

Appendix 10.2

ADMS-Roads Assessment Inputs

ADMS-Roads Assessment Inputs

1.1 The proposed development has the potential to impact on air quality at existing sensitive receptor locations. Dispersion modelling using ADMS-Roads was therefore undertaken to predict NO₂, PM₁₀ and PM_{2.5} concentrations at sensitive locations both with and without the development in order to consider potential changes as a result of the proposals.

1.2 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.

1.3 Assessment inputs are described in the following subsections.

Dispersion Modelling

1.4 Dispersion modelling was undertaken using the ADMS Roads dispersion model (version 4.0.1.0). 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.

Assessment Area

1.5 Ambient concentrations were predicted over the proposed development site and surrounding highway network. One Cartesian grid was included in the model over the area NGR: 471230, 173890 to 471520, 174180 at the following heights

- 1.5m – Ground Floor
- 4.5m – First Floor Town House
- 6.5m – First Floor Apartments Southern Side
- 9.5m – Second Floor Apartments Southern Side
- 12.5m Third Floor Apartments Southern Side

1.6 Results were subsequently used to produce contour plots within the Surfer software package.

Traffic Flow Data

- 1.7 For this assessment, traffic data was not available therefore 24-hour Annual Average Daily Traffic (AADT) flows and fleet composition as HDV proportion, was provided by Peter Brett Associates, the appointed Transport Consultant for the project for the baseline year (2017), and the future year 2025 with and without the development in place. Additional data was downloaded from the Department for Transport (DfT) Matrix. This 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 2017. It should be noted that the DfT matrix is referenced in DEFRA guidance LAQM (TG16) 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.
- 1.8 Road widths were estimated from aerial photography and UK highway design standards. Reference should be made to Figure 10 within Appendix 10.1 for a graphical representation of the road link locations. A summary of the traffic data used in the verification scenarios is provided in Table 1.

Table 1: 2017 Verification Traffic Data

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Vehicle Speed (km/h)
L1	Roundabout Caversham/Vastern Road	10.5	28,240	6	32
L2	Caversham Road Northbound (Adjacent Site) Slowdown	10.2	16,568	6	16
L3	Caversham Road Northbound	6.5	16,568	6	48
L4	Caversham Road Tunnel (under railway)	13.7	32,280	6	48
L5	Caversham Road Northbound (South of Site)	6.8	16,568	6	48
L6	Caversham Road Northbound Traffic Lights	6.8	16,568	6	16
L7	Speed up onto Caversham Road Northbound	6.2	3,314	6	40
L8	Caversham Road/Chatham Street Roundabout	6.8	10,238	3	32
L9	Caversham Road Northbound	6.5	3,314	6	16

	Roundabout Slowdown				
L10	Caversham Road Under Roundabout Northbound (elevation change)	7.8	13,254	6	40
L11	Caversham Road Northbound (Adjacent Site)	7.3	16,568	6	64
L12	Caversham Road Speed up (North of Site)	7.7	15,712	5	32
L13	Caversham Road Southbound (Adjacent Site)	6.1	15,712	5	48
L14	Caversham Road Southbound (South of Site)	6.4	15,712	5	48
L15	Caversham Road Traffic Lights	6.0	15,712	5	24
L16	Caversham Road Under Roundabout Southbound (elevation change)	7.4	12,570	5	64
L17	Caversham road Southbound	7.7	15,712	5	64
L18	Slow down onto Caversham Roundabout	5.8	3,142	2	48
L19	Speed up onto Caversham Road Southbound	8.1	3,142	2	48
L20	Slowdown Vastern Road/Caversham Road Roundabout	10.8	11,857	6	16
L21	Vastern Road Westbound	6.5	11,857	6	32
L22	Vastern Road Westbound Traffic Lights	6.8	11,857	6	24
L23	Speed Up off Vastern Road/ Roundabout	6.3	11,857	6	32
L24	Vestern Road/George Street Roundabout	10.1	11,768	4	40
L25	Vastern Road Speed up	7.7	13,074	5	32

L26	Vastern Road Eastbound	4.9	13,074	5	48
L27	Vastern Road Eastbound Traffic lights	5.9	13,074	5	24
L28	Vastern Road Eastbound	5.7	13,074	5	40
L29	Vastern Road/George Road Roundabout Slowdown	9.3	13,074	5	16
L30	Slowdown Vastern Road Northbound	11.7	10,462	2	16
L31	Vastern Road Northbound	11.1	10,462	2	40
L32	Speed up Vastern Road Northbound	13.3	10,462	2	24
L33	Roundabout A329	11.2	10,462	2	40
L34	Vastern road south Speed up	8.9	10,462	2	24
L35	Vastern road Southbound	11.1	10,462	2	40
L36	Vastern Road South Slowdown	11.9	10,462	2	16
L37	Speed up Forbury Road East	9.5	10,462	2	24
L38	Forbury Road East	6.8	10,462	2	40
L39	Forbury Road East Traffic Light	6.8	10,462	2	40
L40	Forbury Road/ Roundabout Slowdown	8.7	10,462	2	16
L41	Forbury Road slowdown Westbound	7.7	10,462	2	16
L42	Forbury Road Westbound	7.0	10,462	2	40
L43	Forbury Road Westbound Traffic Lights	7.7	10,462	2	40
L44	Forbury Road Speed up Westbound	8.2	10,462	2	32
L45	Forbury Road Roundabout	10.9	10,577	2	32
L46	Troopers Potts Way	6.7	1,967	7	32
L47	Troopers Potts Way Slowdown	7.6	1,967	7	16

L48	Caversham Road Roundabout Speed up (North of Site)	7.8	13,936	3	32
L49	Caversham road Northbound (North of Site)	5.5	13,936	3	48
L50	Caversham Road Northbound Traffic Light	5.2	13,936	3	40
L51	Caversham Road Northbound	5.1	13,936	3	48
L52	Caversham road/Caversham Bridge Street Roundabout Slowdown	8.3	13,936	3	24
L53	Caversham road southbound Slowdown (North of site)	9.9	13,936	3	16
L54	Caversham Road Southbound (North of Site)	5.4	13,936	3	48
L55	Caversham Road Southbound Traffic Lights	5.4	13,936	3	24
L56	Caversham Road Southbound	5.2	13,936	3	48
L57	Caversham Road Southbound Speed up (North of Site)	8.2	13,936	3	40
L58	Caversham road/Caversham Bridge Street Roundabout	11.1	13,936	3	40
L59	Caversham Bridge Northbound Speed up	5.7	13,936	3	40
L60	Caversham Bridge Northbound	4.8	13,936	3	48
L61	Caversham road/Church Street Junction Slow down	7.2	13,936	3	16
L62	Caversham Bridge Southbound slowdown	7.4	13,936	3	24
L63	Caversham Bridge Southbound	4.7	13,936	3	48
L64	Caversham Bridge Southbound Speedup	6.3	13,936	3	40

L65	Chatham Street East Slowdown	10.4	8,901	3	16
L66	Chatham Street East	4.8	8,901	3	64
L67	Chatham Street East Traffic Lights	16.5	8,901	3	24
L68	Chatham Street East	7.7	8,901	3	64
L69	Chatham Street East Speedup	12.0	8,901	3	32
L70	Chatham Street Roundabout	4.0	8,901	3	40
L71	Chatham Street/ Caversham Road Roundabout Speed up	4.1	8,901	3	24
L72	Chatham Street West	4.2	8,901	3	32
L73	Chatham Street West Traffic Lights	5.0	8,901	3	24
L74	Chatham Street West	4.0	8,901	3	32
L75	Chatham Street West Slowdown	4.0	8,901	3	16
L76	Chatham road R Roundabout /Traffic lights	5.5	8,901	3	24
L77	Oxford Road East Speed up	6.5	6,861	4	32
L78	Oxford Road	9.3	13,721	4	48
L79	Oxford Road West Slowdown	5.7	6,861	4	32
L80	Chatham Road Roundabout Slow down	6.5	6,861	4	16
L81	Forbury road North/Roundabout slowdown	10.4	10,691	2	16
L82	Forbury road North	7.6	10,691	2	48
L83	Forbury Road/ Watlington Street	5.9	10,691	2	48
L84	Watlington Street/ Queens Road	7.5	10,691	2	48
L85	Forbury Road Speed up	8.0	10,691	2	32
L86	Forbury Road	7.3	10,691	2	32

L87	Forbury Road/ Watlington Street Speed up	5.5	10,691	2	16
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1.9 The road width and mean vehicle speeds shown in Table All.1 remained the same for the 2025 DM and DS scenarios. Due to

1.10 A summary of the 2025 traffic data are shown in Table 2.

Table 2: 2025 Traffic Data

Road Link		DM		DS	
		24-hour AADT Flow	HDV Prop. (%)	24-hour AADT Flow	HDV Prop. (%)
L1	Roundabout Caversham/Vastern Road	32,676	5	32,926	5
L2	Caversham Road Northbound (Adjacent Site) Slowdown	18,616	6	18,759	6
L3	Caversham Road Northbound	18,616	6	18,759	6
L4	Caversham Road Tunnel (under railway)	39,063	6	39,349	6
L5	Caversham Road Northbound (South of Site)	18,616	6	18,759	6
L6	Caversham Road Northbound Traffic Lights	18,616	6	18,759	6
L7	Speed up onto Caversham Road Northbound	3,723	6	3,752	6
L8	Caversham Road/Chatham Street Roundabout	11,317	4	11,361	4
L9	Caversham Road Northbound Roundabout Slowdown	3,723	6	3,752	6
L10	Caversham Road Under Roundabout Northbound (elevation change)	14,893	6	15,007	9

L11	Caversham Road Northbound (Adjacent Site)	18,616	6	18,759	6
L12	Caversham Road Speed up (North of Site)	20,447	5	20,590	5
L13	Caversham Road Southbound (Adjacent Site)	20,447	5	20,590	5
L14	Caversham Road Southbound (South of Site)	20,447	5	20,590	5
L15	Caversham Road Traffic Lights	20,447	5	20,590	5
L16	Caversham Road Under Roundabout Southbound (elevation change)	16,357	5	16,472	5
L17	Caversham road Southbound	20,447	5	20,590	5
L18	Slow down onto Caversham Roundabout	4,089	5	4,118	5
L19	Speed up onto Caversham Road Southbound	4,089	5	4,118	5
L20	Slowdown Vastern Road/Caversham Road Roundabout	16,021	6	16,200	6
L21	Vastern Road Westbound	16,021	6	16,200	6
L22	Vastern Road Westbound Traffic Lights	16,021	6	16,200	6
L23	Speed Up off Vastern Road/ Roundabout	16,021	6	16,200	6
L24	Vestern Road/George Street Roundabout	13,785	4	13,892	4
L25	Vastern Road Speed up	15,510	5	15,689	5
L26	Vastern Road Eastbound	15,510	5	15,689	5
L27	Vastern Road Eastbound Traffic lights	15,510	5	15,689	5

L28	Vastern Road Eastbound	15,510	5	15,689	5
L29	Vastern Road/George Road Roundabout Slowdown	15,510	5	15,689	5
L30	Slowdown Vastern Road Northbound	12,059	2	12,095	2
L31	Vastern Road Northbound	12,059	2	12,095	2
L32	Speed up Vastern Road Northbound	12,059	2	12,095	2
L33	Roundabout A329	12,059	2	12,095	2
L34	Vastern road south Speed up	12,059	2	12,095	2
L35	Vastern road Southbound	12,059	2	12,095	2
L36	Vastern Road South Slowdown	12,059	2	12,095	2
L37	Speed up Forbury Road East	12,059	2	12,095	2
L38	Forbury Road East	12,059	2	12,095	2
L39	Forbury Road East Traffic Light	12,059	2	12,095	2
L40	Forbury Road/ Roundabout Slowdown	12,059	2	12,095	2
L41	Forbury Road slowdown Westbound	12,059	2	12,095	2
L42	Forbury Road Westbound	12,059	2	12,095	2
L43	Forbury Road Westbound Traffic Lights	12,059	2	12,095	2
L44	Forbury Road Speed up Westbound	12,059	2	12,095	2
L45	Forbury Road Roundabout	12,020	2	12,055	2
L46	Troopers Potts Way	2,177	7	2,891	6
L47	Troopers Potts Way Slowdown	2,177	7	2,891	6
L48	Caversham Road Roundabout Speed up (North of Site)	14,377	3	14,430	3
L49	Caversham road Northbound (North	14,377	3	14,430	3

	of Site)				
L50	Caversham Road Northbound Traffic Light	14,377	3	14,430	3
L51	Caversham Road Northbound	14,377	3	14,430	3
L52	Caversham road/Caversham Bridge Street Roundabout Slowdown	14,377	3	14,430	3
L53	Caversham road southbound Slowdown (North of site)	14,377	3	14,430	3
L54	Caversham Road Southbound (North of Site)	14,377	3	14,430	3
L55	Caversham Road Southbound Traffic Lights	14,377	3	14,430	3
L56	Caversham Road Southbound	14,377	3	14,430	3
L57	Caversham Road Southbound Speed up (North of Site)	14,377	3	14,430	3
L58	Caversham road/Caversham Bridge Street Roundabout	14,377	3	14,430	3
L59	Caversham Bridge Northbound Speed up	14,377	3	14,430	3
L60	Caversham Bridge Northbound	14,377	3	14,430	3
L61	Caversham road/Church Street Junction Slow down	14,377	3	14,430	3
L62	Caversham Bridge Southbound slowdown	14,377	3	14,430	3
L63	Caversham Bridge Southbound	14,377	3	14,430	3
L64	Caversham Bridge Southbound Speedup	14,377	3	14,430	3
L65	Chatham Street East Slowdown	9,163	3	9,172	3
L66	Chatham Street East	9,163	3	9,172	3

L67	Chatham Street East Traffic Lights	9,163	3	9,172	3
L68	Chatham Street East	9,163	3	9,172	3
L69	Chatham Street East Speedup	9,163	3	9,172	3
L70	Chatham Street Roundabout	9,163	3	9,172	3
L71	Chatham Street/ Caversham Road Roundabout Speed up	9,163	3	9,172	3
L72	Chatham Street West	9,163	3	9,172	3
L73	Chatham Street West Traffic Lights	9,163	3	9,172	3
L74	Chatham Street West	9,163	3	9,172	3
L75	Chatham Street West Slowdown	9,163	3	9,172	3
L76	Chatham road R Roundabout /Traffic lights	9,163	3	9,172	3
L77	Oxford Road East Speed up	7,122	4	7,131	4
L78	Oxford Road	14,245	4	14,262	4
L79	Oxford Road West Slowdown	7,122	4	7,131	4
L80	Chatham Road Roundabout Slow down	7,122	4	7,131	4
L81	Forbury road North/Roundabout slowdown	11,980	2	12,016	2
L82	Forbury road North	11,980	2	12,016	2
L83	Forbury Road/ Watlington Street	11,980	2	12,016	2
L84	Watlington Street/ Queens Road	11,980	2	12,016	2
L85	Forbury Road Speed up	11,980	2	12,016	2
L86	Forbury Road	11,980	2	12,016	2
L87	Forbury Road/ Watlington Street Speed up	11,980	2	12,016	2

Street Canyon

- 1.11 Sections of Church Street (L67) are flanked by tall buildings on both sides of the highway and therefore potential street canyon effects were considered for the purpose of the dispersion modelling assessment. This allows the additional turbulent flow patterns occurring within a street with high structures on either side to be considered within the predicted concentrations. The average building height on each road were included in the model to provide robust assessment results.

Rail Flow data

- 1.12 A desk-top study was undertaken in order to identify the number of daily diesel locomotive movements along the railway line adjacent to the proposed development site. The data was sourced from the Realtime Trains website, which uses data provided by Network Rail to show rail timetables for specific rail networks.
- 1.13 There are current eight rail tracks situated within Reading Station. Each track has an estimated width of 4.5m based on aerial photography and the height of the track was measured to be 6m. It has been assumed that rail movements throughout the station will be split equally through the platforms, based on the current layout to the station. Figure 10.14 within Appendix 10.1 shows the modelled rail links used within the DM and DS scenario.
- 1.14 A summary of the locomotive details utilised within the assessment are shown in Table 3.

Table 3: Rail Traffic Data

Destination	Train Classification	Type of Locomotive	Weekly Movements		
			Weekday	Saturday	Sunday
Reading	Diesel Multiple Unit	Class 165/1 or 166	110	52	26
Newbury	Diesel Multiple Unit	Class 165/1 or 166	15	12	7
Acton TC	Diesel Locomotive	Class 66	4	1	0
Bedwyn	Diesel Multiple Unit	Class 165/1 or 166	16	9	6
Gatwick Airport	Diesel Multiple Unit	Class 165/1 or 166	17	0	0
Basingstoke	Diesel Multiple Unit	Class 165/1 or 166	35	37	6
Didcot Fuelling Point	Diesel Locomotive	Class 66	2	2	0
Moreton in Marsh	High Speed Train	HST125	1	2	0
Redhill	Diesel Multiple Unit	Class 165/1 or 166	15	0	0
Swansea	High Speed Train	HST125	15	9	0

Destination	Train Classification	Type of Locomotive	Weekly Movements		
			Weekday	Saturday	Sunday
Shalford	Diesel Multiple Unit	Class 165/1 or 166	3	0	0
Manchester Piccadilly	Diesel Multiple Unit	Class 220/221 (Voyager)	15	2	13
Worcester Forge Street	High Speed Train	HST125	5	1	0
Oxford	Diesel Multiple Unit	Class 165/1 or 166	17	3	0
London Paddington	High Speed Train	HST125	103	69	0
Newcastle	Diesel Multiple Unit	Class 220/221 (Voyager)	9	0	0
London Paddington	Diesel Multiple Unit	Class 165/1 or 166	18	12	6
Oxford	High Speed Train	HST125	6	15	0
Bristol Temple Meads	High Speed Train	HST125	18	6	0
Penzance	High Speed Train	HST125	6	2	0
Great Malvern	High Speed Train	HST125	4	4	0
Paignton	High Speed Train	HST125	3	1	0
Cardiff Central	High Speed Train	HST125	8	0	0
Bournemouth	Diesel Multiple Unit	Class 220/221 (Voyager)	14	6	0
Cheltenham Spa	High Speed Train	HST125	7	2	0
Guildford	Diesel Multiple Unit	Class 165/1 or 166	2	0	0
Southampton Central	Diesel Multiple Unit	Class 220/221 (Voyager)	7	0	0

Destination	Train Classification	Type of Locomotive	Weekly Movements		
			Weekday	Saturday	Sunday
Newbury	High Speed Train	HST125	1	0	0
Hereford	High Speed Train	HST125	4	2	0
Reading Traincare Depot	Diesel Multiple Unit	Class 165/1 or 166	7	13	1
Plymouth	High Speed Train	HST125	5	6	0
Reading Traincare Depot	Diesel Locomotive	Class 66	2	1	0
Theale ARC	Diesel Locomotive	Class 66	1	0	0
Bristol Freightliner Trml	Diesel Locomotive	Class 66	1	0	0
Weston Super Mare	High Speed Train	HST125	5	0	0
Felixstow North F.L.T	Diesel Locomotive	Class 66	1	0	0
Garston F.L.T	Diesel Locomotive	Class 66	1	0	0
Edinburgh	Diesel Multiple Unit	Class 220/221 (Voyager)	1	0	0
Whateley Quarry	Diesel Locomotive	Class 66	3	1	0
Dagenham Docks ARC	Diesel Locomotive	Class 66	1	0	0
Maidenhead	Diesel Multiple Unit	Class 165/1 or 166	1	0	0
Taunton	High Speed Train	HST125	2	0	0
Banbury	Diesel Multiple Unit	Class 165/1 or 166	1	0	0

Destination	Train Classification	Type of Locomotive	Weekly Movements		
			Weekday	Saturday	Sunday
Exeter St.Davids	High Speed Train	HST125	2	0	0
Carmarthen	High Speed Train	HST125	1	0	0
Purfleet Deep Wtr Wf (Rfd)	Diesel Locomotive	Class 66	1	0	0
York	Diesel Multiple Unit	Class 165/1 or 166	1	0	0
London Gateway	Diesel Multiple Unit	Class 165/1 or 166	1	0	0
Birmingham New Street	Diesel Multiple Unit	Class 220/221 (Voyager)	4	0	0
Worcester Shurb Hill	High Speed Train	HST125	2	2	6
Slough	Diesel Multiple Unit	Class 165/1 or 166	0	1	0
Twyford	Diesel Multiple Unit	Class 165/1 or 166	0	1	0
Eastleigh Trsmnd	Diesel Multiple Unit	Class 66	0	1	0
Leeds FLT	Diesel Locomotive	Class 66	0	1	0
Hayes and H'ton Tarmac	Diesel Locomotive	Class 66	0	1	0
Churchyard Sdgs	Diesel Locomotive	Class 66	0	1	0
Moreton-on- Lugg	Diesel Locomotive	Class 66	0	1	1
Swindon	High Speed Train	HST125	0	1	0

Road Traffic Emissions Factors

- 1.15 Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 7.0) released in 2017, which incorporates updated COPERT5 vehicle emissions factors for NO_x and vehicle fleet information.

1.16 Emission factors for the 2025 Future Year scenarios were calculated using the Calculator Using Realistic Emissions for Diesels (CURED, version V3A), developed by Air Quality Consultants Ltd. This calculator gives realistic, worst case emission factors for diesels for future years which utilise recent real-world emissions test data. This calculator was used exclusively for the future year 2025 Future Year Scenario for NO_x.

1.17 It should be noted that PM₁₀ emission factors were calculated using the Emission Factor Toolkit (version 8.0.1) for the 2017 Verification scenario and the future years scenarios.

Time Varied Emissions

1.18 Locomotive emission factors were calculated based on the number of daily train movements, power output and information obtained from the following sources of data:

- Realtime Trains Website; and
- Estimation of Rail Environmental Costs, AEA Energy & Environment, 2007

1.19 A summary of emissions factors utilised in the assessment is shown in Table 4.

Table 4: Diesel Locomotive Emission Factors

Train Classification	Pollutant	Weekday Emission Factors (g/km/s)	Saturday Emission Factors (g/km/s)	Sunday Emission Factors (g/km/s)
Class 66	NO _x	0.00600	0.07989	0.00333
	PM ₁₀	0.00012	0.00165	0.00007
	PM _{2.5}	0.00012	0.00165	0.00007
Class 165	NO _x	0.09604	0.04860	0.01990
	PM ₁₀	0.00196	0.00099	0.00041
	PM _{2.5}	0.00196	0.00099	0.00041
Class 220	NO _x	0.05752	0.00902	0.01466
	PM ₁₀	0.00121	0.00019	0.00031
	PM _{2.5}	0.00121	0.00019	0.00031
HST125	NO _x	1.41739	0.86850	0.04169
	PM ₁₀	0.06141	0.03763	0.06141
	PM _{2.5}	0.06141	0.03763	0.04169

1.20 Emissions from the locomotives were modelled utilising daily movement conditions as specified on the Realtime Trains website. As such, a time-varied file was applied to represent the number of daily movements of diesel locomotives for the weekday, the number of movements of diesel

locomotives for Saturday and the number of daily movements of diesel locomotives for Sunday. This again provides a realistic assessment scenario reflecting actual operating timetables.

- 1.21 It should be noted that it was considered that the entire particulate matter emission factor for the locomotives consisted of only PM₁₀ and PM_{2.5}. This allowed the maximum impacts, with respect to the relevant criteria, to be assessed. Actual emissions of particulate matter are unlikely to only consist of only one particulate matter fraction and as such, resulting in a worst-case assessment.

Meteorological Data

- 1.22 Meteorological data used in the assessment was taken from Benson Airport meteorological station over the period 1st January 2017 to 31st December 2017 (inclusive). Benson Airport meteorological station is located at NGR: 462250, 191600 which is approximately 20.2km north-east of the site.
- 1.23 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 for a wind rose of utilised meteorological data.

Roughness Length

- 1.24 A roughness length (z₀) of 1m was used in this dispersion modelling study. This value of z₀ is considered appropriate for the morphology of the assessment area and meteorological station location and is suggested within ADMS-Roads as being suitable for 'Cities, woodlands'
- 1.25 A z₀ of 0.3m was utilised to represent the morphology of the meteorological station location and is suggested as being suitable for 'agricultural areas (max).'

Monin-Obukhov Length

- 1.26 The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m was used in this dispersion modelling study. This value is considered appropriate for the nature of the assessment area and is suggested within ADMS-Roads as being suitable for 'cities and large towns'.
- 1.27 A Monin-Obukhov length of 30m was also used to represent the meteorological station location and is suggested within ADMS-Roads as being suitable for 'small towns <50,000'.

Background Concentrations

- 1.28 Annual mean concentrations from 2017 as predicted by DEFRA was used in the dispersion modelling assessment to represent annual mean pollutant levels in the vicinity of the site and for the verification process. Background concentrations for 2017 were utilised in preference to the future years of 2025. This provided a robust assessment and is likely to overestimate actual pollutant concentrations during the operation of the proposals. Table 5 displays the specific background concentrations for the monitoring locations.

Table 5: Background Pollutant Concentrations

Monitoring Location	1km Grid		Monitoring Location	Predicted Background Concentration (µg/m ³)
	X	Y		2017

Monitoring Location	1km Grid		Monitoring Location	Predicted Background Concentration ($\mu\text{g}/\text{m}^3$)
	X	Y		2017
RD1, T3, T4, T5, T6, T7, T8, T9, T10, T11	471500	174500	NO ₂	34.96
			NO _x	23.12
			PM ₁₀	15.25
			PM _{2.5}	9.90
T1, T2	471500	173500	NO ₂	45.32
			NO _x	28.47
			PM ₁₀	15.64
			PM _{2.5}	9.89
T12	472500	173500	NO ₂	37.74
			NO _x	24.63
			PM ₁₀	15.12
			PM _{2.5}	9.60

- 1.29 Since 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.
- 1.30 Table 6 displays the predicted background concentrations by DEFRA used in the operational phase assessment for the sensitive receptor locations.

Table 6: Receptor Background Pollutant Concentrations

Monitoring Location	1km Grid		Monitoring Location	Predicted Background Concentration ($\mu\text{g}/\text{m}^3$)
	X	Y		2017
R1 to R9	472500	173500	NO ₂	34.96
			NO _x	23.12
			PM ₁₀	15.25

Monitoring Location	1km Grid		Monitoring Location	Predicted Background Concentration ($\mu\text{g}/\text{m}^3$)
	X	Y		2017
			PM _{2.5}	9.90
R10 to R13, R15, R17 to R18	471500	173500	NO ₂	45.32
			NO _x	28.47
			PM ₁₀	15.64
			PM _{2.5}	9.89
R14	470500	173500	NO ₂	40.90
			NO _x	25.98
			PM ₁₀	15.00
			PM _{2.5}	9.29
R16	472500	173500	NO ₂	37.74
			NO _x	24.63
			PM ₁₀	15.12
			PM _{2.5}	9.60

- 1.31 Similarly to emission factors, background concentrations for 2017 were utilised in preference to the development opening year. This provided a robust assessment and is likely to overestimate actual pollutant concentrations during the operation of the proposals.

NO_x to NO₂ Conversion

- 1.32 Predicted annual mean NO_x concentrations from the dispersion model were converted to NO₂ concentrations using the spreadsheet provided by DEFRA, which is the method detailed within LAQM (TG16).

Verification

- 1.33 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.
- 1.34 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.
- 1.35 For the purpose of this assessment model verification was undertaken for 2017, using traffic data, meteorological data and monitoring results from this year.
- 1.36 RBC undertakes monitoring of NO₂ concentrations at one location suitable for verification purposes within the assessment extents. The road contribution to total NO_x concentration was calculated from the monitored NO₂ result for use in the verification process. This was undertaken following the methodology contained within DEFRA guidance LAQM (TG16).
- 1.37 The dispersion model was run with the traffic input data previously detailed for 2017 to predict the NO_x concentration at the monitoring location. The results are shown in Table AII.5.

ID	Monitoring Location	Modelled Road NO _x Concentration (µg/m ³)	Monitored Road NO _x Concentration (µg/m ³)	Difference (%)
RD1	Caversham Road	25.84	26.64	3.01
T1	33 Caversham Road	29.13	44.83	35.01
T2	59a Caversham Road	39.14	40.11	2.43
T3	197 Caversham Road	17.47	26.57	34.25
T4/5/6	Caversham Co-location	28.42	29.64	4.11
T7		27.96	36.41	23.21
T8	131 Caversham Road	19.96	26.71	25.26
T11	31a Vastern Road (lamppost)	29.73	30.43	2.29

- 1.38 The monitored and modelled NO_x road contribution concentrations were graphed and the equation of the trendline based on the linear progression through zero was calculated, as shown in Graph 1. This indicated that a verification factor of **1.1769** was required to be applied to all NO_x modelling results, showing the model has a tendency to underestimate pollutant concentrations.

- 1.39 Table All.5 presents the monitored annual mean NO₂ concentrations and the adjusted modelled total NO₂ concentration based on the above verification factor. Exceedances of the annual mean AQO for NO₂ are shown in **bold**.

Site ID	Monitoring Location	Monitored NO ₂ Concentration (µg/m ³)	Adjusted Modelled Total NO ₂ Concentration (µg/m ³)	Difference (%)
RD1	Caversham Road	36.00	37.70	9.88
T1	33 Caversham Road	45.30	40.82	-5.73
T2	59a Caversham Road	43.32	45.80	7.68
T3	197 Caversham Road	35.97	33.21	-4.51
T4/5/6	Caversham Co-location	37.35	39.04	3.80
T7	108 Caversham Road	40.33	38.80	4.07
T8	131 Caversham Road	36.03	34.57	-5.34
T11	31a Vastern Road (lamppost)	37.70	39.72	-4.71

- 1.40 RBC 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.

- 1.41 Table All.6 indicates the monitored and calculated annual mean PM₁₀ concentrations.

ID	Monitoring Location	Modelled Road PM ₁₀ Concentration (µg/m ³)	Monitored Road PM ₁₀ Concentration (µg/m ³)
RD1	Caversham Road	2.00	22.00

- 1.42 The monitored and modelled roadside concentrations were compared to calculate the associated ratio. This indicated a verification factor of **1.2757** was required to be applied to all PM₁₀ modelling results.

- 1.43 As PM_{2.5} monitoring is not undertaken within the assessment extents, the verification factors applied for PM₁₀ were also used to adjust model predictions of PM_{2.5} in accordance with the guidance provided within LLAQM (TG16).