	36	Vectos
L94	Croston Road Slowdown	7.7	8,117	9.49	15	Eddisons
L95	Croston Road to Jubilee Road	9.6	8,117	9.49	25	Eddisons
L96	Farington Road East of Roundabout Slowdown	11.2	29,258	6.85	15	Vectos
L97	Lostock Lane Roundabout	12.3	25,784	6.53	15	Calculated
L98	Farington Road East of Roundabout	7.5	29,258	6.85	36	Vectos
L99	Stanifield Lane	7.1	13,252	5.94	43	Vectos
L100	Lostock Lane	20.1	45,325	6.49	39	Vectos
L101	John Horrocks Way Roundabout Junction	8.0	9,001	6.52	15	Vectos
L102	John Horrocks Way Roundabout Junction	5.5	8,318	4.59	15	Vectos
L103	John Horrocks Way	14.0	17,319	5.59	50	Vectos
L104	Site Access on Penwortham Way	6.0	0	0.00	20	Vectos

Reference should be made to Figure 13.6 within Appendix 13.1 for a graphical representation of the road link locations used within the verification assessment. The road width shown in Table 13.2.1 remained the same for the 2031 scenarios, however there are changes to the mean vehicle speed based on data provided by Vectos, as shown in Table 13.2.2.

A summary of the 2031 traffic data is shown in Table 13.2.2.

Table 13.2.2: 2031 Traffic Data

Road Link		Mean Vehicle Speed (km/hr)	DM Scenario		DS Scenario	
			24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L1	B5254 - Watkin Lane Slowdown to Roundabout	15	16,329	5.35	16,630	5.26
L2	B5254 - Watkin Lane	19	16,329	5.35	16,630	5.26
L3	B5254 - Watkin Lane	19	16,329	5.35	16,630	5.26
L4	B5254 - Watkin Lane	11	17,073	3.96	17,441	3.94
L5	B5254 - Watkin Lane	11	17,073	3.96	17,441	3.94
L6	B5254 - Watkin Lane - between Jubilee Road and Brownedge Road	11	17,073	3.96	17,441	3.94
L7	B5254 - Watkin Lane - between Coote Lane and Brownedge Road	11	17,073	3.96	17,441	3.94
L8	B5254 - Watkin Lane - North of Coote Lane	11	16,531	4.06	16,518	4.07
L9	B5254 - Watkin Lane - South of Flag Lane	11	16,531	4.06	16,518	4.07
L10	B5254 - Watkin Lane - north of Flag Lane	22	16,516	3.93	16,526	3.93
L11	B5254 - Watkin Lane - north of Flag Lane Slow Down	16	16,516	3.93	16,526	3.93

Road Link		Mean Vehicle Speed (km/hr)	DM Scenario		DS Scenario	
			24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L12	Roundabout - The Cawsey/ B5254	15	11,570	4.15	11,600	4.12
L13	B5254 (North of roundabout) Slow Down	11	19,581	4.30	19,977	4.20
L14	B5254 (North of roundabout)	11	19,581	4.30	19,977	4.20
L15	B5254 (North of roundabout) - from site access	11	19,581	4.30	19,977	4.20
L16	B5254 Slow Down	11	19,581	4.30	19,977	4.20
L17	B5253 continued	21	16,824	4.80	16,954	4.77
L18	Leyland Road, north of Factory Lane	21	16,824	4.80	16,954	4.77
L19	B5253 Leyland Road, north of Factory Lane Slow Down	21	16,824	4.80	16,954	4.77
L20	The Cawsey Slow Down	21	9,496	4.23	9,912	4.03
L21	The Cawsey	26	9,496	4.23	9,912	4.03
L22	Brownedge Road Slow Down - from Leyland Road	5	7,096	3.72	7,392	3.52
L23	Brownedge Road	13	7,096	3.72	7,392	3.52
L24	Brownedge Road Slow Down	5	7,096	3.72	7,392	3.52
L25	Brownedge Road	13	7,096	3.72	7,392	3.52
L26	Brownedge Road Slow Down	5	7,096	3.72	7,392	3.52
L27	Brownedge Road Slow Down	5	7,096	3.72	7,392	3.52
L28	London Way	65	32,029	1.76	32,029	1.76
L29	Roundabout - A6 London Way/ Carrwood Road	15	20,502	2.07	20,710	2.06
L30	A6 London Way North of Roundabout	45	32,029	1.76	32,445	1.76
L31	A6 London Way North of Mean High Water	25	32,029	1.76	32,445	1.76
L32	Jubilee Road Slowdown	15	8,671	9.49	8,671	9.49
L33	Carrwood Road	26	9,496	4.23	9,912	4.03
L34	Carrwood Road	26	9,496	4.23	9,912	4.03
L35	Carrwood Road	26	9,496	4.23	9,912	4.03
L36	Carrwood Road (Eastbound) Slow Down	15	4,748	4.23	4,956	4.03
L37	Carrwood (Westbound) Slow Down	15	4,748	4.23	4,956	4.03
L38	Roundabout - Carrwood	15	4,748	4.23	4,956	4.03
L39	Carrwood Road - Slow Down (Eastbound)	15	4,748	4.23	4,956	4.03
L40	Carrwood Road - Slow Down (Westbound)	15	4,748	4.23	4,956	4.03
L41	Carwood Road	26	9,496	4.23	9,912	4.03
L42	Proposed Crossborough Link Road	26	9,496	4.23	9,912	4.03
L43	Flensburg Way	28	22,719	4.57	22,783	4.57
L44	Marshall's Brow Slowdown	15	9,292	5.19	9,618	4.97
L45	Marshall's Brow	29	9,292	5.19	9,618	4.97
L46	Cop Lane (North of Pope Lane)	22	8,615	1.86	8,955	1.95

Road Link		Mean Vehicle Speed (km/hr)	DM Scenario		DS Scenario	
			24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L47	Cop Lane Junction Slow Down	10	8,615	1.86	8,955	1.95
L48	Cop Lane (North of Golden Way)	22	8,615	1.86	8,955	1.95
L49	Cop Lane Slow Down	10	8,615	1.86	8,955	1.95
L50	Liverpool Road South of Cop Lane Slow Down	10	22,829	3.66	22,829	3.66
L51	Liverpool Road South of Cop Lane	35	22,829	3.66	22,829	3.66
L52	Penwortham Brow Slow Down	10	22,829	3.66	22,829	3.66
L53	Penwortham Brow	35	22,829	3.66	22,829	3.66
L54	Leyland Road Slowdown	15	16,755	2.87	16,808	2.91
L55	Leyland Road	27	16,755	2.87	16,808	2.91
L56	Golden Way	30	33,671	4.59	34,798	4.39
L57	A582 Roundabout	15	25,491	4.79	26,244	4.58
L58	A582 Roundabout Southbound Approach	30	15,414	4.35	16067	4.14
L59	A582 Roundabout Northbound Exit	13	18,257	4.80	18731	4.61
L60	Millbrook Way	25	5,590	3.74	5,590	3.74
L61	A582 Roundabout to Millbrook Way	20	2,795	3.74	2,795	3.74
L62	Millbrook Way Slowdown to A582 Roundabout	15	2,795	3.74	2,795	3.74
L63	Golden Way to Roundabout Northbound	25	12,149	4.93	12,613	4.60
L64	Roundabout Exit onto Golden Way	5	10,689	6.12	11,471	5.68
L65	Golden Way Between Roundabouts	25	22,838	5.49	24,084	5.11
L66	Golden Way to Penwortham Way Slowdown	5	10,689	6.12	11,471	5.68
L67	Junction to Penwortham Way Slowdown	25	12,149	4.93	12,613	4.60
L68	Penwortham Way North of Site Access	13	24,543	5.71	25,955	5.25
L69	Penwortham Way South of Site Access	13	24,607	5.69	26,621	5.15
L70	Penwortham Way North of Site to Golden Way Slow Down	6	12,771	5.59	13,312	5.09
L71	Golden Way to Penwortham Way	20	11,772	5.83	12,643	5.42
L72	Pope Lane North of Junction	27	6,795	7.04	7,233	6.48
L73	Pope Lane (North of Junction) to Golden Way Slow Down	15	3,398	7.04	3,616	6.48
L74	Golden Way to Pope Lane (North of Junction) Speed Up	20	3,398	7.04	3,616	6.48
L75	Pope Lane South of Junction	20	6,285	3.95	6,280	3.90
L76	Golden Way to Pope Lane South	11	3,143	3.95	3,140	3.90
L77	Pope Lane South to Golden Way	18	3,143	3.95	3,140	3.90
L78	A6 London Way continued	25	34,714	2.85	35,130	2.85
L79	A6 London Way continued	25	34,714	2.85	35,130	2.85
L80	Penwortham Way North of Junction Slowdown	14	24,607	5.69	26,621	5.15

Road Link		Mean Vehicle Speed (km/hr)	DM Scenario		DS Scenario	
			24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L81	Penwortham Way South of Junction Slowdown	15	31,866	6.17	32,745	5.92
L82	Coote Lane Slowdown to Penwortham Way	17	5,729	2.54	7,143	2.07
L83	Chain House Lane East of Junction	17	5,729	2.54	7,143	2.07
L84	Coote Lane	20	3,820	3.77	4,461	3.37
L85	Coote Lane Slowdown to Leyland Road	10	3,820	3.77	4,461	3.37
L86	Chain House Lane Slowdown West of Junction	17	10,534	6.16	10,676	6.01
L87	Chain House Lane West of Junction	17	10,534	6.16	10,676	6.01
L88	A582 Roundabout	15	29,398	5.69	30,009	5.52
L89	Penwortham Way South of Junction	52	31,866	6.17	32,745	5.92
L90	Flensburg Way	30	33,608	5.99	34,498	5.76
L91	Flensburg Way Roundabout	15	24,754	5.84	25,348	5.64
L92	Farington Road Roundabout	15	25,296	6.39	25,889	6.18
L93	A582 Between Roundabouts	30	33,608	5.99	34,498	5.76
L94	Croston Road Slowdown	15	8,671	9.49	8,671	9.49
L95	Croston Road to Jubilee Road	25	8,671	9.49	8,671	9.49
L96	Farington Road East of Roundabout Slowdown	15	33,608	5.99	34,498	5.76
L97	Lostock Lane Roundabout	15	28,578	5.75	29,108	5.61
L98	Farington Road East of Roundabout	30	33,608	5.99	34,498	5.76
L99	Stanifield Lane	40	14,184	5.59	14,176	5.56
L100	Lostock Lane	32	50,193	5.77	51,127	5.64
L101	John Horrocks Way Roundabout Junction	15	9,225	6.45	9,362	6.28
L102	John Horrocks Way Roundabout Junction	15	8,537	4.51	8,681	6.28
L103	John Horrocks Way	50	17,762	5.52	18,043	5.38
L104	Site Access on Penwortham Way	20	0	0.00	4,760	0.00

Reference should be made to Figure 13.6 within Appendix 13.1 for a graphical representation of the road link locations used within the operation phase assessment.

Vectos have also provided traffic data associated with the dualling of Penwortham Way. This data was used for the sensitivity analysis shown in Appendix 13.3 and a summary of the data is provided in Table 13.2.3. Vectos has also confirmed that the mean vehicle speed changes alongside the road width due to the dualling of Penwortham Way.

Table 13.2.3: Penwortham Way Dualling Scenario -2031 Opening Year

Road Link		Mean Vehicle Speed (km/hr)	Road Width (m)	DS Dualling Scenario	
				24 Hr AADT Flow	HDV Prop (%)
L1	B5254 - Watkin Lane Slowdown to Roundabout	15	9.3	15,083	5.80

Road Link		Mean Vehicle Speed (km/hr)	Road Width (m)	DS Dualling Scenario	
				24 Hr AADT Flow	HDV Prop (%)
L2	B5254 - Watkin Lane	19	8.0	15,083	5.80
L3	B5254 - Watkin Lane	19	8.8	15,083	5.80
L4	B5254 - Watkin Lane	11	8.0	16,055	4.12
L5	B5254 - Watkin Lane	11	8.3	16,055	4.12
L6	B5254 - Watkin Lane - between Jubilee Road and Brownedge Road	11	10.5	16,055	4.12
L7	B5254 - Watkin Lane - between Coote Lane and Brownedge Road	11	10.8	16,055	4.12
L8	B5254 - Watkin Lane - North of Coote Lane	11	8.8	15,565	4.26
L9	B5254 - Watkin Lane - South of Flag Lane	11	7.6	15,565	4.26
L10	B5254 - Watkin Lane - north of Flag Lane	22	7.6	15,576	4.08
L11	B5254 - Watkin Lane - north of Flag Lane Slow Down	16	7.0	15,576	4.08
L12	Roundabout - The Cawsey/ B5254	15	6.7	11,420	4.11
L13	B5254 (North of roundabout) Slow Down	11	9.4	19,275	4.28
L14	B5254 (North of roundabout)	11	19.0	19,275	4.28
L15	B5254 (North of roundabout) - from site access	11	19.0	19,275	4.28
L16	B5254 Slow Down	11	8.0	19,275	4.28
L17	B5253 continued	21	7.5	16,682	4.91
L18	Leyland Road, north of Factory Lane	21	7.5	16,682	4.91
L19	B5253 Leyland Road, north of Factory Lane Slow Down	21	7.5	16,682	4.91
L20	The Cawsey Slow Down	21	10.6	10,139	3.87
L21	The Cawsey	26	7.7	10,139	3.87
L22	Brownedge Road Slow Down - from Leyland Road	5	8.5	7,241	3.61
L23	Brownedge Road	13	7.0	7,241	3.61
L24	Brownedge Road Slow Down	5	8.0	7,241	3.61
L25	Brownedge Road	13	8.2	7,241	3.61
L26	Brownedge Road Slow Down	5	8.2	7,241	3.61
L27	Brownedge Road Slow Down	5	7.3	7,241	3.61
L28	London Way	65	19.8	32,029	1.76
L29	Roundabout - A6 London Way/ Carrwood Road	15	11.1	20,824	2.04
L30	A6 London Way North of Roundabout	45	21.0	32,671	1.76
L31	A6 London Way North of Mean High Water	25	21.0	32,671	1.76
L32	Jubilee Road Slowdown	15	9.7	8,671	9.49
L33	Carrwood Road	26	7.2	10,139	3.87
L34	Carrwood Road	26	10.0	10,139	3.87
L35	Carrwood Road	26	7.4	10,139	3.87

Road Link		Mean Vehicle Speed (km/hr)	Road Width (m)	DS Dualling Scenario	
				24 Hr AADT Flow	HDV Prop (%)
L36	Carrwood Road (Eastbound) Slow Down	15	6.1	5,069	3.87
L37	Carrwood (Westbound) Slow Down	15	7.4	5,069	3.87
L38	Roundabout - Carrwood	15	10.0	5,069	3.87
L39	Carrwood Road - Slow Down (Eastbound)	15	4.3	5,069	3.87
L40	Carrwood Road - Slow Down (Westbound)	15	5.9	5,069	3.87
L41	Carwood Road	26	7.0	10,139	3.87
L42	Proposed Crossborough Link Road	26	7.0	10,139	3.87
L43	Flensburg Way	28	7.5	22,674	3.59
L44	Marshall's Brow Slowdown	15	7.3	9,258	5.15
L45	Marshall's Brow	29	7.5	9,258	5.15
L46	Cop Lane (North of Pope Lane)	22	7.2	8,919	1.81
L47	Cop Lane Junction Slow Down	10	12.6	8,919	1.81
L48	Cop Lane (North of Golden Way)	22	6.2	8,919	1.81
L49	Cop Lane Slow Down	10	7.7	8,919	1.81
L50	Liverpool Road South of Cop Lane Slow Down	10	11.9	22,829	0.00
L51	Liverpool Road South of Cop Lane	35	9.1	22,829	0.00
L52	Penwortham Brow Slow Down	10	11.9	22,829	0.00
L53	Penwortham Brow	35	16.7	22,829	0.00
L54	Leyland Road Slowdown	15	7.5	16,646	2.81
L55	Leyland Road	27	8.6	16,646	2.81
L56	Golden Way	30	19.3	35,169	4.40
L57	A582 Roundabout	15	5.5	26,473	4.60
L58	A582 Roundabout Southbound Approach	30	6.5	16,235	4.16
L59	A582 Roundabout Northbound Exit	13	6.3	18,934	4.60
L60	Millbrook Way	25	7.7	5,590	3.74
L61	A582 Roundabout to Millbrook Way	20	7.3	2,795	3.74
L62	Millbrook Way Slowdown to A582 Roundabout	15	7.9	2,795	3.74
L63	Golden Way to Roundabout Northbound	25	7.3	12,925	4.52
L64	Roundabout Exit onto Golden Way	5	6.6	11,764	5.69
L65	Golden Way Between Roundabouts	25	11.4	24,689	5.08
L66	Golden Way to Penwortham Way Slowdown	5	18.4	11,764	5.69
L67	Junction to Penwortham Way Slowdown	25	12.9	12,925	4.52
L68	Penwortham Way North of Site Access	13	20.0	27,074	5.17
L69	Penwortham Way South of Site Access	13	20.0	27,566	5.09

Road Link		Mean Vehicle Speed (km/hr)	Road Width (m)	DS Dualling Scenario	
				24 Hr AADT Flow	HDV Prop (%)
L70	Penwortham Way North of Site to Golden Way Slow Down	6	16.5	14,000	5.06
L71	Golden Way to Penwortham Way	20	12.1	13,074	5.29
L72	Pope Lane North of Junction	27	7.3	7,891	6.10
L73	Pope Lane (North of Junction) to Golden Way Slow Down	15	8.5	3,945	6.10
L74	Golden Way to Pope Lane (North of Junction) Speed Up	20	5.5	3,945	6.10
L75	Pope Lane South of Junction	20	6.3	6,172	4.06
L76	Golden Way to Pope Lane South	11	3.0	3,086	4.06
L77	Pope Lane South to Golden Way	18	5.8	3,086	4.06
L78	A6 London Way continued	25	12.0	35,357	2.85
L79	A6 London Way continued	25	12.8	35,357	2.85
L80	Penwortham Way North of Junction Slowdown	14	18.8	27,566	5.09
L81	Penwortham Way South of Junction Slowdown	15	19.3	33,862	5.83
L82	Coote Lane Slowdown to Penwortham Way	17	12.4	5,825	2.00
L83	Chain House Lane East of Junction	17	6.4	5,825	2.00
L84	Coote Lane	20	6.4	3,801	3.70
L85	Coote Lane Slowdown to Leyland Road	10	7.0	3,801	3.70
L86	Chain House Lane Slowdown West of Junction	17	11.5	10,599	6.13
L87	Chain House Lane West of Junction	17	6.7	10,599	6.13
L88	A582 Roundabout	15	10.5	31,592	5.23
L89	Penwortham Way South of Junction	52	7.6	33,862	5.83
L90	Flensburg Way	30	7.9	38,239	5.67
L91	Flensburg Way Roundabout	15	9.8	25,493	5.67
L92	Farington Road Roundabout	15	9.1	28,383	6.06
L93	A582 Between Roundabouts	30	12.2	38,239	5.67
L94	Croston Road Slowdown	15	7.7	8,671	9.49
L95	Croston Road to Jubilee Road	25	9.6	8,671	9.49
L96	Farington Road East of Roundabout Slowdown	15	11.2	38,239	5.67
L97	Lostock Lane Roundabout	15	12.3	29,663	5.66
L98	Farington Road East of Roundabout	30	7.5	38,239	5.67
L99	Stanifield Lane	40	7.1	14,140	5.58
L100	Lostock Lane	32	20.1	51,190	5.62
L101	John Horrocks Way Roundabout Junction	15	8.0	9,265	6.42
L102	John Horrocks Way Roundabout Junction	15	5.5	8,960	6.42
L103	John Horrocks Way	50	14.0	18,225	5.34

Road Link		Mean Vehicle Speed (km/hr)	Road Width (m)	DS Dualling Scenario	
				24 Hr AADT Flow	HDV Prop (%)
L104	Site Access on Penwortham Way	20	6.0	4,760	0.00

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 10.1) released in August 2020, which incorporates updated COPERT 5.3 vehicle emissions factors for NOx and PM and EURO 6 vehicle fleet sub-categories.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2 concentrations using the NO_x to NO_2 Calculator (v.8.1) provided by DEFRA, which is the method detailed within LAQM.TG(16).

Meteorological Data

Meteorological data used in this assessment was taken from Manchester Ringway meteorological station over the period 1st January 2019 to 31st December 2019 (inclusive).

Manchester Ringway meteorological station is located at approximate NGR: 381745, 383960 which is approximately 50.5km south-east of the Proposed Development. Although there is a large distance between the application site and Manchester Ringway the use of this data has prior approval from the Environmental Health Department at South Ribble Borough Council and is therefore considered to provide a reasonable representation of conditions at the development site.

All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 5 within Appendix A for a wind rose of utilised meteorological data.

Roughness Length

The specific roughness length (z_0) values used to represent conditions during the verification process, DM/DS scenario, as well as conditions at the Manchester Ringway meteorological station are summarised in Table 13.2.4.

Table 13.2.4: Utilised Roughness Lengths

Scenario	Roughness Length (m)	ADMS Description
Verification, DM and DS Scenarios	0.5	Parkland, open suburbia
Manchester Ringway	0.3	agricultural areas (max)

These values of z_0 are considered appropriate for the morphology of the assessment area.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere within certain urban or rural contexts. The specific length values used to represent conditions during the verification process, DM/DS scenario, as well as conditions at the Manchester Ringway are summarised in Table 13.2.5.

Table 13.2.5: Utilised Monin-Obukhov Lengths

Scenario	Monin-Obukhov Length (m)	ADMS Description
Verification, DM and DS Scenarios and Manchester Ringway	30	Cities and large towns

This Monin-Obukhov value is considered appropriate for the morphology of the assessment area.

Background Concentrations

The annual mean NO_2 concentrations detailed in Table of the main Air Quality Chapter , was used in the dispersion modelling assessment to represent annual mean pollutant levels at the Proposed Development site and local monitoring sites.

Table 13.2.6 displays the specific background concentrations as predicted by DEFRA, utilised to represent the condition at the monitoring locations used within the verification process.

Table 13.2.6: Predicted Background Pollutant Concentrations for Diffusion Tubes

Monitoring Location	DEFRA Grid Square	Pollutant	2019 Predicted Background Concentration (µg/m³)
11, 12, 13, 14, 15	354500, 425500	NO_x	18.35
		NO_2	13.56
21, 22, 23	355500, 428500	NO_x	16.64
		NO_2	12.47
17, 18	351500, 428500	NO_x	13.82
		NO_2	10.52
16	352500, 428500	NO_x	16.38
		NO_2	12.31

Table 13.2.7 displays the predicted background concentrations by DEFRA used in the operational phase assessment for the sensitive receptor locations. The 2030 predicted background concentrations have been provided to represent the concentrations used during the 2030 emission factor sensitivity analysis scenario considered within Appendix 13.3.

Table 13.2.7: Predicted Background Pollutant Concentrations at Sensitive Receptors

Monitoring Location	DEFRA Grid Square	Pollutant	2025 Predicted Background Concentration (µg/m³)	2030 Predicted Background Concentration (µg/m³)
R1, R13, R14	354500, 426500	NO_x	16.07	14.59
		NO_2	11.95	10.93
		PM_{10}	10.81	10.75
		$PM_{2.5}$	7.11	7.07
R2 to R4	354500, 427500	NO_x	10.99	9.84
		NO_2	8.49	7.65
		PM_{10}	10.14	10.08
		$PM_{2.5}$	6.64	6.60

Monitoring Location	DEFRA Grid Square	Pollutant	2025 Predicted Background Concentration (µg/m³)	2030 Predicted Background Concentration (µg/m³)
R5 to R8, R12	353500, 426500	NO_x	11.15	9.98
		NO_2	8.60	7.74
		PM_{10}	10.29	10.23
		$PM_{2.5}$	6.84	6.79
R9 to R11, R32, R33	353500,427500	NO_x	11.34	10.12
		NO_2	8.74	7.84
		PM_{10}	10.32	10.26
		$PM_{2.5}$	6.95	6.91
R15 to R21, R46 to R49	354500, 425500	NO_x	14.22	12.69
		NO_2	10.75	9.66
		PM_{10}	11.00	10.94
		$PM_{2.5}$	7.48	7.43
R22	355500,425500	NO_x	16.47	14.07
		NO_2	12.32	10.64
		PM_{10}	11.59	11.53
		$PM_{2.5}$	7.65	7.61
R23, R44, R45	355500,428500	NO_x	12.65	11.03
		NO_2	9.68	8.51
		PM_{10}	10.97	10.91
		$PM_{2.5}$	7.08	7.04
R24	351500,426500	NO_x	8.94	7.96
		NO_2	7.01	6.27
		PM_{10}	10.05	9.99
		$PM_{2.5}$	6.27	6.22
R25 to R27, R41	352500, 426500	NO_x	10.06	8.90
		NO_2	7.83	6.96
		PM_{10}	10.21	10.15
		$PM_{2.5}$	6.67	6.62
R28 to R30	352500, 425500	NO_x	9.49	8.42
		NO_2	7.41	6.61
		PM_{10}	10.07	10.01
		$PM_{2.5}$	6.35	6.30
R31	353500,425500	NO_x	10.46	9.45
		NO_2	8.10	7.36
		PM_{10}	9.90	9.84
		$PM_{2.5}$	6.46	6.42

Monitoring Location	DEFRA Grid Square	Pollutant	2025 Predicted Background Concentration (µg/m³)	2030 Predicted Background Concentration (µg/m³)
R34 to R37, R43	352500,427500	NO_x	10.69	9.41
		NO_2	8.29	7.34
		PM_{10}	10.17	10.11
		$PM_{2.5}$	6.69	6.65
R38	352500, 428500	NO_x	12.32	10.65
		NO_2	9.46	8.42
		PM_{10}	10.69	10.63
		$PM_{2.5}$	6.98	6.94
R39	351500, 428500	NO_x	10.76	9.61
		NO_2	8.33	7.48
		PM_{10}	10.12	10.06
		$PM_{2.5}$	6.69	6.65
R40	351500, 427500	NO_x	10.19	9.09
		NO_2	7.92	7.10
		PM_{10}	10.31	10.25
		$PM_{2.5}$	6.69	6.65
R41	352500, 426500	NO_x	10.06	8.90
		NO_2	7.83	6.96
		PM_{10}	10.21	10.15
		$PM_{2.5}$	6.67	6.62
R42	351500, 426500	NO_x	8.94	7.96
		NO_2	7.01	6.27
		PM_{10}	10.05	9.99
		$PM_{2.5}$	6.27	6.22

Verification

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and
- Uncertainties associated with monitoring data, including locations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

For the purpose of this assessment model verification was undertaken for 2019, using traffic data, meteorological data and monitoring results from this year.

SRBC undertakes periodic monitoring of NO_2 concentrations at 11 roadside monitoring location within the assessment extents. The use of these diffusion tubes was confirmed acceptable by the Environmental Health Office at South Ribble Borough Council via email on 4th August 2021.

The road contribution to total NO_x concentration was calculated from the monitored NO_2 result for use in the verification process. This was undertaken following the methodology contained within DEFRA guidance LAQM.TG(16). The monitored annual mean NO_2 concentration and calculated road NO_x concentration are summarised in Table 13.2.8.

Table 13.2.8: NO_x Concentrations

Site ID	Monitored Road NO_x Concentration (µg/m³)	Modelled Road NO_x Concentration (µg/m³)	% Difference ((Monitored Modelled)/Monitored)) * 100
11	32.51	13.01	60
12	36.32	15.00	59
13	51.15	20.54	60
14	43.56	21.69	50
15	33.07	17.65	47
16	36.28	11.40	69
17	24.31	14.63	40
18	39.25	16.12	59
21	37.63	13.81	63
22	33.28	14.25	57
23	38.65	21.05	46

The monitored and modelled NO_x road contribution concentrations were graphed and the equation of the trend line based on the linear progression through zero was calculated, as shown in Graph 13.2.1.

This indicated that a verification factor of **2.2235** was required to be applied to all NO_x modelling results, showing the model overestimated pollutant concentrations throughout the assessment extents.

Graph 13.2.1 is provided below.

Graph 13.2.1 - Verification Adjustment Factor

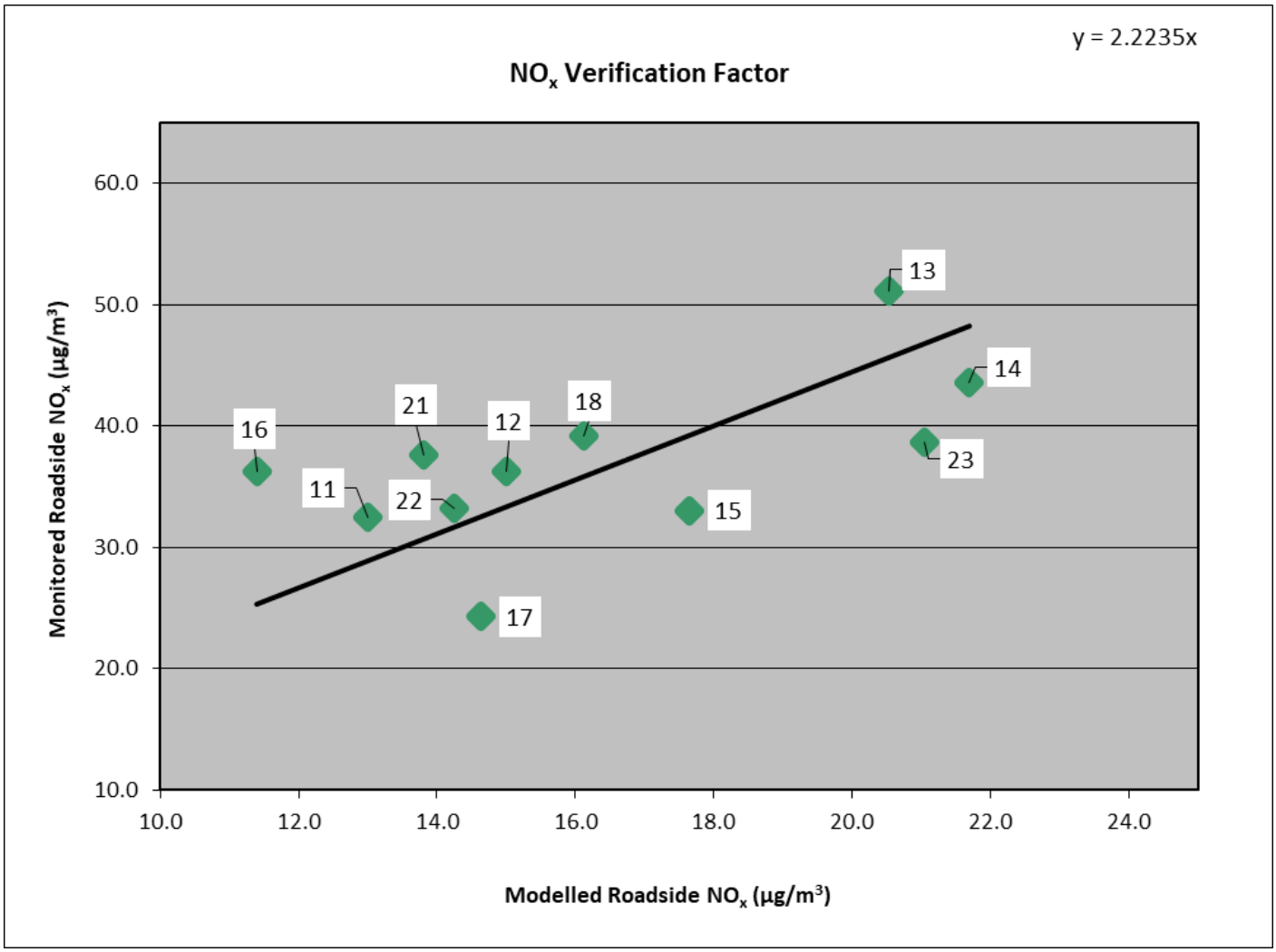


Table 13.2.9 presents the monitored annual mean NO_2 concentrations and the adjusted modelled total NO_2 concentration based on the above verification factor.

Table 13.2.9: NO_2 Concentrations

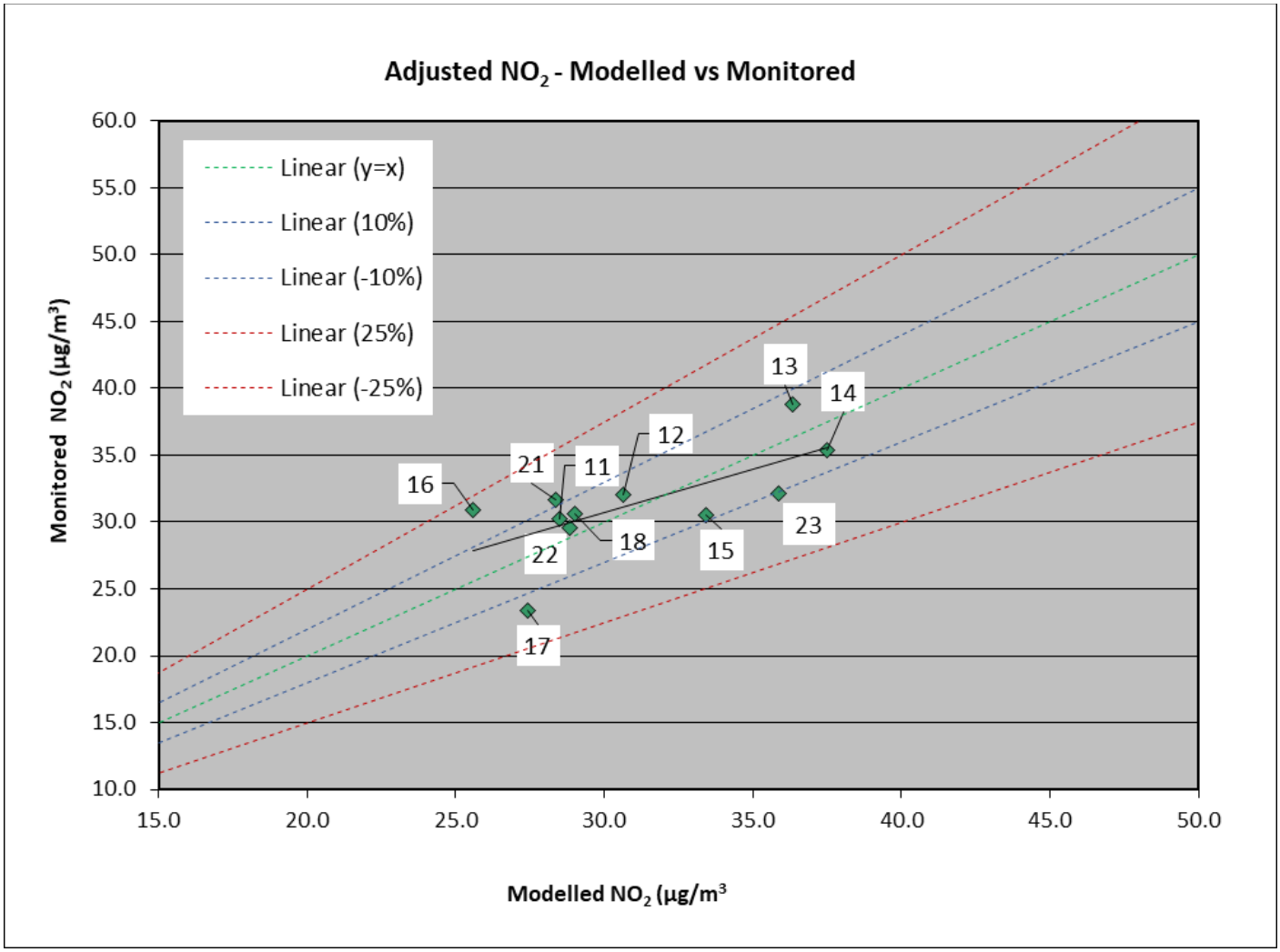
Site ID	Monitored Road NO_2 Concentration (µg/m³)	Adjusted Modelled Road NO_2 Concentration (µg/m³)	% Difference ((Monitored Modelled)/Monitored)) * 100
11	30.24	28.52	6
12	32.05	30.65	4
13	38.80	36.36	6
14	35.40	37.51	-6
15	30.51	33.42	-10
16	30.88	25.59	17
17	23.37	27.42	-17
18	30.62	29.01	5
21	31.66	28.36	10

Site ID	Monitored Road NO_2 Concentration (µg/m³)	Adjusted Modelled Road NO_2 Concentration (µg/m³)	% Difference ((Monitored Modelled)/Monitored)) * 100
22	29.60	28.83	3
23	32.14	35.88	-12

As demonstrated in Table 13.2.9, the percentage difference between modelled and monitored concentrations is deemed acceptable and is less than 25% in all cases, and less than 10% at 6 locations. This reduces uncertainties in the model predictions and provide a robust representation of pollutant concentrations in accordance with the guidance suggested in LAQM.TG(16).

A graphical representation of the adjusted NO_2 concentrations is provided within Graph 13.2.2.

Graph 13.2.2 – Adjusted NO_2 – Modelled vs Monitored



As PM monitoring is not undertaken within the assessment extents, the NO_x adjustment factor of **2.2235** was utilised to adjust model predictions of PM in accordance with the guidance provided within LAQM.TG(16)[2].