Appendix 10.2: ADMS Parameters

Air Dispersion Model

The Atmospheric Dispersion Modelling System for Roads (ADMS-Roads) v5.0.1.3 was used to assess the local air quality impact of development-generated vehicle exhaust emissions, on concentrations of NO_2, PM_{10} and $PM_{2.5}$ at existing receptors located adjacent to the assessed road network, and to assess the suitability of the site for residential use.

The ADMS-Roads model is a comprehensive tool for investigating air pollution in relation to road networks. The model uses algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions. It can predict long-term and short-term concentrations, as well as calculations of percentile concentrations.

The ADMS-Roads model has been comprehensively validated in a large number of studies by the software manufacturer CERC (Cambridge Environmental Research Consultants). This includes comparisons with data from the UK's Automatic Urban Network (AUN) and specific validation exercises using standard field, laboratory and numerical data sets. CERC is also involved in European programmes on model harmonisation, and their models have been compared favourably against other EU and US EPA systems. Further information in relation to this is available from the CERC website at www.cerc.co.uk.

Traffic Data

24-hour annual average daily traffic (AADT) flow data was provided by SLR Consulting Limited for use in the assessment. **Figure 10.1** shows the roads included within the model.

Vehicles within the study area were assumed to travel up to 48 kph on all roads apart from the approach to junctions, roundabouts and other locations where queuing traffic occurs. The speed of vehicles in these areas was slowed down to 5 kph as appropriate.

The traffic data used in the assessment is detailed in **Table A10.2.1**.

Table A10.2.1 – Traffic Data

Link Number	Name	2022 Verification Year		2026 Opening Year Without the Proposed Development		2026 Opening Year With the Proposed Development	
		AADT	HDV%	AADT	HDV%	AADT	HDV%
1	Holt Road (South of Hullah)	12,656	1.04%	12,493	0.76%	13,835	0.87%
2	Holt Road (Hullah - Cefn (at Hullah))	10,383	1.21%	10,316	1.06%	11,623	1.02%
3	Holt Road (Hullah - Cefn (at Cefn))	10,518	1.17%	10,523	1.04%	11,724	1.03%
4	Holt Road (A534 (at Cefn))	13,745	1.28%	13,324	1.35%	15,614	1.17%
5	Holt Road West (Cefn - A534 (at A5156))	12,914	1.33%	12,740	1.41%	15,204	1.24%
6	A534 (East of A5156)	26,940	1.63%	29,454	1.61%	31,547	1.53%
7	Cefn Road (Holt - Hullah (at Holt))	10,523	0.46%	10,114	0.49%	13,077	0.40%
8	Cefn Road (Holt - Hullah (at Hullah))	8,183	0.59%	7,661	0.70%	10,675	0.52%
9	Cefn Road (Hullah - Access)	7,897	0.65%	7,925	0.73%	11,191	0.48%
10	Cefn Road (South of site)	7,897	0.65%	7,930	0.73%	8,576	0.63%

11	Hullah Lane (at holt Rd)	3,906	0.14%	4,052	0.14%	4,041	0.04%
12	Hullah Lane (at Cefn Rd)	1,577	0.36%	1,521	0.47%	1,409	0.20%
13	Dean Road	9,552	0.39%	9,900	0.51%	10,490	0.61%
14	Bryn Estyn Road	1,021	2.22%	1,016	2.09%	1,016	1.95%
15	A5156 North of Site Access	26,362	1.26%	28,292	1.32%	29,810	1.23%
16	A5156 (West of Borras)	28,376	0.95%	30,487	0.95%	32,642	0.88%
17	Borras Road	1,442	6.09%	1,482	5.92%	1,510	6.00%
18	Borras Park Road	6,460	0.42%	7,044	0.52%	6,909	0.39%
19	Roundabout Circling for A5156, Borras Park Road and Borras Road roundabout	15,660	1.14%	16,826	1.17%	17,718	1.09%

Receptors

All receptors were assessed at a height of 1.5 m. This height is representative of the height of the average person.

Meteorological Data

Meteorological data from the Hawarden recording station for the year 2022 was used in the ADMS-Roads model. This is the most representative recording station for the development site. Other meteorological inputs within the ADMS model are provided in **Table 10.2.2**.

Table 10.2.2 – Meteorological Inputs into ADMS

Input	Dispersion Site	Meteorological Site
Surface roughness	0.5	0.5
Monin Obukhov length	30	30

Background Concentrations

The assessment process requires the derivation of background pollutant concentration data that are factored into the year of assessment, to which the model adds contributions from the assessed roads.

Defra background concentrations were used for the NO_2, PM_{10} and $PM_{2.5}$ concentrations[ix].

Emission Factors

DEFRA's Emission Factor Toolkit (EFT) (v12.0.1), was used within the ADMS model to predict emissions from road vehicles.

Conversion of NO_x to NO_2

Oxides of nitrogen (NO_x) concentrations have been predicted using the ADMS-Roads model. The modelled road contribution of NO_x at the identified sensitive receptor locations have been converted to NO_2 using the DEFRA NO_x to NO_2 calculator (v8.1, 2020) in accordance with DEFRA guidance[xi].

Model Verification

Model verification is the process of adjusting model outputs to improve the consistency of modelling results with respect to available monitored data. DEFRA guidance was followed during model verification[vi].

Model verification has been completed for NO_2. There are no representative PM_{10} or $PM_{2.5}$ air quality monitors available for model verification. Monitoring of NO_2 is undertaken by WCBC at several locations within the study area using diffusion tubes. The

ADMS model was used to predict concentrations of NO_x at one of these sites, WBC-042, due to traffic data restrictions and due to 2018 being the final year of monitoring at WBC-021. The air quality model was initially found to be slightly underpredicting. Consequently, a verification factor of 1.3135 was used. **Table A10.2.3** shows the outcomes of the verification process.

Table A10.2.3 – Model Verification

Monitor	2022 Monitored Total NO_2	2022 Monitored Road NO_x	2022 Background NO_2	2022 Background NO_x	Monitored Road Contribution NO_2 (total - background)	Modelled Road Contribution NO_x (excludes background)	Ratio of Monitored Road Contribution NO_x / Modelled Road	Adjustment Factor	Adjusted Road Contribution NO_x	Adjusted Modelled Total NO_x (including background NO_x)	Modelled Total NO_2 (based on empirical NO_x / NO_2 relationship)	% Difference [(modelled - monitored) / monitored] x 100
WBC-042	18.30	19.88	7.59	9.72	10.71	15.13	1.3135	1.3135	19.88	29.60	18.30	0