APPENDIX 7.1

Assessment Modelling Inputs

7.1. Dispersion modelling using ADMS Roads was therefore undertaken to quantify baseline conditions, consider the suitability of the site for the proposed end-use and assess potential impacts as a result of the development.

7.2. Additionally, dispersion modelling using ADMS-5 has been used to predict NO_2 concentrations at sensitive locations as a result of the proposed Energy Centre.

7.3. The dispersion 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.

7.4. Assessment inputs are described in the following subsections.

Dispersion Model(s)

7.5. ADMS-Roads dispersion model (version 5.0.1.0). 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.

7.6. **ADMS-5 (v5.2)** developed by CERC. ADMS-5 is a short-range dispersion modelling software package that simulates a wide range of buoyant and passive releases to atmosphere. It is a new generation model utilising boundary layer height and Monin-Obukhov length to describe the atmospheric boundary layer and a skewed Gaussian concentration distribution to calculate dispersion under convective conditions. The model utilises hourly meteorological data to define conditions for plume rise, transport and diffusion. It estimates the concentration for each source and receptor combination for each hour of input meteorology, and calculates user-selected long-term and short-term averages.

Assessment Area

7.7. Ambient concentrations were predicted over the area NGR: 518940, 168800 and 519460, 169320. One Cartesian grid at heights of 1.5m and 4.5m were used within the model to represent concentrations floor levels level to produce data suitable for contour plotting using the Surfer software package.

7.8. Reference should be made to Figure 7.6 within Appendix 7.1 for a graphical representation of the assessment grid extents.

ADMS Roads - Traffic Flow Data

7.9. Traffic data for use in the assessment, including development flows, was provided by Markides Associates the appointed Transport Consultants for the Environmental Impact Assessment (EIA).

7.10. Growth factors provided by the Trip End Model Presentation Program (TEMPRO) software package were utilised to allow for conversion from the obtained 2018 traffic flow year to 2039, which was used to represent the base year and opening year scenarios.

7.11. Road widths were estimated from aerial photography and UK highway design standards. Reference should be made to Figure 7.6 within Appendix 7.1 for a graphical representation of the road link locations. A summary of the traffic data used in the verification scenarios is provided in Table 7.1

Table 7.1 2018 Verification Traffic Data

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
1	Cambridge Road South	10.1	16,065	11.00	25
2	Cambridge Road North	10.1	16,364	8.00	25
3	Cambridge Road Slowdown	8.6	16,364	8.00	10
4	Cambridge Road West of Site Slowdown	12.5	19,423	9.00	10
5	Cambridge Road West of Site	8.0	19,423	9.00	25
6	Cambridge Road Slowdown at London Road	11.4	19,423	9.00	10

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
7	Cambridge Road Approach onto Hawks Road	4.3	7,059	7.00	15
8	Hawks Road Slowdown onto Cambridge Road	13.4	7,059	7.00	10
9	Hawks Road	6.8	14,117	7.00	25
10	Fairfield South	6.8	6,969	9.00	25
11	Orchard Road Slowdown	5.3	3,485	9.00	10
12	A307 Approach onto Orchard Road	6.0	3,485	9.00	10
13	London Road Approach onto Cambridge Road	9.4	19,423	9.00	10
14	London Road	15.1	18,535	7.00	30
15	London Road Slowdown at Birkenhead Avenue	13.4	18,535	7.00	10
16	London Road	8.8	18,535	7.00	20
17	London Road North of Coombe Road	7.9	18,535	7.00	20
18	London Road Slowdown at Roundabout	7.5	18,535	7.00	10
19	Kingston Hill Slowdown	8.7	18,535	7.00	10
20	Kingstone Hill	7.8	18,535	7.00	20
21	Kingstone Hill Roundabout	7.4	13,197	6.66	20
22	Coombe Road Slowdown	9.3	15,808	4.52	10
23	Coombe Road	7.7	15,808	4.52	30
24	Junction at Cambridge Road	6.4	18,535	7.00	15
25	London Road West of Cambridge Road, Slowdown	8.5	22,226	11.00	10
26	London Road West of Cambridge Road	10.3	22,226	11.00	30
27	London Road Slowdown at Fairfield North	9.2	11,113	11.00	10
28	Fairfield North	10.1	31,024	13.83	30
29	Fairfield North Slowdown	9.0	15,512	13.83	10
30	Clarence Street Approach onto Fairfield North	9.1	15,512	13.83	10
31	Wheatfield Way	13.0	36,315	3.29	25

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
32	Wheatfield Way Southbound	6.3	18,091	2.93	25
33	Wheatfield Way Northbound	6.1	18,212	3.57	25
34	Wheatfield Way at Fairfield North	10.0	35,831	1.98	10
35	Wheatfield Way Southbound Slowdown at Orchard Road	5.9	18,091	2.93	10
36	Wheatfield Way Southbound South of Orchard Road	8.6	18,020	2.55	25
37	Clarence Street Slowdown at Fairfield North	10.0	30,174	6.88	10
38	Clarence Street	9.0	30,659	8.35	30
39	Clarence Street Slowdown at Richmond Road	10.1	30,659	8.35	10
40	Clarence Street onto Richmond Road	6.9	30,305	7.28	10
41	Clarence Street	8.8	29,391	4.40	30
42	Clarence Street Eastbound Approach onto Sopwith Way	5.7	12,176	7.52	15
43	Sopwith Way	10.8	34,122	5.21	25
44	Sopwith Way East of Kingsgate Road	9.3	18,294	5.89	15
45	Richmind Road	7.7	31,740	5.90	15
46	Cromwell Road	9.2	35,103	9.77	25
47	Cromwell Road Slowdown	9.8	34,514	8.22	10
48	Cromwell road South of Queen Elizabeth Road	8.2	11,499	8.19	25
49	Cromwell Road Slowdown onto London Road	3.4	14,816	11.00	10
50	Fairfield North Approach onto Cromwell Road	7.0	22,978	4.09	15
51	Kingsgate Road North of Sopwith Way	5.7	10,240	4.34	30
52	Kingsgate Road North of Sopwith Way Slowdown	8.9	10,240	4.34	10
53	Richmond Road Between Kingsgate Road and Sopwith Way	7.5	14,036	6.73	30
54	Richmond Road North of Kingsgate Road	9.0	28,438	4.64	25
55	Richmond Road Slowdown at Sury Basin	10.1	28,438	4.64	10
56	Richmond Road North of Sury Basin	15.2	28,438	4.64	30
57	Richmond Road Slowdown South of King's Road	12.8	28,438	4.64	10

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
58	Richmond Road Slowdown North of King's Road	9.3	28,438	4.64	10
59	Richmond Road North of King's Road	6.6	28,438	4.64	30
60	Clarence Street Westbound	8.9	12,176	7.52	30
61	Clarence Street Westbound at Kingsgate Road	9.2	25,387	5.67	30
62	Clarence Street Westbound West of Kingsgate Road	6.1	25,387	5.67	30
63	Clarence Street Eastbound West of Kingsgate Road	9.1	25,388	5.67	30
64	Clarence Street Eastbound Approach onto Kingsgate Road	8.7	25,388	5.67	10
65	Wheatfield Way Southbound Slowdown onto Kingston Hall Road Roundabout	6.7	18,692	6.05	10
66	Kingston Hall Road Exit onto Penrhyn Road Southbound	6.4	7,572	12.55	25
67	Penrhyn Road Southbound	5.8	7,467	11.32	30
68	Penrhyn Road Northbound	6.2	7,467	11.32	30
69	Penrhyn Road Northbound Slowdown onto Kingston Hall Road Roundabout	9.0	7,467	11.32	10
70	Kingston Hall Road Exit onto Clarence Road Westbound	8.0	18,693	6.06	25
71	Kingston Hall Road Roundabout	10.5	29,675	4.97	25
72	Penrhyn Road Slowdown	12.0	14,934	11.32	10
73	Penrhyn Road	6.0	14,934	11.32	25
74	Gloucester Road Slowdown	9.6	6,668	10.00	10
75	Gloucester Road	8.1	6,668	10.00	25
76	South Lane West Slowdown	10.5	8,617	4.26	10
77	South Lane West	7.6	10,305	4.35	25
78	Villiers Road Slowdown	8.5	12011	8.00	10
79	Villiers Road	10.8	12011	8.00	30

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
80	King's Road Slowdown	7.1	3,854	3.20	10
81	King's Road	7.4	3,854	3.20	25
82	St Peter's Road	5.3	351	4.00	25
83	Washington Road	5.6	1148	11.00	25
84	Burritt Road	5.9	910	7.00	25
85	Vincent Road	6.7	471	7.00	25
86	Cambridge Grove Road	5.5	119	19.00	25
87	Willingham Way	5.4	498	13.00	25

7.12. A summary of the 2039 traffic data used for the proposed site operational phase scenarios is shown in Table 7.2. The road width and mean vehicle speed remained the same for the DM and DS scenarios.

Table 7.2 2027 Traffic Data

Road Link		2027 DM 1		2027 DS 2	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
1	Cambridge Road South	19,449	11.00	19,856	11.00
2	Cambridge Road North	19,702	8.00	20,194	8.00
3	Cambridge Road Slowdown	19,702	8.00	20,194	8.00
4	Cambridge Road West of Site Slowdown	23,386	9.00	23,757	9.00
5	Cambridge Road West of Site	23,386	9.00	23,757	9.00
6	Cambridge Road Slowdown at London Road	23,386	9.00	23,757	9.00
7	Cambridge Road Approach onto Hawks Road	8,552	7.00	8,613	7.00
8	Hawks Road Slowdown onto Cambridge Road	8,552	7.00	8,613	7.00

Road Link		2027 DM 1		2027 DS 2	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
9	Hawks Road	17,103	7.00	17,225	7.00
10	Fairfield South	8,497	9.00	8,619	9.00
11	Orchard Road Slowdown	4,249	9.00	4,310	9.00
12	A307 Approach onto Orchard Road	4,249	9.00	4,310	9.00
13	London Road Approach onto Cambridge Road	23,386	9.00	23,757	9.00
14	London Road	22,317	7.00	22,542	7.00
15	London Road Slowdown at Birkenhead Avenue	22,317	7.00	22,542	7.00
16	London Road	22,317	7.00	22,542	7.00
17	London Road North of Coombe Road	22,317	7.00	22,542	7.00
18	London Road Slowdown at Roundabout	22,317	7.00	22,542	7.00
19	Kingston Hill Slowdown	22,317	7.00	22,542	7.00
20	Kingstone Hill	22,317	7.00	22,542	7.00
21	Kingstone Hill Roundabout	15,889	6.66	15,889	6.66
22	Coombe Road Slowdown	19,033	4.52	19,033	4.52
23	Coombe Road	19,033	4.52	19,033	4.52
24	Junction at Cambridge Road	22,317	7.00	22,542	7.00
25	London Road West of Cambridge Road, Slowdown	26,760	11.00	27,026	11.00
26	London Road West of Cambridge Road	26,760	11.00	27,026	11.00
27	London Road Slowdown at Fairfield North	26,760	11.00	27,026	11.00
28	Fairfield North	37,352	13.83	37,352	13.83
29	Fairfield North Slowdown	18,676	13.83	18,676	13.83
30	Clarence Street Approach onto Fairfield North	18,676	13.83	18,676	13.83
31	Wheatfield Way	43,724	3.29	43,724	3.29
32	Wheatfield Way Southbound	21,781	2.93	21,781	2.93
33	Wheatfield Way Northbound	21,927	3.57	21,927	3.57
34	Wheatfield Way at Fairfield North	43,141	1.98	43,141	1.98

Road Link		2027 DM 1		2027 DS 2	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
35	Wheatfield Way Southbound Slowdown at Orchard Road	21,781	2.93	21,781	2.93
36	Wheatfield Way Southbound South of Orchard Road	21,696	2.55	21,696	2.55
37	Clarence Street Slowdown at Fairfield North	36,329	6.88	36,329	6.88
38	Clarence Street	36,913	8.35	36,913	8.35
39	Clarence Street Slowdown at Richmond Road	36,913	8.35	36,913	8.35
40	Clarence Street onto Richmond Road	36,487	7.28	36,487	7.28
41	Clarence Street	35,387	4.40	35,387	4.40
42	Clarence Street Eastbound Approach onto Sopwith Way	14,659	7.52	14,659	7.52
43	Sopwith Way	41,083	5.21	41,083	5.21
44	Sopwith Way East of Kingsgate Road	22,027	5.89	22,027	5.89
45	Richmind Road	38,215	5.90	38,215	5.90
46	Cromwell Road	42,265	9.77	42,265	9.77
47	Cromwell Road Slowdown	41,555	8.22	41,555	8.22
48	Cromwell road South of Queen Elizabeth Road	13,845	8.19	13,845	8.19
49	Cromwell Road Slowdown onto London Road	26,760	11.00	26,760	11.00
50	Fairfield North Approach onto Cromwell Road	27,665	4.09	27,665	4.09
51	Kingsgate Road North of Sopwith Way	12,329	4.34	12,329	4.34
52	Kingsgate Road North of Sopwith Way Slowdown	12,329	4.34	12,329	4.34
53	Richmond Road Between Kingsgate Road and Sopwith Way	16,900	6.73	16,900	6.73
54	Richmond Road North of Kingsgate Road	34,239	4.64	34,239	4.64
55	Richmond Road Slowdown at Sury Basin	34,239	4.64	34,239	4.64
56	Richmond Road North of Sury Basin	34,239	4.64	34,239	4.64

Road Link		2027 DM 1		2027 DS 2	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
57	Richmond Road Slowdown South of King's Road	34,239	4.64	34,239	4.64
58	Richmond Road Slowdown North of King's Road	34,239	4.64	34,239	4.64
59	Richmond Road North of King's Road	34,239	4.64	34,239	4.64
60	Clarence Street Westbound	14,659	7.52	14,659	7.52
61	Clarence Street Westbound at Kingsgate Road	30,566	5.67	30,566	5.67
62	Clarence Street Westbound West of Kingsgate Road	30,566	5.67	30,566	5.67
63	Clarence Street Eastbound West of Kingsgate Road	30,567	5.67	30,567	5.67
64	Clarence Street Eastbound Approach onto Kingsgate Road	30,567	5.67	30,567	5.67
65	Wheatfield Way Southbound Slowdown onto Kingston Hall Road Roundabout	22,505	6.05	22,505	6.05
66	Kingston Hall Road Exit onto Penrhyn Road Southbound	9,117	12.55	9,117	12.55
67	Penrhyn Road Southbound	8,990	11.32	8,990	11.32
68	Penrhyn Road Northbound	8,990	11.32	8,990	11.32
69	Penrhyn Road Northbound Slowdown onto Kingston Hall Road Roundabout	8,990	11.32	8,990	11.32
70	Kingston Hall Road Exit onto Clarence Road Westbound	22,506	6.06	22,506	6.06
71	Kingston Hall Road Roundabout	35,728	4.97	35,728	4.97
72	Penrhyn Road Slowdown	17,981	11.32	17,981	11.32
73	Penrhyn Road	17,981	11.32	17,981	11.32
74	Gloucester Road Slowdown	8,029	10.00	8,155	9.85
75	Gloucester Road	8,029	10.00	8,155	9.85
76	South Lane West Slowdown	10,375	4.26	10,375	4.26
77	South Lane West	12,407	4.35	12,407	4.35
78	Villiers Road Slowdown	14461	8.00	14,461	8.00

Road Link		2027 DM 1		2027 DS 2	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
79	Villiers Road	14461	8.00	14,461	8.00
80	King's Road Slowdown	4641	3.20	4,641	3.20
81	King's Road	4641	3.20	4,641	3.20
82	St Peter's Road	529	4.00	529	4.00
83	Washington Road	1382	11.00	1,509	11.00
84	Burritt Road	1095	7.00	1,236	7.00
85	Vincent Road	568	7.00	683	7.00
86	Cambridge Grove Road	143	19.00	143	19.00
87	Willingham Way	599	13.00	599	13.00

Emission Factors

7.13. Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 9.0) released in May 2019, which incorporates updated COPERT 5 vehicle emissions factors for NOx and PM and EURO 6 vehicle fleet sub-categories.

7.14. There is current uncertainty over NO_2 concentrations within the UK, with roadside levels not reducing as previously expected due to the implementation of new vehicle emission standards. Therefore, 2018 emission factors have been utilised for the prediction of pollution levels for all scenarios in preference to the development opening year in order to provide a robust assessment.

ADMS 5 – Process Conditions Data

7.15. A central Energy Centre at the base of Block E is proposed for the development. It has been estimated (refer to Energy Statement submitted in-conjunction with this ES) that 6.8 Mega Watts (MW) of gas boilers capacity will be required to produce the required heat for the development. This will be predominantly for the dwellings and potentially for the commercial units.

7.16. To model the 6.8 MW gas boilers a series of modular gas boilers has been considered,

typical of boiler Wessex ModuMax mk3 floor1 standing boiler. 8 No. MK3 762V boiler modules have been modelled with emission from 2 No. Multi flues with 4 Boiler Sources on each stack.

7.17. Reference should be made to Table 7.3 for dispersion modelling inputs. It should be noted that the process conditions shown are per flue (8 No.).

Table 7. 3 Process Conditions

Condition	Unit	Boiler
Stack location	NGR	519089.8, 169025.4
Stack diameter	m	0.25
Stack height	m	40.23
Flue gas volumetric flow rate	m^3/s	0.295
Flue gas efflux velocity	m/s	6.01
Temperature	°C	82.0
Mass emission rate	gNOx/s	0.009

7.18. Reference should be made to Figure 13 within Appendix I for a graphical representation of the stack locations.

Meteorological Data

7.19. Meteorological data used in this assessment was taken from Heathrow Airport meteorological station over the period 1st January 2018 to 31st December 2018 (inclusive). Heathrow Airport meteorological station is located at approximate NGR: 507060, 176500 which is approximately 13km north-west of the Site and is therefore considered to provide a reasonable representation of conditions at the Site.

7.20. 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 I for a wind rose of utilised meteorological data.

[1] https://www.hamworthy-heating.com/Products/Commercial-boilers/Wessex-ModuMax-mk3-boiler

Roughness Length

7.21. The specific roughness length (z_0) values used to represent conditions during the verification process, DS scenario, as well as conditions at the Heathrow Airport meteorological station are summarised in Table 7.4.

Table 7.4 Utilised Roughness Lengths

Scenario	Roughness Length (m)	ADMS Description
Verification, Operational phase (DS scenarios) and Meteorological Station	0.5	Parkland and Suburbia

7.22. These values of z0 are considered appropriate for the morphology of the assessment area.

Monin-Obukhov Length

7.23. 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, DS scenario, as well as conditions at the Heathrow Airport meteorological station are summarised in Table 7.5.

Table 7.5 Utilised Monin-Obukhov Lengths

Scenario	Monin-Obukhov Length (m)	ADMS Description
Verification and Operational phase (DS scenarios) and Meteorological Station	30	Cities and Large Towns

7.24. This Monin-Obukhov value is considered appropriate for the morphology of both assessment areas.

Background Concentrations

7.25. An annual mean NO_2 concentration of 31.42 µg/m^3 and PM_{10} concentration of 16.81µg/m^3, as predicted by DEFRA, was used in the dispersion modelling assessment to represent annual mean pollutant levels in the vicinity of the site.

7.26. Since both the monitoring locations used in the verification process and the receptor locations used in the operational phase assessment were located in several grid squares, predicted concentrations from their respective grid squares were used to represent their respective background concentrations for the modelling process.

7.27. Table 7.6 displays the specific background concentrations by DEFRA used for each diffusion tube in the verification process. This data was used in to ensure an accurate and robust model.

Table 7.6 Predicted Diffusion Tube Monitoring Background Pollutant Concentrations

Tube Grid Square	Diffusion Tubes	Pollutant	Predicted Background Concentration (µg/m^3)
			2018
518500, 169500	KT5, 25	NO_x	37.75
		NO_2	24.87
518500, 168500	2	NO_x	30.84
		NO_2	21.10
518500, 170500	26	NO_x	30.28
		NO_2	20.76
519500, 169500	28, 39, 40	NO_x	32.94
		NO_2	22.27
520500, 169500	36	NO_x	29.13
		NO_2	20.13
520500, 168500	38	NO_x	29.97
		NO_2	20.64

7.28. Table 7.7 displays the predicted background concentrations by DEFRA used in the operational phase assessment for the sensitive receptor locations.

Table 7.7 Predicted Background Pollutant Concentrations for Receptors

Receptor Grid Square	Receptors	Pollutant	Predicted Background Concentration (µg/m^3)
			2018
520500, 168500	R1 – R3, R5	NO_x	29.98
		NO_2	20.64
		PM_{10}	17.16
		$PM_{2.5}$	11.76
519500, 168500	R4, R6 – R9	NO_x	29.90
		NO_2	20.54
		PM_{10}	16.41
		$PM_{2.5}$	11.24
519500, 169500	R10, R13 – R15	NO_x	32.94
		NO_2	22.27
		PM_{10}	17.20
		$PM_{2.5}$	11.65
518500, 169500	R11, R17 – R26	NO_x	37.75
		NO_2	24.87
		PM_{10}	17.78
		$PM_{2.5}$	11.93
519500, 170500	R12, R16	NO_x	29.07
		NO_2	20.08
		PM_{10}	16.52
		$PM_{2.5}$	11.25

7.29. Background concentrations for 2018 were utilised in preference to the development future year 2039. This provided a robust assessment and is likely to overestimate actual pollutant concentrations during the operation of the proposals.

NO_x to NO_2 Conversion

7.30. The recommended methodology to model NO_2 concentrations from NOx stack emissions (taking into account background concentrations) has been considered in line with TG-16. As the stacks are included within models representing wider urban areas with a large number of emissions sources, the predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2 concentrations using the spreadsheet provided by DEFRA, which is the method detailed within LAQM (TG16)**Error!**

Bookmark not defined..

7.31. For Short-term (1-Hour) NO_x to NO_2 conversion from the energy centre Environment Agency guidance has been followed where is has been assumed that 50 % of emissions of oxides of nitrogen convert to nitrogen dioxide in the environment.

Verification

7.32. 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.

7.33. 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.

7.34. For the purpose of this assessment model verification was undertaken for 2018, using traffic data, meteorological data and monitoring results from this year.

7.35. RBKuT undertakes monitoring of NO_2 concentrations at nine locations suitable for verification purposes. The road contribution to total NOx concentration was calculated from the monitored NO_2 result for use in the verification process. This was undertaken following the methodology contained within IAQM and EPUK guidance LAQM (TG16)2.

7.36. Monitoring location 24 was removed from the verification process given significant underpredictions during the process, which lead to an over-adjustment of modelling at roadside sites. It was clear that localised conditions where contributing to inaccuracies beyond the 25% threshold between modelled and monitored NOx specified within LAQM TG(16)**Error! Bookmark not defined.**. It was therefore considered appropriate to eject monitoring location 24 from the process to improve the overall accuracy of the verification process.

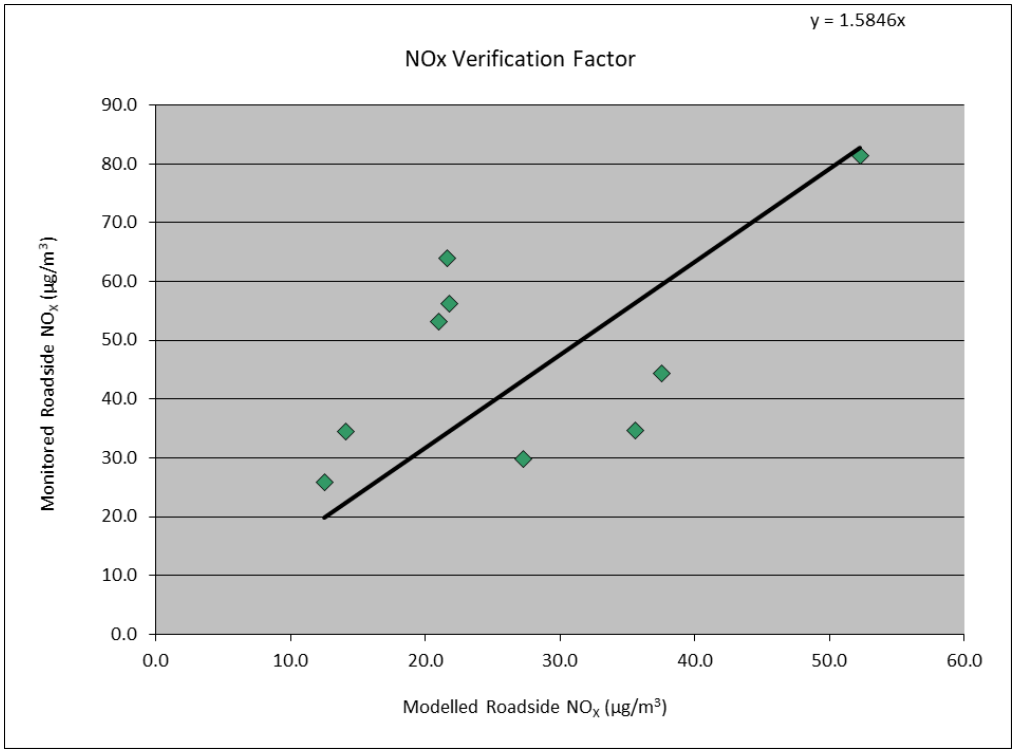
7.37. Following the above considerations, the dispersion model was run with the traffic input data previously detailed for 2018 to predict the NOx concentration at the monitoring locations. and are shown in Table 7.8.

Table 7.8 NO_x Verification Results

ID	Monitoring Location	Modelled Road NO_x Concentration ($\mu g/m^3$)	Monitored Road NO_x Concentration ($\mu g/m^3$)	Difference (%)
KT5	Cromwell Road	52.27	81.32	35.73%
2	17-19 Penrhyn Road	20.98	53.13	60.51%
25	Queen Elizabeth Rd/London Rd	35.60	34.62	-2.82%
26	Richmond Road / Kings Road	27.25	29.88	8.79%
28	41 Kingston Hill	21.63	64.03	66.21%
36	38 Coombe Lane West near A3 junction	12.51	25.94	51.77%
38	Kingston Road (Carpet Right)	14.11	34.54	59.15%
39	Cambridge Rd/Gloucester Rd	21.79	56.28	61.29%
40	Cambridge Rd/Hawks Rd	37.54	44.40	15.45%

7.38. The monitored and modelled NOx 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 1 This indicated that a verification factor of **1.5846** was required to be applied to all NO_x modelling results. This verification factor shows that the model underestimated pollutant concentrations

Graph 1 – Verification Factor



7.39. Table 7.9 presents the monitored annual mean NO_2 concentrations and the adjusted modelled total NO_2 concentration based on the above verification factor. Exceedances of the annual mean AQO for NO_2 are shown in bold.

Table 7.9 2018 NO_2 Monitoring Results

ID	Monitoring Location	Monitored NO_2 Concentration ($\mu g/m^3$)	Adjusted Modelled Total NO_2 Concentration ($\mu g/m^3$)	Difference (%)
KT5	Cromwell Road	57.00	57.49	-0.86%
2	17-19 Penrhyn Road	44.00	36.11	17.92%
25	Queen Elizabeth Rd/London Rd	40.00	48.38	-20.96%
26	Richmond Road/Kings Road	34.70	40.16	-15.73%
28	41 Kingston Hill	49.60	38.25	22.89%
36	38 Coombe Lane West near A3 junction	32.20	29.48	8.44%
38	Kingston Road (Carpet Right)	36.10	30.86	14.52%
39	Cambridge Rd/Gloucester Rd	46.80	38.35	18.06%
40	Cambridge Rd/Hawks Rd	42.30	47.97	-13.40%

7.40. In all cases the percentage difference between modelled and monitored NO_2 concentrations is well below the referenced 25% accuracy threshold.

7.41. RBuKT also undertakes monitoring of annual mean PM10 concentrations at one monitoring location within the assessment extents, it was therefore possible to provide a separate PM10 verification factor. The results are shown in in Table 7.10.

Table 7.10 PM_{10} Verification Results

Site ID	Monitoring Location	Monitored PM_{10} Concentration ($\mu g/m^3$)	Unadjusted Modelled Total PM_{10} Concentration ($\mu g/m^3$)	Adjusted Modelled Total PM_{10} Concentration ($\mu g/m^3$)	Difference (%)
KT5	Cromwell Road	30.00	2.51	12.22	32.37

7.42. The monitored and modelled roadside concentrations were compared to calculate the associated ratio. This indicated a verification factor of **1.4787** was required to be applied to all PM_{10} modelling results.

7.43. As $PM_{2.5}$ monitoring is not undertaken within the assessment extents at suitable

locations, the PM_{10} adjustment factor of **1.4787** was applied to the respective location to adjust model predictions of $PM_{2.5}$ in accordance with the guidance provided within LAQM (TG16)2.

ADMS 5 - Building Effects

7.44. Analysis of the site layout indicated that a number of structures should be included within the model in order to take account of effects on pollutant dispersion. It should be noted that committed developments within in the vicinity of the site have been included within the model where relevant. Building input geometries are shown in Table 7.11.

Table 7.11 Building Geometries

Building	NGR (m)		Height (m)	Length (m)	Width (m)	Angle (°)
	X	Y				
E1	519083.3	169025.4	38.2	29.5	17.7	177.5
E2	519125.5	169026.6	38.5	27.1	17.6	179.9
E3	519125.5	168986.2	35.1	27.5	17.7	179.9
E4	519083.1	168987.2	26.2	27.6	17.4	182.0
E5	519104.2	169033.7	14.0	10.3	16.5	181.0
E6	519104.1	168978.8	13.8	9.5	15.8	179.9
D3	519123.5	169071.6	42.8	26.7	17.8	179.8
D4	519083.0	169073.4	32.6	28.2	17.7	185.2
H1	519167.3	169025.3	49.9	27.5	17.9	178.1
H4	519170.5	168988.9	36.3	28.2	17.5	173.1
F1	519138.8	168938.9	40.1	29.5	17.9	173.3

7.45. Reference should be made to Figure 11 within Appendix I for a graphical representation of the modelled building locations.