A47 Blofield to North Burlingham Dualling

Scheme Number: TR010040

Volume 6
6.2 Environmental Statement Appendices
Appendix 5.1 – Air Quality Dispersion Modelling Process

Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning
(Applications: Prescribed Forms and
Procedure) Regulations 2009**

A47 Blofield to North Burlingham
Development Consent Order 202[x]

**ENVIRONMENTAL STATEMENT APPENDICES
Appendix 5.1 Air Quality Dispersion Modelling**

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Author:	A47 Blofield to North Burlingham Dualling Project Team, Highways England

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Appendix 5.1- Air Quality Dispersion Modelling Process

5.1. Introduction

5.1.1. The Atmospheric Dispersion Modelling System (ADMS) Roads dispersion modelling software has been developed by Cambridge Environmental Research Consultants Ltd (CERC) and is a software which models air pollution using road traffic as a source of pollutant emissions. ADMS Roads version 5.0.0.1 was used for this study.

5.2. Modelling Parameters

5.2.1. The following model input parameters were used for this assessment:

Road Parameters

5.2.2. ADMS Roads requires inputs of road widths (and height if canyons have been specified, although this was not required for this project). Road widths were determined using the Ordnance Survey Mastermap data within ArcGIS.

Surface Roughness Length

5.2.3. The surface roughness length at the meteorological measurement site (at Norwich Airport) was set to 0.3m due to the area being largely agricultural/rural with only a slight urban environment. The remainder of the study area had a surface roughness set to 0.5m which was representative of parkland and open suburbia areas.

Monin-Obukhov Length

5.2.4. The Monin-Obukhov length is a parameter used to measure the stability of the atmosphere. It describes the turbulence length which is dependent on the meteorological conditions. For very stable conditions, in rural areas, a typical value can range between 2 to 20m. In large urban areas, an urban heat island effect can occur as result of the buildings and traffic warming the air above the town/city. This can prevent the atmosphere ever becoming stable. A minimum Monin-Obukhov length will vary depending on how large the area is. A minimum Monin-Obukhov length of 10m was set for this study area, which was representative of small towns with a population of less than 50,000.

Terrain

5.2.5. A gradient of greater than 1:10 can impact dispersion. Following a review of the study area, terrain was not required to be considered within the assessment, therefore no terrain file was included in the model.

5.3. Background Concentrations

5.3.1. The background concentrations across the study area have been obtained from maps published by Defra. The downloaded data covered all local authorities within the ARN, on a 1km x 1km grid from years 2017 to 2030.

5.3.2. As per consultation with Highways England, it was agreed the most recent 2017 based background maps would be downloaded for the assessment and factored back to the baseline year of 2015. A backcasting factor obtained from Highways England was used to cast the NOx 2017 background maps to the year 2015. This factor has been derived by calculating the average annual mean NOx concentration from 55 background AURN monitoring stations for the relevant years and then divided by the average of the data from the same set of background AURN monitoring stations for the year 2017. This produced a factor of 1.004 for the year 2015. This 2017 mapped backgrounds were multiplied by this factor to obtain 2015 NOx values.

5.3.3. As Defra did not provide a backcasting factor for PM10 concentrations, a similar process was undertaken to cast the 2017 PM10 backgrounds back to 2015. Annual mean PM10 data was downloaded from the two nearest automatic monitoring stations for the years 2014 to 2018. A factor was produced by dividing the 2017 annual mean concentration with the 2015. An average was taken of the two factors produced which was then applied to the downloaded 2017 PM10 background maps. Full details on how the PM10 factor was produced can be found in Table 5-1.

Table 5-1: PM$_{10}$ backcasting factor derivation

Site ID	Site Type	PM$_{10}$ Annual Mean (µg/m^3)					Factor (2015/2017)	Average
		2014	2015	2016	2017	2018		
Castle Meadow	Roadside	21	21	20	23	27	0.9130	0.9253
Lakenfields	Urban Background	16	15	16	16	16	0.9375	

5.3.4. A more detailed breakdown of background concentrations per 1km grid square for the study area can be found in Table 5-2.

Table 5-2: Background concentrations per 1km x 1km grid square

Grid Square (x,y co-ordinates)	2015 (µg/m³)		2025 (µg/m³)	
	NO_x	PM_{10}	NO_x	PM_{10}
629_308	19.47	15.15	14.03	15.07
629_309	17.00	15.01	12.58	14.93
628_310	17.16	14.75	12.74	14.65
628_311	16.29	14.07	12.13	13.93
627_315	14.21	15.05	10.57	15.00
628_315	14.21	14.95	10.61	14.89
633_307	14.99	12.52	11.40	12.25
631_308	16.85	13.41	12.79	13.20
632_308	16.20	13.00	12.30	12.75
634_306	13.95	12.92	10.62	12.68
633_309	16.18	13.32	12.03	13.09
631_309	18.26	14.47	13.18	14.33
634_307	14.04	13.72	10.59	13.55
633_308	15.15	13.78	11.50	13.60
632_309	18.61	14.50	13.42	14.36
634_309	17.02	15.12	12.33	15.04
630_309	16.93	14.30	12.39	14.17
632_313	13.75	14.42	10.29	14.31
634_313	13.51	14.77	10.08	14.69
631_314	14.25	13.58	10.67	13.40

Grid Square (x,y co-ordinates)	2015 (µg/m³)		2025 (µg/m³)	
	NO_x	PM_{10}	NO_x	PM_{10}
633_310	17.31	14.82	12.49	14.73
630_314	14.58	14.52	10.90	14.41
634_314	13.31	14.20	10.00	14.08
637_306	13.19	14.23	9.85	14.09
638_307	12.93	14.53	9.70	14.42
637_309	16.57	14.88	11.88	14.79
637_305	13.15	14.12	9.93	13.98
638_308	13.20	14.89	9.84	14.81
637_307	13.12	14.56	9.86	14.46
636_308	13.97	13.71	10.43	13.53
635_309	15.62	14.78	11.40	14.68
636_306	13.05	14.30	9.86	14.18
639_310	18.73	14.69	13.19	14.58
635_312	13.43	14.15	10.03	14.02
640_309	13.21	13.12	9.85	12.89
644_308	14.20	12.43	10.44	12.14
640_310	17.09	13.11	12.30	12.86
642_314	12.87	13.99	9.72	13.85
641_311	15.16	13.27	11.66	13.06
642_312	13.26	13.74	10.03	13.58
642_313	13.08	14.04	9.86	13.90
651_304	18.58	12.80	13.90	12.52

Grid Square (x,y co-ordinates)	2015 (µg/m³)		2025 (µg/m³)	
	NOx	PM₁₀	NOx	PM₁₀
652_304	35.46	13.27	25.69	12.99
652_305	50.86	13.56	40.44	13.34
651_308	20.93	12.46	15.38	12.17
651_306	23.25	13.07	17.65	12.89
651_305	21.85	12.62	16.72	12.36
651_307	24.63	12.92	18.63	12.66
652_306	49.01	13.53	37.45	13.28
652_308	24.89	13.18	18.67	12.91
643_307	12.45	12.78	9.40	12.52
642_307	12.51	13.68	9.46	13.50
636_310	14.56	14.22	10.72	14.09
636_309	16.15	14.94	11.68	14.85
635_310	15.34	14.97	11.23	14.90
627_309	19.88	13.07	14.71	12.81
641_309	13.77	13.72	10.14	13.54

5.4. Local Authority Monitoring

5.4.1. The monitoring results for Broadland District Council ranging from years 2015 to 2018 are presented in Table 5-3.

Table 5-3: Broadlands District Council monitoring results 2015-2018

Site ID	Name	Type	Annual Mean Concentrations (µg/m³)				
			2014	2015	2016	2017	2018
BN1	A47 N Burlingham	Roadside	30.8	28.4	30.6	24	26.3

Site ID	Name	Type	Annual Mean Concentrations (µg/m³)				
			2014	2015	2016	2017	2018
BN2	Norwich Road	Kerbside	21.6	18.3	19.3	16.6	-
BN3	Coxs Hill	Roadside	16.5	13.3	14.4	14.4	-
BN4	Hillside Ave	Suburban	14.6	12.7	14.9	13.6	14.3
BN5	Dussingdale	Suburban	22	20.2	20.5	16.7	-
BN6	Breck Road	Suburban	13.8	12.7	12.5	13.5	13.6
BN7	17 Heath Crescent	Suburban	15.5	13.6	14	15.5	14.2
BN8	Hansell Road	Suburban	15.4	11.8	12.8	14.4	13.4
BN9	Chartwell Road	Suburban	23.4	28.3	29.4	31	26.9
BN10	Yarmouth Road	Suburban	22.7	20.6	20	19.8	18.7
BN11	21 Reepham Road	Suburban	34.3	30.1	32	34	29.6
BN12	10a Boundary Road	Suburban	33.5	29.2	30.5	30	29.4
BN13	213 Milecross Lane	Suburban	25.8	24.4	24.8	23.4	22.8
BN14	Berrington Road	Suburban	17.6	16	16.2	15	-
BN15	Wroxham Library	Roadside	21.7	16.6	17.4	15.6	22
BN16	The Avenue	Roadside	20.5	19.2	17	18.4	18.2
BN17	School Road	Roadside	-	-	-	19.5	14
BN18	Middletons Lane	Suburban	-	-	-	18.1	26

Site ID	Name	Type	Annual Mean Concentrations (µg/m³)				
			2014	2015	2016	2017	2018
BN19	189 Yarmouth Road	Suburban	-	-	-	31.8	27.2
BN20	The Street Acle	Kerbside	-	-	-	-	22.52
BN21	Thorpe End	Roadside	-	-	-	-	18.73
BN22	Wroxham Road	Roadside	-	-	-	-	31.71
BN23	Dussingdale	Roadside	-	-	-	-	17.72
BN24	Fifers Lane	Suburban	-	-	-	-	18.13
BN25	Red Lion Street	Roadside	-	-	-	-	21.73